

Parasitoids

Abstracts book

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PA 1

**Five Egg Parasitoids of Sunn Pest (*Eurygaster integriceps*)
in Syria and Biology of *Trissolcus grandis* Under Laboratory Conditions.**

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Sunn pest (*Eurygaster integriceps* Put.) is the most important insect pest of wheat and barley in Syria. Hymenopteran egg parasitoids are among the natural enemies that contribute to the reduction of Sunn pest population. The results of our surveys conducted during 1997-1999 in Syria showed that five parasitoid species belonging to two families in the order Hymenoptera were found attacking Sunn pest eggs. The four species of the family Scelionidae are *Trissolcus grandis* (Thomson), *T. simoni* (Mayr), *T. vassilievi* (Mayr), and *Gryon fasciatus* (Priener). *Ooencyrtus fecundus* (Ferrière & Voegelé) was the only species found belonging to the family Encyrtidae. These egg parasitoids become active in the spring, about two weeks after Sunn pest migrates to cereal fields from the overwintering sites. The level of parasitism varies from year to year, and in 1999 it reached 100% at Azaz region during the second week of May. The results of the biology study of *T. grandis* under laboratory condition (23 °C, 60-70% Humidity and a photoperiod of 16:8 (light:dark) showed that the life span of the female is 19 days. During this period, the total number of Sunn pest eggs parasitized by a *T. grandis* female was 111.5. The percent egg hatch of these parasitized eggs was 83.7%, of which 79.9% were females. The generation time was 15.2 and 17.6 days, for the male and the female, respectively.

PA 2

**Identification of Some Parasites on Grapevine
Moth *Lobesia botrana* (Den and Schiff.) in Southern Syria**

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Grapevine moth (*Lobesia botrana*) is the most harmful pest for grapevine in southern Syria. In absence of integrated pest management losses in production up to 50% were reported. The use of pesticides negatively affected the biological balance and led to the appearance of resistant races of the pest. During 1997-1998, a study on Grape moth (*Lobesia botrana*) biology in the southern region of Syria was conducted. By using sexual pheromone traps, the population dynamics of the adults were monitored. Laboratory rearing experiments were carried out on collected samples, and some of parasites appeared and were identified by the International Institute of Entomology (CABI, UK) for the first time in Syria. The parasites were belong to Hymenoptera: Braconidae “*Ascogaster quadridentata* (Wesmael), *Bassus (Microdus) dimidiator* (Nees), *Bracon brevicornis* (Wesmael), *Bracon* sp.”; Ichneumonidae “*Campopleginae* indet, *Indet* sp.A, *Indet* sp. B, *Pristomerus* sp.”; Pteromalidae “*Dibrachys boarmiae* (Walker)”. The parasitism rate reached 0.17% on eggs, 5.9% on larvae and 1.66% on both stages during 1998, and 4.52% on larvae during 1997. The parasites were collected from different areas for further study.

PA 3

**Population Dynamics of the *Parasitoid Cales noaki* how which Attach the
Insect pest *Aleurotrixus floccosus* Mask in Algeria**

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Because of the seriousness of *Aleurotrixus floccosus* attach, the alternative of using biological control agents with high performance such as *C. noaki* was investigated. Samples of *C. noaki* were collected every week to identify the duration of different generations. For every observation the number of eggs, young and old larvae, pre-nymph and nymphs were recorded. *C. noaki* behaved differently in relation to the host density. *C. noaki* developed six generations during the year. The observations showed that the implantation of *C. noaki* in the first year was satisfactory. This is attributed to its adaptation and resistance to the new medium.

PA 4

**Estimating the Parasitism Rate on Larvae of Olive Fruit fly
Bactrocera (Dacus) oleae Grnelin in Al-Jabal Al- Akhdar, Libya**

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The present study discussed the first record of a parasite belonging to order Hymenoptera, family Figitidae, sub-Family Figitinae on the larvae of olive fruit fly *Bactrocera(Dacus) oleae* Grnelin, at the university experimental site, Ras Turab and Qurnada (Al-Jabal Al-Akhdar, Libya). The parasite appeared at the end of August with higher parasitism rate at the university site as compared with Ras turab and Qurnada. The highest rate at the university and Ras Turab sites was recorded during October (19.3%, 11.7%, respectively). At the Qurnada site, the highest parasitism rate was during November (5.6%). The lowest parasitism rate at the three investigated locations was recorded during July and August.

PA 5

Biology and Parasitism of *Trichogramma evanescens* Westwood (Hymenoptera: Trichogrammatidae) on *Spodoptera exigua* Hubner and *Sesamia nonagrioides* Lefevbre (Lepidoptera, Noctuidae) Eggs

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Spodoptera exigua and *Sesamia nonagrioides* are important pests on the second maize crop in Cukurova region. The former pest causes economical damage for the young seedlings stage of the second maize crop while the latter causes damage from seedling stage till harvest. Their damage is more severe when second maize crop is sown after the beginning of July in the region. Biological features of *Trichogramma evanescens* on *S. exigua* and *S. nonagrioides* eggs were studied at $25\pm 1^{\circ}\text{C}$, $60\pm 10\%$ relative humidity and 16 h photoperiod in order to obtain basic information for the biological control of both pests. Oviposition time, adult longevity, developmental time, total progeny, number of parasitized eggs, emergence rate, sex ratio, number of emerged parasitoids per parasitized egg, daily and total parasitism of *T. evanescens* on both hosts eggs were investigated. Oviposition times and adult longevities of *T. evanescens* on *S. exigua* and *S. nonagrioides* were found 3.95 ± 0.34 , 8.25 ± 0.66 days and 4.25 ± 0.39 and 10.45 ± 0.63 days, respectively. Number of parasitized *S. nonagrioides* eggs were higher than that of *S. exigua* with 85.80 ± 6.48 and 55.20 ± 2.90 , respectively. There was no significant difference in the developmental times of parasitoid on the two hosts. In addition, total progeny of *T. evanescens* was significantly higher on *S. nonagrioides* than *S. exigua* eggs. Most parasitism on both hosts eggs occurred during the early days of the parasitoid life. In conclusion, although *T. evanescens* were found to be effective on both pests under laboratory conditions, inundative releases of the parasitoid should be done in order to confirm effectiveness of the parasitoid under field conditions.

PA 6

Functional Response: View Point

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The relationships of parasitism rate to host density is commonly modeled as the non linear Holling type-II Functional response or “disc equation” which is so often used to obtain parameters such as instantaneous attack rate (attack coefficients). Several authors believe that this parameter should not be treated as a constant because of parasitoid egg depletion. Despite of this criticism no much work has been directed to address the validity of the disc equation as a model of parasitism in particular on this parameter, but rather time was advocated looking to the best method for estimating parameters. However, in a series of tedious experiments we were able to measure the changes in parasitoid functional response on a daily basis through the life span of female parasitoid in order to reveal the changes in parameters estimates. The results of these experiments indicated that the attack coefficient has different values related with the age differences of female parasitoid through which this value had dropped to about 75% toward the end of parasitism period. We conclude that parameters estimated of Holling disc equation may change at different age intervals and hence stimulate the idea of modifying the equation by a factor taking into account this consideration and come up with a new model of parasitism.

PA 7

**Study of Pupal Parasitism Rate of *Malacosoma neustria* (L.)
in Al- Jabal Al- Akdar, Libya**

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This study conducted in Al-Jabal AL-Akhdar during 1994-1996 seasons. Two parasites species were recorded on pupae of *Malacosoma neustria* (L.), *Exorisia larvarum* L. and *Pimpla* sp. Pupal parasitism was highest on cocoons from the ground levels (18.5%) and progressively lower in shrub and crown levels (2%).

PA 8

**Preliminary Observations on Parasitism of the Leaf Miner *Phyllocnistis citrella*
(Lepidoptera: Gracillariidae) Under Salalah Plain
Conditions of the Sultanate of Oman**

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This study was carried out during 1996-1999 on citrus leaf miner infesting four different citrus varieties; local Omani lime, Orange, Grapefruit and mandarin. The objective of this study was to determine the rate of parasitism on the citrus leaf miner and determine the qualitative structure of these parasitoids. The study showed that the highest rate of parasitism was during the last week of May 1999 and was estimated at about 97% on local lime, whereas the monthly mean of the four varieties was 66.3% in May of the same year. This rate coincided with the highest infestation of the pest on the plant. Parasites species identified were *Citrostichus Phyllocnistoides* and *Citrospilus quadeistriatus* (Hymenoptera: Eulophidae). Another two species, responsible of 3% parasitism are yet to be identified. *C. Phyllocnistoides* was the most abundant and efficient throughout the study period.

PA 9

**Ecological and Biological Study on the Parasite
Encarsia formosa (Gahan) in Syria**

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Encarsia formosa is one of the most important agents in biological and integrated pest management for controlling many whitefly species, where pesticides failed in controlling it worldwide. Due to the importance of this parasite in Syria it was essential to carry out a biological and ecological study. Field trips conducted during 1989 in all governorates of the country showed that *E. formosa* was found to naturally parasitize greenhouse whitefly *Trialeurodes vaporariorum*, which in turn, infests an ornamental plant species which belongs to the genus *Ipomoea*. Distribution sites of *E. formosa* were identified and allocated: [Damascus (Ghota, Sirgaya, Yabroude), Daraa, Qunaytra, Homs]. The parasite was found only in the open fields, but not inside greenhouses. It has been found that this parasite has two hosts, (i) the greenhouse whitefly *T. vaporariorum* and (ii) the tobacco white fly *Bemisia tabaci*. In addition, nine plant hosts were identified for *T. vaporariorum* and 57 for *B. tabaci*. Effectiveness of *E. formosa* was studied in the field for three years (1994-1996). It was found that the maximum parasitism rate was 42.05% during November, 1994 and the minimum was 8% during March 1995 on *T. vaporariorum* on the host plant *Lantana camara*, but parasitism rate reached 77.34% in September 1994 on *T. vaporariorum* on *Ipomoea* sp.

PA 10

**A Study on the Indigenous and Introduced Natural Enemies of the
Citrus Leaf Miner *Phyllocnistis citrella* Saint in Western Algeria**

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Phyllocnistis citrella was reported in Algeria at the beginning of 1994. It was necessary to survey the parasitoids for this pest. The study was conducted in three non-chemically treated sites at different locations. One sample of ten citrus leaves infested with the leaf miners was collected. All observations related to the parasitoides were recorded and the pupal stage of the parasite was transferred to a test tube, for easier collection and identification of the emerging adults. The parasitoid inventories permitted the identification of four parasitoids: *Pnigalio* sp, *Cirrospilus pictus*, *C. vittatus* and *Semiela cher petiolatus*. The insect inventory permitted to follow the emergence of the parasitoid, and its activity in space and time. These results would permit to make strategies for the biological control by introducing more efficient parasitoid species.

PA 11

Egg Parasitoids Biodiversity in Syria

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Thirteen Hymenoptera families include egg parasitoids parasitizing various host species. Most of these families include a low number of species showing an oophagous behavior. The families Trichogrammatidae, Mymaridae and Scelionidae contain almost exclusively such species. In Syria, only few egg parasitoids were listed in four families, as follows: Trichogrammatidae: genus *Trichogramma* represented by *T. principium* Sugonjaev & Sorokina and *T. cacoeciae* Marchal.; Scelionidae: genus *Trissolcus* represented by *T. grandis* (Thomson), *T. semistriatus* (Nees), *T. simoni* (Mayr) and *T. vassilievi* (Mayr), genus *Telenomus* represented by *T. acrobates* Giard, and genus *Gryon* by *G. fasciatus* Priesner; Encyrtidae: genus *Ooencyrtus* represented by *O. fecundus* Ferriere & Voegelé and *O. pityocampae* (Mercet); Eulophidae: genus *Baryscapus* represented by *B. servadeii* (Domenichini). Genera which include egg parasitoids reported in Syria represent 2% of Euro-asiatic genera of Trichogrammatidae, 4% of Scelionidae, 8% of Encyrtidae, 7% of Eulophidae, and 0% of each of the other nine families in which such species are known. A considerable inventory work has thus to be undertaken to identify the existing biodiversity, mainly to protect it, and to make available new biological control means against agricultural pests.

PA 12

The Biodiversity of *Trichogramma* in Iran

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The genus *Trichogramma* attacks eggs of various insects, mainly Lepidoptera, many of which are of economic importance. In this study, *Trichogramma* of Iran was evaluated by means of morphological, Biological and enzymatic methods. Eleven species are collected and identified from different parts of Iran. Diagnostic characteristics, distribution, hosts and key to the known species of Iran were given. Morphology of male genitalia, male antenna and enzymatic data were used for identification. The identified species are as follows: *Trichogramma brassicae* Bezdenko, *T. evanescens* Westwood, *T. embryophagum* (Hartig), *T. dendrolimi* Matsumura; *T. semblidis* (Aurivillius); *T. principium* Sugonjaev & Sorokina, *T. pintoii* Voegelé, *T. tshumakovae* Sorokina, *T. ingricum* Sorokina, *T. cacoeciae* Marchal, and *T. sp.*. The most widespread species in Iran was *T. brassicae* Bezdenko. Intraspecific and interspecific crossing were carried out between different populations to test reproductive isolation. Electrophoretic study of esterases was carried out using polyacrylamide gel molded between glass plates. There was a great polymorphism in esterase bands in some populations, especially among different individuals of *T. brassicae* Bezdenko.

PA 13

**Larval Parasitoids of Chickpea Leaf Miner
(*Liriomyza cicerina* Rond.) in North Syria**

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The level of parasitism by two larval parasitoids, *Opius monilicornis* and *Diglyphus isaea* on the third generation of chickpea leafminer, *Liriomyza cicerina* Rond., was assessed in 1998 and 1999 at Aleppo and Azaz regions. In Aleppo, the percent parasitism of *O. monilicornis* was 71.5%, whereas that of *D. isaea* was 9.7% around the first week of June 1998. A similar level of parasitism was recorded in 1999, 75.2% and 12.1% for *O. monilicornis* and *D. isaea*, respectively. In Azaz region, a similar picture to that of Tel Hadya was also observed. The level of parasitism by *O. monilicornis* was 68.1 and 70.3% in 1998 and 1999, respectively, whereas that by *D. isaea* was 7.6 and 11.1% in 1998 and 1999 respectively. This study sheds light on the importance of the parasitoid *O. monilicornis* in reducing the population of chickpea leaf miner in northern Syria.

PA 14

**Biological Control of European Corn Borer, *Ostrinia nubilalis* Hubner
(Lepidoptera:Pyralidae) by *Trichogramma evanescens* Westwood
(Hymenoptera: Trichogrammatidae) in Corn Fields in the
East Mediterranean Region of Turkey**

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This study was carried out during 1998 to determine the effectiveness of inundative release of the egg parasitoid, *T. evanescens* for biological control of European corn borer, *O. nubilalis* in Cukurova region of Turkey. *O. nubilalis*, *Ephestia kilehiella* Zeller (Lepidoptera: Pyralidae) and *T. evanescens* were reared in a climatic room under constant temperature ($25\pm 1^{\circ}\text{C}$), relative humidity ($65\pm 10\%$) and appropriate light regime for the three species. *T. evanescens* was released twice with 10 days interval, at the beginning of the oviposition period of the third generation of *O. nubilalis* for the second maize crop. A total of 300,000 parasitoids/20 da. were released and the average parasitism rate of the eggs of *O. nubilalis* was 86.19%. Compared with control treatments, the number of infested plant was reduced by 96% in the release areas. At harvest, the average grain weight was 850-900 kg/da, 650-750 kg/da, 840-870 kg/da and the 1000 grain weight was 379.96 gr, 314.76 gr and 360.40 gr in released, control and insecticides-treated parcels, respectively. The results of this experiment indicated that biological control of *O. nubilalis* with *T. evanescens* can be an important control component in corn fields in Turkey.

PA 15

**Artificial Rearing of Parasitoid Insects, Especially
Oophagous Species: An Overview**

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The extension of the use of entomophagous insects in biological control strategies is greatly impeded, especially in inundative releases, by the necessity to easily produce high numbers of insects at reasonable costs. The production under artificial conditions needs artificial diets. Nevertheless, there are two aims for the studies on artificial diets: the mass production is the more obvious aim, but the possibility to obtain the development of a species *in vitro* constitutes a powerful tool for physiological and ethological studies of this species. There are two main kinds of artificial diet, with or without insect components. At present, about 40 species of parasitoids can be reared under artificial conditions, most of them are oophagous species, and mainly are members of Trichogrammatidae. The studies dealing with artificial rearing of parasitoids must be expanded and it would be necessary to consider basic research concerning the nutritional physiology of the species to be reared.

PA 16

***In vitro* Comparative Studies on the Effect of Nutrition and Host on Some
Biological Traits of Two Parasitoids: *Trichogramma principium*,
Sogonyaev and *T. brassicae* Sorokina Bezdanko**

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Studies on effect of the food type and host (presence, absence) on biological characters of the two species indicated that honey is necessary for survival (male and female) for longer period. The longevity of the two species (with honey) were 17 days for female, and 6 days for males. Water did not have any effect on the longevity of the parasitoids. When the host and honey were provided, longevity of female increased (12 days for *T. principium*, and 7.8 days for *T. brassicae*), and longevity of male decreased (12, 14 days for the two species respectively). When parasitoids were provided with honey, its fecundity increased. It reached 85.7 ± 33.5 and 74.1 ± 32.5 eggs for the two species, respectively. Feeding mothers with honey had no effect on emergence percentage of the first generation. Sex ratio (Female/Total) decreased when honey was applied, which led to increased longevity of the females.

PA 17

Rearing of Egg Parasitoid, *Trichogramma embryophagum*

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Trichogramma spp. are considered the most important insect egg parasitoids and widely used in field control of various insect pests. This research is intended to standardize rearing conditions of *T. embryophagum* and the selection of suitable host eggs. The results indicated that parasitism rate on *Ephestia calidella* egg was the highest (83%) with average adult parasite emergence of 96% in comparison with eggs of two other *Ephestia* spp. or *Plodia interpunctella*. It was certain that this parasitoid prefer eggs of *E. calidella* over the two other species of the same genus in a preference test. An inverse relation was found between temperature and parasitoid life cycle. The optimum temperature for rearing was 18°C, where the life cycle period averaged 20 days, adult emergence 98% and with an average of 19 parasitized eggs/female with 16 generations/year. The results indicated the possibility of storing the parasitized eggs for a period of 76 and 300 days under 7 and 4 °C, respectively, and without any effect on the activity of the emerging adults.

PA 18

Mass Release Program of *Apanteles* Parasitoid for the Control of Pomegranate Moth *Ectomyelois ceratoniae*

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The pomegranate moth, *Ectomyelois ceratoniae* is the most important pest which attacks pomegranate and causes economic damage in Iraq. The first three larval stages are attacked by the solitary endo-parasitoid *Apanteles angaleti*. This is a most common parasitoid in pomegranate moth and widely spread on pomegranate plantations. A mass release program of this parasitoid which included mass rearing of host larvae on artificial diet, parasitoid mass production, timing of release, release process, and construction of life tables for the parasitoid and moth under released and non released conditions of the parasitoid in the fields was accomplished. Evaluation of release program based on analysis of mortality factors of life tables indicated that parasitoid release program increased percent of parasitization to 31.8% as compared to 13.7% in non-released area. The release process play an important role in lowering the rate of pomegranate infection to 13.3% at harvesting time, where the infection reached 38% at locations where the parasitoid was not released. Processing of over-wintering moth larvae left in falling fruits in the field under release condition, revealed that 22.2 % of them contain parasitoid larvae, as compared with only 3.4% in non-release field conditions.

Predators

PR 1

**Some Biological Characteristics of *Harmonia axyridis* Pallas
(Coleoptera: Coccinellidae) When Feeding on Eggs of *Ephestia kuehniella* Zell
(Lepidoptera: Pyralidae)**

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The effect of feeding larvae and adults of the predator *H. axyridis* on eggs of *E. kuehniella* was studied to evaluate fecundity, pre-oviposition period, oviposition period, post-oviposition period and longevity. The eggs of *E. kuehniella* used were stored at $2\pm 1^{\circ}\text{C}$ for different periods (1 month, 2 months and 5 months) and at $-20\pm 1^{\circ}\text{C}$ for three months and one year. The life cycle of *H. axyridis* was studied and daily consumption of the larvae was evaluated when it was fed on *E. kuehniella* eggs stored at $2\pm 1^{\circ}\text{C}$, for one month. The results showed that storage periods of *E. kuehniella* eggs at $2\pm 1^{\circ}\text{C}$ affected significantly the fecundity and pre-oviposition of the predator. The fecundity was 1731.9 ± 477.9 and 438.4 ± 149.6 eggs when females were fed on eggs stored under $2\pm 1^{\circ}\text{C}$ for one month and 5 months, respectively. The pre-oviposition period was 46.13 ± 15.56 and 11.4 ± 2.41 days when females were fed on eggs stored at $2\pm 1^{\circ}\text{C}$ for one month and 5 months respectively. Longevity was not affected by storage period of *E. kuehniella* eggs at $2\pm 1^{\circ}\text{C}$ and $-20\pm 1^{\circ}\text{C}$. The larvae did not develop when they fed on *E. kuehniella* eggs stored at $-20\pm 1^{\circ}\text{C}$ for one year. The life cycle of *H. axyridis* from egg to adult emergence was 23.7 ± 0.89 days. The total number of eggs consumed during the different larval stages of *H. axyridis* was 2432.4 ± 329.6 .

PR 2

**A Comparative Study of *Serandium parcesetosum* and *Clitostethus arcuatus*
(Coleoptera: Coccinellidae): Two Whitefly Predators in Syria**

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A laboratory study on the predators *S. parcesetosum* and *C. arcuatus* was carried out under controlled condition of temperature and humidity. Duration of immature stage development was defined under 3 different temperatures (21, 27 and 32°C), and significant differences were found between various temperatures, the two predators were exposed to. The predation rate of larval stage and the daily predation ratio of the adult insects of the two predators were studied after being fed on eggs or fourth instar larvae of *Bemisia tabaci* throughout the growth period. Ingestion of eggs and fourth instar larvae by *S. parcesetosum* was higher than that of *C. arcuatus* by 2 and 4 times, respectively. Fecundity of the two predators was studied and results showed, that the prey stage did not affect egg-laying by *S. parcesetosum* while *C. arcuatus* did not lay eggs without feeding on prey eggs. The total egg production by a female of *S. parcesetosum* was 440 eggs (mean) at a daily rate of 18 eggs. Whereas the total egg-production of *C. arcuatus* was 110 eggs, at a daily rate 2.30 eggs. In nature, *S. parcesetosum* exists on most whitefly host plants, while *C. arcuatus* prefers only plants with smooth leaf surface..

PR 3

**Biology and Feeding Consumption of the Aphidophagous
Coccinellid: *Exochomus pubscens* Kuster**

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Developmental periods of the different stages and feeding consumption of the black coccinellid *Exochomus pubscens* Kuster was studied. The incubation period takes 5-6 days. The successive four larval instars take 1.5, 2, 2, and 3.5 days, respectively. The pupal stage takes 6.5-7 days at $25\pm 2^{\circ}\text{C}$. This is a nonspecific voracious aphid predator. It has been found attacking *Aphis gossypii* on eggplants and okra and *Microsiphoniella sarborni* (Gillet) on chrysanthemum. Different aphid species were used to feed the predator culture.

PR 4

**Determination of Relative Toxicity of Some Pesticides to Predator
Cyrtolaemus montrouzieri Mulsant and its Prey *Planococcus citri* (Risso)**

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The objective of this Study is to contribute more information about insecticide selectivity on *Cyrtolaemus montrouzieri* and *Planococcus citri* so that some of these chemicals might be used in an integrated control program. The results of the duration of the harmful activity indicated that Permethrin, Propoxure and Methidathion were short-lived insecticide, (less than three days) and Methomyl was slightly persistent (less than 13 days). Thus, *Cyrtolaemus montrouzieri* could be released safely in the field without the risk of side-effects to natural enemies following treatment with these compounds. Few of these compounds, namely, Benzoximat, Pirimiphose-methyl did have a long term effect on fecundity, inspite of their low toxicity compared with the above mentioned insecticides.

PR 5

**The Effects of Different Aphid Foods on Some Biological Properties of Two
Coccinellid Predators, *Harmonia axyridis* P. and *Coccinella septum--punctata* L.
(Coleoptera: Coccinellidae) Under Laboratory Conditions**

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The performance of the newly introduced aphid predator (*Harmonia axyridis* P.) was studied in comparison to the already established one, *Coccinella septum-punctata* L., on two aphid species, Russian wheat aphid (*Diuraphis noxia*, Mordvilko) and black bean aphid (*Aphis fabae*, Scopoli). The experiment was carried out in the insect rearing room (23±2°C, 75±5% RH. and 16:8 h (L:D)) at ICARDA. *H. axyridis* had a significantly higher fecundity than *C. septum-punctata*; both predators had significantly higher fecundity when reared on black bean aphid than on Russian wheat aphid. *H. axyridis* laid a total of 1536 and 843 eggs/female on the two aphid species, while on the other hand, *C. septum-punctata* laid only 1164 and 218 eggs/female on the two respective aphid species. The other biological parameters (oviposition period, adult longevity, % egg hatch) were similar for the two predators. Thus, *H. axyridis* could be a potential predator of faba bean aphids in West Asia and North Africa.

PR 6

**Effectiveness of Different Release of *Hypospis mils* (Beralese) on the Control of
Sciariid fly *Lycoriella Solani* (Winnertz) in Mushroom Crops**

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Laboratory and field trials were conducted in mushroom crops to assess the possibility of biological control of *Lycoriella solani* (Winnertz) which infests cultivated mushrooms (*Agaricus bisporus*). Laboratory trials in mini bags containing mushroom compost showed that the predatory mite *Hypoaspis miles* (Berlese) suppress populations of its prey to very low levels. To assess the possibility of biological control of *L. solani* on a larger scale, trials were carried out in commercial growing bags on a mushroom farm. The mite suppressed its prey to very low densities. Crop yield was higher where the predators had been introduced at spawning, and more mushroom production was significantly increased.

Entomopathogens

EM 1

Insecticidal Effect of Entomopathogenic Fungus *M. flavoviride* on the Fifth Larval Stage and Adults of *Locusta migratoria*

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The locust, especially migratory locust, is a serious insect pest of crops throughout Africa and Asia. The pest is becoming increasingly resistant to chemical insecticides. The use of entomopathogenic fungi spores as possible biological control agents of locusts were investigated. In order to study the efficiency of *M. flavoviride* against the different larval stages and adults of *L. migratoria*, several doses from 10^3 to 10^6 spores/ml were evaluated. A high mortality was observed after treatment. The LD 50 and TL 50 of death rate were determined.

EM 2

**In Vitro Studies on the Use of the White Muscadina Fungus
Beauveria bassiana to Control *Spodoptera littoralis* (Lepidoptera : Noctuidae)
Larvae Collected from Alfalfa**

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The effect of the white Muscadina Fungus *Beauveria bassiana* (strain LARC 192) as biological control agent for the cotton leaf-worm, *Spodoptera littoralis* collected from alfalfa was investigated. Selected isolates of *B. bassiana* originally isolated from naturally infected *Zeuzera pyrinae* larvae was grown on Sabouraud's artificial medium and tested in vitro against 3rd, 4th, and 5th instar larvae of *S. littoralis*, using two formulations, topically in liquid-form (SPS) and as a dry powder (DSP). Pathogenicity tests indicated that the fungus was virulent, and the time required for it to express its action, as determined from the observed mortality rate, appeared to be related to the formulation and larval instars used. The 3rd instar larvae were found to be more sensitive regardless of the mode of application of the fungus at any time interval, with a maximum mortality rate of 95.2% was achieved within 14 days after treatment when the fungus was applied topically as a dry powder (DSP).

EM 3

Effect of Entomopathogenic Fungus *Metarhizium anisopliae* on Some Physiological Parameters of *Schistocera gregaria*.

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The desert locust *S. gregaria* is a serious insect pest of crops. Several studies were made on this species world wide to limit the use of chemicals. Recently, the use of entomopathogens proved to be promising. In this study, the toxicity of one fungus *Metarhizium anisopliae* on adults of *S. gregaria* was evaluated. Results showed a high death rate for the two sexes of the stage selected, which is observed 4-5 days after treatment. The effect of the same dose on breathing and cardiac rhythm of the locust was also determined.

EM 4

**The Use of *Cydia Pomonella Granulovirus* to Control the Codling
Moth in Apples and Pears**

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Granulovirus (Carpovirusine) was produced by using larvae infected by the viral strain from Mexico, distributed by the B.B.A. (Darmstadt, Germany). It was observed that a treatment of 10^{13} OBs per hectare every 10 days gave sufficient protection, providing that the destructive population level was weak to moderate. A study carried out on codling moths which survived the treatment did not show any difference in weight between the pupae of the following treatments: untreated control, granulovirus, chemical insecticide and alternating chemicals with granulovirus. The moths did not show any malformation of the ovaries. The study showed an increase in mortality and modification of the adults emergence curves. Vertical transmission of this virus to the next generation was evident both in the laboratory and in moths from treated orchards.

EM 5

The Efficiency of *Beauveria bassiana* (Bals) Against *Locusta migratoria* and *Schistocerca gregaria* (Orthoptera:Acrididae)

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Historically, the desert locust, *Schistocerca gregaria* has been considered as one of the main plagues of humanity during its gregarious phase. The damage it causes extend from the west coast of Africa over to India. The migratory locust *Locusta migratoria* is also a gregarious *Acrididae* which causes considerable damage in African and Asian countries. In order to use an alternative means of control other than chemicals against these two pests, trials are in progress to evaluate the efficiency of applying entomopathogenic fungi, mainly *Beauveria bassiana*. The pathogenic fungus was isolated from *S. gregaria* in Adrar from an irrigated crop during December, 1996. The efficacy of conidia of *B. bassiana* (Balsamo) was tested in the laboratory against two grasshoppers: *S. gregaria* and *L. migratoria* with two doses 10^5 and 10^2 spores/ml. A spray method was used for inoculating larvae (L1, L2, L3, L4 and L5) and adults. Results indicated a good efficacy of *B. bassiana*. *S. gregaria* was more susceptible to the fungus than *L. migratoria*.

EM 6

**Study on Natural Enemies of Apple Stem Borrer *Zeuzera pyrina* L.
(Lepidoptera: Cossidae) in Al-Jabal Al-Akhdar, Libya**

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The objective of this study was to identify natural enemies of the stem apple borrrer, *Zeuzera pyrina* L. in Al-Jabal Al-Akhdar, Libya. The studies showed that the one insect parasite belonging to the order Hymenoptera and family Chalacidae was identified. In addition, the entomopathogenic fungus *Beuaveria bassiana* was isolated from larvae of the pest. The fungus was grown on three different media (P.D.A., Peptone 3% +M.A. and S.D.A.), and the effect of *B. bassiana* was tested under three different storage conditions (9°C, 25°C and fresh by prepared spores). The results showed that the fresh by prepared spores were the most effective.

EM 7

**Production of Bacterial Insecticide (*Bacillus thuringiensis* var *aizawai*) and its use
Against the Wax Moth in Iraq**

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Cultivation and propagation of *Bacillus thuringiensis* var *aizawai* on local fermentation medium was studied. Revealed that the medium of 25% whey and 105 g/l corn steep liquor (CSL), supported the growth and production of a high yield spore-crystal preparation (a maximum of 0.5×10^9 spores/ml in flask and a mean of 3×10^8 spores/ml in the fermentor). The biomass produced was formulated in slurry form and been stored at room and cool conditions for shelf life studies. The formulated preparation demonstrated a high insecticidal activity against 10-12 days old larvae of wax moth (*Galleria mellonella*) under laboratory conditions.

EM 8

Effectiveness of *Metarhizium anisopliae* (Hypomycetes: Deuteromycotina) on the Hemolymphatic Proteins of *Schistocerca gregaria* (Orthoptera: Acrididae)

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In the present work, the effect of *M. anisopliae* on the hemolymphatic protein of adults and 5 instars of *S. gregaria* was studied. Results revealed that the fungus affects significantly proteinemia in a qualitative and quantitative way. Indeed, a decrease in the rate of proteins and the number of the protein fractions were noticed on the treated locusts as compared with the control.

EM 9

**Evaluation of National Isolate of *Beauveria bassiana* (Balls) vull.,
Two Formulae of *Bacillus thuringiensis* and the Insecticide
Enitrothion Against *Zeuzera pyrina* L. Larvae**

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An isolate of *Beauveria bassiana* at 3.2×10^8 conidia/ml and a combination of the fungus with the insecticide fenitrothion at a concentration of 0.05% and fenitrothion alone at 0.15% were tested on different instar larvae of *Zeuzera pyrina* L. by injection in the tunnel bored stem cuttings of pomegranate. A sample of each of two preparation formulae of *Bacillus thuringiensis* B.T. (Eza 5865) at a concentration of 12.8×10^7 spore/ml and B. T. (SOMEBIO) at a concentration of 5.5×10^7 spore/ml were also tested. Different instar larva of this insect were left non treated in the tunnels as control. Treatment of *Zuzera* larvae with the fungal isolate alone gave an average mortality of 72, 76, 86 and 94 % after 3, 7, 10 and 14 days respectively. When a combination treatment of fungus + fenitrothion was used, the mortality rates were 42, 52, 57 and 66%, after the same periods, respectively. When fenitrothion alone as used, a mortality rate of 31, 36, 50 and 64 % were obtained for the same period, respectively. Under the same conditions, the mortality rate for B.T. (Bza 5855) was 40, 60, 77 and 80%, and 36, 55, 67 and 71% for B. T. (SOMEBIO), whereas for the control treatment it was 6, 12, 17 and 20%, respectively.

EM 10

**Evaluation of the Pathogenicity of Some Entomopathogenic Fungi to Parasitize
Aphids**

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A study was conducted under laboratory and green house conditions to evaluate the biocontrol efficiency of three entomopathogenic fungi *Beauveria bassiana* isolate 1 and 2, *Verticillium lecanii* and *Paecilomyces* sp. as biocontrol agents of *Aphis fabae* on broad bean plant. The biocontrol efficiency of the three entomopathogenic fungi was found to be fungal species and exposure time dependent. *V. lecanii* showed high biocontrol potentiality in both laboratory and green house conditions. Under laboratory conditions, *V. lecanii* showed the highest rate of parasitism (83.16 and 89.55%) after 72 and 96 hours respectively. Whereas, under green house conditions, the highest rate of parasitism (72.22%) was recorded after 96 hours.

EM 11

***Erynia phytonomi*: A New Record in Iraq**

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A fungal pathogen, *Erynia phytonomi* (Zygomycetes: Entomophthoraceae) was identified to infect the larvae and pupae of alfalfa weevil *Hypera postica* in central of Iraq. Morphological study indicated that infection developed along two distinct physiological lines, each culminating in the production of either conidial or resting spores, in larvae which are morphologically distinct. *E. phytonomi* produced conidial spores in early infected larval instars and resting (spores) in later instars as a survival strategy for the pathogen. Phenological study indicated that the rate of infection and epidemic development of the disease in the field were not dependent on host density.

EM 12

**Isolation and Use of Granulosis Virus for Control Potato
Tuber Moth in the Field**

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Symptoms of slow motion, no feeding, change to white milky color and death of larvae of potato tuber moth (PTM) *Phthorimaea operculella* (Lepidoptera: Gelechiidae) was observed in the field. The virus was then identified from dead larvae, isolated, and purified. The result of virus application indicated that the virus influenced the rate of infection by PTM in the field. That was obvious in all concentrations and weather the virus applied as a spray on plants or in a dust form with tubers. The application of the virus in the field showed the ability of the virus to survive and remain active in the soil from one season to another, as indicated by the lower rate of infestation of potato replanted plots with the virus. The damage on these plants for the following three seasons were 7.1,13.5,23.6 mine plant, as compared with 33.5, 64.5, 53.4 mine/plant in potato replanted in non treated plots. The best concentration of the virus, which gave effective control of PTM was at five larvae per liter of water. No significant differences were observed when the virus was applied as a powder or solution.

Plant Extracts

PE 1

Effect of Neem-Derived Products on Chickpea Leaf Miner (*Liriomyza cicerina* Rond.) Infestation and its Natural Enemies

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In West Asia and North Africa region, chickpea leaf miner (*Liriomyza cicerina* Rond.) causes yield losses that could go up to 30%. Among the bio-insecticides, variable preparations from neem (*Azadirachta indica* Juss.) including water seed extract (50 g/l), powder (6g/l) and oil (2ml/l) were evaluated for leaf miner control in comparison to unsprayed checks and Deltamethrin (Decis) (0.25 cc/l). Three to 5 sprays of neem seed extract at weekly intervals starting at about flowering stage effectively reduced the percent mining caused by leaf miner. Neem oil also reduced leaf miner damage, but less effectively than neem seed extract. Neem applications had little effect on chickpea leaf miner parasitoids; the level of parasitism on treated plots with neem products was reduced only by 15%. Whereas, plots sprayed with Deltamethrin reduced the level of parasitism by about 50%. The results of these studies show the potential of using Neem-derived products as a component in an integrated pest management program for chickpea leaf miner control.

PE 2

**Efficacy of Plant Extracts Against Nymphs of Whitefly
Bemisia tabaci Gennadius**

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Extracts of eight plants namely *Azadirachta indica*, *Annona squamosa*, *Acacia nilotica*, *Myrtus communis*, *Crotolaria juncea*, *Jatropha dhofarica*, *Sueda aegyptiaca* and *Boswellia sacra* were prepared by steeping 12.5 gm of shade dried powder of the plants in 62.5 ml of water-ethanol (1:4 v/v) for 24 hours, followed by suction filtration. One ml of the filtrate was diluted to 10 ml with water containing 0.01 % emulsifier (Triton X-100) and used as spray solutions. Cucurbit leaves with whitefly nymphs were sprayed with the plant extracts. The leaves were kept in contact on filter papers for 2 hours just before spraying and after 24 hours of spraying of the extracts. The papers were sprayed with ninhydrin (0.4 % in ethanol) which gave purple spots due to honeydew secreted by whitefly nymphs. The difference between the number of spots before and after spray gave the mortality count. Among the extracts tested the highest mortality (70.40 %) was recorded in *A. nilotica*, followed by *A. indica* (57.41%), *C. juncea* (53.93 %) and *A. squamosa* (50.00 %). *B. sacra* recorded 44.20 % mortality while in *S. aegyptiaca*, *M. communis* and *J. dhofarica* the mortality was low ranging from 11.57 to 23.02 %. Control recorded no mortality.

PE 3

**Influence of Secondary Metabolites on Resistance of Corn to
Corn Stem Borer *Sesamia cretica***

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Laboratory and field studies were carried out to evaluate the influence of secondary metabolites present in corn such as lignin and coumarins on resistance to corn stem borer *S. cretica*. Results showed that the percent of lignin present in the green part of different corn genotypes ranged from 12.3 to 17.3%. When lignin content was related to level of infestation by stem borer it was found that the genotype SAKHA 9433 which contains a high percent of lignin had 10% infestation as compared with 35.9% infestation of the genotype CML 329, which contains lower lignin content. In addition, results showed that coumarins were present in different concentrations in corn genotypes. In the resistant genotype SAKHA 9433, the amount of coumarins was four times higher than in the susceptible genotype Across 9433. The amount of damage caused by stem borer was 10% in the first genotype and 57% in the second. It was evident that when coumarin content in corn genotypes increased, the survival rate of stem borer larvae decreased.

PE 4

**Responses of Two Insect Pests on Vegetables
to Extracts of *Melia azedarach* L.**

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Extracts of leaves and fruits of *Melia azedarach* L., the Chinaberry tree, were assayed against *Bemisia tabaci* (Gennadius), the sweetpotato whitefly, and *Liriomyza huidobrensis* (Blanchard), the pea leafminer. Extracts of *Melia* fruits were tested against adults and early nymph instars of the whitefly on tomato in a glasshouse. Aqueous extracts of *Melia* fruits and leaves were tested against larval instars of the leafminer on cucumber in a greenhouse. Treatments included *Melia* extracts of 200, 20.0, and 2.00 mg-eq/ml, certain selected biorational insecticides, and control as distilled water with and without Triton. Results indicated that adults of *B. tabaci* were significantly repelled by aqueous and non-aqueous fruit extracts of 200 mg-eq/ml compared to the control after 72 h. There were significant differences in % mortality of nymphal instars (27.7–57.5%) among these extracts and the control. In the greenhouse experiment, *Melia* fruit extracts were comparable in their effect to the selected insecticides and significantly decreased the number of live larvae per cucumber leaf compared to the control, throughout the period of the experiment. Thus, *M. azedarach* extracts seem to have good potential in the management of these two pests.

PE 5

A Laboratory Study on the Effect of Neem Extract on Some Biological Properties of the Parasitoid *Diaeretiella rapae* McIntoch (Hymenoptera: Aphididae) which Attack the Russian Wheat Aphids (*Diuraphis noxia* Mord.) (Hymenoptera: Aphididae)

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Natural enemies play an important role in the population dynamics of the Russian wheat aphid *Diuraphis noxia*. The parasitoid *Diaeretiella rapae* is considered among the most important natural enemies which parasitise aphids and significantly reduce their numbers. In this study, the effect of seed neem extract (Neem Azal T/S), which contains 1% azadirachtin, on the biological properties of the parasitoid was evaluated. Laboratory tests, indicated that the application of the neem extract (0.2% commercial product) led to L2 larval mortality before and after parasitism of 59 and 48%, respectively. The treatment led to an elongation of the parasitism and mummy formation periods. The main effect of the treatments was on the rate of adult emergence as compared to the control. The above two treatments equally reduced adult parasitoid emergence to 78% as compared to 96% for the control. The treatment had also significantly reduced adult fecundity, mainly during the first five days after emergence, and during the whole adult life in general.

PE 6

The Effect of Some Chemical Compounds on Citrus Leaf Miner (*Phyllocnistis citrella*) and its Natural Enemies

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Four chemical insecticides (American neem, Burman neem, Summer oil and Vertemic) were tested against Citrus leaf miner (CLM) (*Phyllocnistis citrella*) at dosage rates of 100, 100, 300 and 7 CC/20 liters, respectively. Water spray was used as control. The number of CLM and parasitoids emerged from the samples which collected from the treatments was 344, 338, 353, 329, 268 for CLM and 285, 247, 272, 329 and 517 for parasitoids for the treatments American neem, Burman neem, Summer oil, Vertemic and water, respectively. From these results, it was evident that these insecticides had an adverse effect on the natural enemies which parasitise CLM as compared with the Control. On the other hand, there was no significant effect to these insecticides in controlling the CLM.

PE 7

Effect of *Melia azedarach* L. Fruit Extracts on *S. crinitus* H. Control

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The deterrent effect of *Melia azedarach* L. dry fruit extracts was evaluated on *Sitona crinitus* H. adults feeding on lentil leaves. The results showed that *S. crinitus* adults feeding was significantly ($P < 0.05$) reduced on lentil leaves sprayed with three concentrations (0.25, 0.5 and 1%) of oil extracted from *M. azedarach* dry fruit compared to unsprayed check. The results also revealed that *S. crinitus* feeding was significantly reduced ($P < 0.05$) on lentil leaves sprayed with three concentrations (15, 25 and 50 gr/litter) of water extracts from *M. azedarach* dry fruits compared to unsprayed check. The water extract solution of 50 gr/l gave a significantly higher protection than the other two concentrations (15, 25 gr/l). The results of this study show the potential of using fruit extracts of *M. azedarach*, a widely grown tree in the region, in integrated pest management program of *S. crinitus*.

PE 8

**Toxic Effect of *Melia azedarach* on the Fifth Larval Stage and
Adults of *Schistocerca gregaria***

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In a search for an alternative method to control locust desert *Schistocerca gregaria*, to reduce the use of chemical insecticides, plant extract from *Melia azedarach* was orally administered to L5 and adults of *Schistocerca gregaria*. Mortality rate, the effect on the cardiac and respiratory rhythm of this locust, in addition to the LD₅₀ and TL₅₀ determination will be presented by the authors.

PE 9

The Effect of Three Plant Extracts from *Melia azedarach*, *Nerium oleander*, and *Inula viscosa* on the Behavior of the Desert Locust *Schistocerca gregaria*

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The desert locust *Schistocerca gregaria* causes enormous damage to agricultural crops in north Africa and neighbouring countries when in gregarious form. The effect of three plant extracts: *Melia azedarach*, *Nerium oleander* and *Inula viscosa* on the behaviour of *Schistocerca gregaria* were studied. These plants extracts were either repulsive or poisonous to the locust when presented as food bait. When plant extracts were injected into the locust, number of individual of *S. gregaria* died few days after the injection. The molting of the surviving individuals was delayed in comparison with untreated individuals. The adults did not reproduce and the sexual maturation was disturbed.

PE 10

Antifeeding Effect of *Melia azedarach* Fruits on the Lepidoptera Larvae

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Larvae of the Mediterranean flour moth *Ephesia kuehniella* Zell. were orally treated with different concentrations of water extracts from dried fruits of *Melia azedarach* L. Results showed 66.7% reduction of pupal weight compared to the control. There was a low toxic effect of these extracts on larvae, even one week after treatment, as mortality rate did not exceed 50% in all treatments (5.55, 11.11, 30.50 and 43.50). The effect of these *Melia* fruit extracts was similar to that of the antifeeding insecticide Pymetrozine (Chess).

PE 11

**Integrated Pest Management of the Potato Tuber Moth *Phthorimaea operculella* Z.
(Lepidoptera: gelechiidae) In Tunisia**

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The potato tuber moth (PTM) is the most serious potato pest in North Africa and the Middle East. In the absence of control measures, losses can easily reach 100% as a result of potato tuber moth and soft rot damage. In the past, Tunisian farmers adopted synthetic pesticides to control potato tuber moth. The overuse of these chemicals dramatically altered the environment without achieving sustainable control. Therefore it became essential to develop alternatives control measures. The INRAT in collaboration of the International Potato Centre developed an integrated strategy for PTM control. Several agronomic practices have been identified and tested to reduce PTM infestation in the field. The biological insecticide *Bacillus thuringiensis* (Bt) proved effective in reducing PTM infestation in stores. A native baculovirus, identified as a granulosis virus (GV) was also tested in the laboratory, in large-scale storage trials, and in the field and it gave promising results. Association of Bt and GV was as efficient as commonly used chemicals. In order to get perfect PTM control, two PTM parasitoids were imported and a release program is underway. Transgenic potato cultivars resistant to PTM were also evaluated in order to be used in the integrated strategy where chemicals are totally absent.

PE 12

Effect of Treatments by Insecticides on Nymphs of Pistachio psyllid "*Agonoscena targionii*" (Homoptera: Psyllidae) and the parasite *Psyllophagus pistaciae* (Hymenoptera: Encyrtidae)

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Pistachio psyllid causes considerable damage to pistachio trees. The first appearance of this insect in Syria was in Al Bab (Aleppo). Then it spread to all pistachio growing areas of Syria. It attacks the fruit buds of the next year production, leading to high quantity and quality losses. During 1991 season, the interior parasite *Psyllophagus pistaciae* (Hymenoptera: Encyrtidae), was discovered for the first time on nymphs of pistachio trees, at the Agricultural Research Center of Aleppo and was classified by the British Museum. During 1993, the rate of parasitism was studied in Halisa, where pest numbers increased and reached to 90 nymphs/leaflets, and rate of parasitism reached 2.0–9.6%, inspite of insecticides application (phosphoric, pyrothroidic, carbamatic). This insect pest was controlled during 1994 by the application of nomolete (nomolete "Tephlobenzorone Sc 15%" and Gimes "Flufenoxuron Ec10%"). The rate of parasitism was increased to 75.9% as compared to 20% for the control. The development of psyllid nymph numbers and rate of parasitism were studied during 1995/96 seasons, under controled conditions and by using Lanet "Mythomil Wp90%" and Decis "Delta methrin Ec50%" in Halisa and Tel Sha'eer locations. It was observed that the average of the pest population was decreased to 24.6 leaflet, and rate of parasitism reached to 48% under no spraying, when the average nymphs number in treated field was 50.7 nymphs/leaflet and rate of parasitism was 10.4%.

Biological Control

BC 1

Biological Control of *Helicoverpa armigera* Hbn. and *Earias insulana* Bois. by Using *Trichogramma principium* Sugon. & Sorok. on Cotton in Syria

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In this research, the possibility of using the eggs parasite *Trichogramma* in the biological control program of Cotton Boll worms eggs in Syria was studied. Three populations of these parasites from three regions: Aleppo, Raka and Dier-ez-zor, were obtained, and found to belong to one known species, recorded for the first time in Syria as *Trichogramma principium*. The suitable conditions for breeding and reproduction of these parasites, as well as for mass rearing under laboratory conditions, were a temperature of 23-26 C° and relative humidity of 75±5% with lighting of about 16 hours a day. The results showed also the possibility of inducing developmental arrest under laboratory conditions, where two types of stopping development of the species were observed: temporary sleeping (quiescence) and real sleeping (diapause). The biological characterizations of *T. principium* were not influenced by storage for a long time under cold conditions (up to six months). The emergence percentage was high (90%) during these months. Mass rearing and storage of *T. principium* was possible until the time of its use in the field. To determine the efficiency of using these parasites in the biological control program of Cotton Boll worms, experimentation of *Trichogramma* release was conducted during 1995, 1996, and 1997 seasons. Two amounts of *Trichogramma* (300,000 and 600,000) were released in cotton fields per hectare at two times, with 100 or 200 sites of release per hectare and with either continuous breeding or breeding with inducing developmental arrest and storage for 6 months. The results obtained in Aleppo region (Zerbeh, and Maskaneh) and in Hama at El Ghab in 1995 showed a high efficiency in controlling the cotton boll worms in the field. The results of 1996 and 1997 equally showed the efficiency of these parasites to limit the attack of these pests in the experimental fields in Aleppo, Hama and Deir-ez-zor. The results also showed that the efficacy stored parasites was equal to those non stored.

BC 2

Biocontrol of Red Palm Weevils, Stem Borers and Grubs in GCC Countries

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A new terrestrial pheromone/kairomone trap was developed. This new trap caught significantly greater number of red date palm weevils (RPW) in comparison with aerial (120 cm high) and apical traps. Moreover the Project traps outperformed other trapping systems such as the Egyptian, Brazilian and traditional traps. The addition of kairomones (extracted from wood and fruits of date palm trees) to terrestrial food-baited pheromone traps, significantly improved their efficiency in capturing greater number of RPW individuals. Two entomopathogenic nematode (EPN) strains were successfully isolated in United Arab Emirates (UAE) and one strain each from State of Qatar and Sultanate of Oman. These strains, in addition to a fourth one from Texas, USA proved their infectivity against RPW and were able to reproduce inside RPW and exit out of it. The project is investigating technologies to transmit the EPN to be in contact with RPW inside tunnels in the trunks of infested date palm trees. Use of *Beauveria bassiana* as spray application on date palm trees before or after infesting these trees with healthy adults of RPW inside large cases, or the release of males of RPW contaminated with *B. bassiana* produced very promising results for the control of RPW.

BC 3

Study of the Activity of the Natural Enemies on the Citrus Leaf Miner (*Phyllosinthis citrella*) in Syria

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During 1996, the parasitism (%) of the citrus leaf miner (CLM) parasitoids were studied in experimental fields in Tartous (Amrit). The presence of the following species was found to differ from one month to the other, and is summarized as follows: *Ratzeburgiola incompleta* (51.6-90%), *Semiela cher petiolatus* (10-42.5%), *Cirrospilus nrlyncus* (0-16.7%), *Sympiesis* sp. (0-3.06%), *Cirrospilus quadristriatus* (0-0.4%), *Neochrysocharis* sp. (0-0.4%) (Eulophidae) and *Ageniaspis citricola* (0%) (Encyrtidae). Generally, the highest efficiency was attributed to the local natural enemy *Ratzeburgiola incompleta* (61.8%) followed by the introduced parasite from Australia *Semiela cher petiolatus* (33.9%).

BC 4

An Improved Method for Ensuring Host-Parasitoid Temporal Coincidence During Seasonal Mass Releases

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An improved method of biological control for the European corn borer, *Ostrinia nubilalis* Hubner, by the use of oophagous parasitoid insects, *Trichogramma brassicae* Bezdenko. was developed. This was achieved by synchronizing emergence of the parasitoid with the first egg-laying of the corn borer, which led to increased parasitic efficiency. The accumulated degree-days characterizing (i) the end of the pre-imaginal development of *T. brassicae* under controlled fluctuating natural temperature conditions after the removal from 3°C, and (ii) the first egg laying occurrence by the phytophagous insect, were calculated. This approach permitted to determine when the oophagous insect must be removed from 3°C. After the applications of this principle for several years, results showed that *T. brassicae* emergence occurred at the time of first egg-laying ± 2 days. This method proved to be reliable when applied in a situation where both host and oophagous insects are submitted to the same temperature conditions during pre-imaginal development.

BC 5

**Biological Control Strategy of Aphids on Pepper Under
Greenhouse in Douiet (Morocco)**

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Two aphid species attack frequently pepper under greenhouse cultivation in Douiet, *Myzus persicae* and *Aphis gossypii*. The greenhouse offers favorable conditions to the multiplication and the quick development of many pests, particularly aphids. Without protection, high populations, which can cause spectacular damage to the crop, are unavoidable. However, chemical control of aphids must be conducted carefully because of the ability of the two species to quickly develop resistance to the majority of insecticides actually available. So, biological control is obligatory for controlling aphids. The use of *Aphidius colemani* (Hymenoptera: Aphidiidae), a parasitic wasp of the two species has limited aphids populations. Containers of *A. colemani* are imported from Koppert France society. The wasp is introduced in a proportion of 0.38 to 0.77 adults/m². Two releases per season are always necessary. Because of releases at the appropriate time and the reduction of chemical treatments against other insects, the number of aphicide applications has been reduced from 10 in 1993 to less than 2 in 1998.

BC 6

**Predators and Parasitoides of the Citrus Leaf Miner *Phyllocnistis citrella*
(Lepidoptera: Gracillaridae) in Algeria in view of their
Utilization in Biological Control**

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Since 1994, citrus orchards in Algeria are threatened by *Phyllocnistis citrella* attack. The survey carried out on lemon and orange trees in Staoueli and Rouiba for four years (1996, 1997, 1998 and 1999), allowed to collect some data on the bio-ecology of the miner and more specifically on both natural enemies and their interferences as well as its parasitism complex. Among predators, *Chrysoperla carnea* Steph (*Chrysopidae*) has been identified. It is a very active species in the month of July specially the L3 and L4 stages that attack the to larvae of the miner. Nevertheless it is necessary to signal that this prey constitutes only a food replacement for this auxiliary which is know of its food specificity for aphids. Otherwise a number of larvae of *Cecidomyidae* has been observed around larvae of the miner. This predator attacks the miner by stinging and sucking of the abdominal part of the insect. Two parasitoides (*Hymenoptera*) were identified: *Cirrospilus pictus* Nees and *Pnigalio mediterraneus*. The first species has a higher multiplication rate as compared to the second. The parasitic impact was limited. The rate of overall parasitism recorded on the lemon tree was in the order of 5,53% in 1996, 10.97% in 1997 and of 8.70% in 1998. On orange trees it was in the order of 3.70% in 1996, 5.19% in 1997 and 10.39% in 1998. The overall parasitic activity was exercised on the 3rd larval stage with an elevated rate on the two speculations. Finally, it is important to note that tests of release of the introduced species *Simielacher petiolatus* gave some satisfactory results contrary to the species *Ageniaspis citricola* whose results were not conclusive.

BC 7

**A Preliminary Study on *Lymantria dispar* L. (Lepidoptera: Lymantridae)
Parasitoids in the Eastern Coastal Mountains Range of Syria**

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A study was conducted to evaluate the effect of natural enemies of the population dynamics of *Lymantria dispar* in the eastern coastal mountains range of Syria. Eggs and larval were collected and maintained in the laboratory until pupation. Pupae of different ages and from different elevations were monitored until adults were emerged. Eggs parasitism with a parasitoid species belonging to the family Encytridae was around 1.5%. However, 29.7% of the larvae were parasitised by *Apanteles melanoscelus* (Hymenoptera: Braconidae), with a very low rate of parasitism with a member of the family Ichneumonidae. The highest rate of pupal mortality, at foci of infestation at 600 m above sea level, reached 96%, whereas at 850 m above seas level it reached 83.3%. Pupal attack was mainly by the parasitoid *Brachymeria intermedia* Nee (Hymenoptera: Calcidae) together with another parasitoid, member of the family Tachinidae. Predation with a beetles larvae (Fam: Fermetidae) was also observed. In additions, the predator *Calosama sycophanta* L. also attacked the larvae and pupae and played an important role in reducing the population of *Lymantria dispar*.

BC 8

**The Occurrence of Natural Enemies Attacking the *Macrosiphum euphorbia*
(Homoptera: Aphididae) Populations infesting *Inula viscosa* in Syria and its
Importance in Biological Control**

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Many wild plant species play the role of host plants for aphids, from which they migrate to crop plants. Aphid populations when feeding on such host plants are attacked by insect predators or parasitoids which reduce these numbers. The natural enemies of *Macrosiphum euphorbiae* feedings on the wild plants *Inula viscosa* were studied during the period from April to late summer. Aphid population was high in April but significantly reduced there after. This reduction was associated with the presence of two natural enemies *Macrolophus* sp. and *Diciphus* sp. (Hemiptera: Miridae) which persisted during the whole study period, inspite of the absence of aphids. The coccinellid beetle *Coccinella septempunctata* was observed in good numbers only during April and until mid-May. In addition, larvae of Syrphid flies were observed until early May. As for parasitoids, two species belonging to Hymenoptera: Aphelinidae emerged from mummified aphids from April to mid-May and again towards the end of June.

BC 9

Abundance and Distribution of Natural Enemies of Root Aphid (*Smynthuodes betae* West) (Eriosomatidae: Homoptera) Associated with Lentil in Southeastern Anatolian Region of Turkey

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This study was carried out in Diyarbakir, Sanliurfa and Mardin provinces during vegetation period of 1997 to determine abundance and distribution of natural enemies of *Smynthuodes betae* West. in southeastern Anatolia. Field studies indicated the presence of some predators that feed on root aphid. These predators include one species belonging to Coccinellidae (Coleoptera), *Hyperaspis quadrimaculatus* Red and one species belonging to Syrphidae (Diptera) *Chrysotoxum intermedium* Meigen which are considered to be a new records on the root aphids in Turkey. Activity of these predators were during flowering and podding stages of lentil. It was found that *H. quadrimaculatus* was the most common in the areas surveyed, while *C. intermedium* was found only in Mardin and Sanliurfa provinces. *H. quadrimaculatus* the most dominating natural enemy of lentil, represented 94% of the total predator population.

BC 10

**Efficiency of Some Pheromone Traps for Controlling Red Palm Weevil,
Rhynchophorus ferrugineus (Olivier), Under Saudi Arabia Conditions**

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The red palm weevil *Rhynchophorus ferrugineus* (Olivier), was detected in early 1987 in Qatif area in the eastern province of Saudi Arabia. Since that time it became a serious pest of date palms and spreads over the major growing areas of date palms by transferring offshoots. All stages of the life cycle are spent in the palm tree and early infestation is so difficult to be detected. Five types of pheromone traps were tested. The result showed that the Saudi trap was more efficient than the others. Females were attracted more than males.

BC 11

Potentials of Utilization Natural enemies in the IPM Practices to Control *Sesamia cretica* Led. (Phalaenidae: Lepidoptera) in Iraq

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The stem borer *Sesamia cretica* is considered the most damaging pest on corn in Iraq. Control action is very essential in order to reduce its damage. Application of an IPM practices that included cultural and biological means provided effective control of the pest. Field studies indicated the presence of some predators and parasitoids on corn plants appearing with seedlings emergence until flowering and seed formation. The most dominant predator was *Orious albidipennis* Reut, making 50-70% of the total predator population. Field surveys indicated the presence of an egg parasitoid, which was recorded for the first time in this country. The preliminary identification indicated that it might belong to the genus *Telenomus*. Confirmation of identification is to be received soon. This parasitoid showed high ability for attacking its host. Parasitization of 100% was obtained when the parasitoid was caged with corn seedling containing the host egg (rate 1:8). In general, predators and parasitoids started arrive to corn plants on the third week after emergence, depending on environmental factors. The proper IPM practice would then be a single application of insecticide at the 2nd week after emergence and then leaving the population of natural enemies to build up and play an active role in field. This practice was found to be very effective in reducing borer infestation and increased corn yield as compared to other practices.

BC 12

Side Effects of *Trichogramma principium* Releases in Syrian Cotton Fields

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Undesirable side effects of releases of the parasitoid *Trichogramma principium* against the cotton bollworms in Syrian cotton fields, were tested on eggs of the beneficial insect *Chrysoperla carnea*. This *Chrysoperla* species was the most important predator in Syrian cotton fields. The test was carried out during September 1998, in a cotton field near Aleppo (AL-ZERBEH), in which the egg density was 20 eggs/100 plants for *Helicoverpa armigera*, and 20 eggs/100 plants for *C. carnea*. The nearby field was planted by Cabbage infected by *Pieris rapae* (2-3 eggs/plant leaf). Plastic capsules containing about 1000 parasitoids (not emerged adult of *T. principium*) were hanged on cotton plants each 10 meters in a 10,000 m² area. Eggs of *H. armigera*, *C. carnea* and *P. rapae* were collected 2, 4, and 6 days after the releasing date. The collected eggs were observed in order to calculate the rate of their parasitism. Results showed *T. principium* does not parasitize *C. carnea* eggs in the field. On the other hand, the parasitism rate of *H. armigera* reached 13%, and that of *P. rapae* reached 29%. A new Syrian egg parasitoid, *Telenomus acrobates*, was recorded on *C. carnea* eggs, the parasitism rate reached 18%.