Biology, behavior, and genetic diversity of Trichogramma aurosum Sugonjaev & Sorokina

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It aims to promote communication between researchers worldwide that are working on egg parasitoids. “Egg Parasitoid News” is published about once a year.

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(all information is listed by alphabetical order of the authors)

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Find the online-version of this issue under website:
http://www.bba.de/eggpara/eggp.htm
6th International Symposium
15-18 SEPTEMBER 2002 in Perugia, Italy

The next Symposium of the Working Group is planned for 2002 and will be held in Perugia, Italy. Pre-registration passed in 2001. Final registration and abstracts have to be submitted until 31 March 2002.

Sessions will traditionally cover basic and applied aspects, but proposals for innovative ideas, emphasising diversity in this group of parasitoids that exploit the same host stage, would be highly appreciated. This should lead to an integration of concepts and strategies, allowing to fully utilise not only the potential of *Trichogramma* but also that of other egg parasitoids, the beneficial role of which has so far been underestimated.

For more information please contact Dr. F. Bin. Further information can be found in the website: [http://www.unipg.it/eggpar](http://www.unipg.it/eggpar)
A symposium on egg parasitoids will be held at the 5th International Society of Hymenopterists' meeting in Beijing, China, 22-26 July, 2002. Organizers of this section are Dr. John Huber and Dr. Nai-Quan Lin. About nine talks on egg parasitoids are expected, contributions are still welcomed. Deadline for registration is 1 May, 2002.

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There is new periodical bulletin with notes on Trichogramma and online-help for identification of Latin American species. It is planned to present information in *.pdf-files that can be be downloaded. You are welcomed to make contributions to this bulletin.

website:  http://cnia.inta.gov.ar/trichogramma (former address: www.biocontrol.8m.net)

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“Pest Directory” is a new worldwide database containing addresses of scientists and experts as well as essential information on agricultural pests and natural enemies including egg parasitoids. Aim of this non-profit organization is to promote information exchange in the field of pest management. “Pest Directory” is available on CD-Rom by ISPI – International Society for Pest Information. Contributing members are welcomed.

website:  http://www.pestinfo.org

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______

News in 30 words

______

**Almatni, W.M., (Syria)**
*Trichogramma principium* is released on about 800 ha / a against American bollworm in cotton in Syria. *T. cacoeciae* was released for the first time against codling moth last year.

**El-Heneidy, A.H. (Egypt)**
*Trichogramma evanescens*, a native species, has been used successfully in Egypt against the sugar-cane borer, *Chilo agammenon* in sugar cane fields and date palm pests, mostly *Ephestia* spp. .

**Fursov, V. (Ukraine)**
We are looking for egg- and larval parasitoids of stored products pests, including *Anisopteromalus, Lariophagus, Bracon* and *Venturia* and various Coleoptera and Lepidoptera. Cooperation with colleagues and collaborative projects are welcomed.

**Hassan, S.A., Prozell, S. & Schöller, M. (Germany)**
For a taxonomic study of the *Trichogramma evanescens* species-group, we are still looking for specimens from Turkestan and Central Asia, preferably living individuals.

**Herz, A. & S.A. Hassan (Germany, Egypt, Tunesia, Greece)**
A European project to control lepidopterous pests in olive started in 2002. The aim is to develop an IPM strategy with *Trichogramma* spp. and a pheromone confusion method. As we are baiting parasitoids of the olive borer *Prays oleae* and jasmin moth *Palpita unionalis* we are looking for suitable parasitoids from colleagues in mediterranean countries.

**Monje, J.C., N. Haider & K. Schrameyer (Germany)**
From August to September 2001 we found a *Trichogramma* species on eggs of *Noctua pronuba* on asparagus. It can be placed among the exiguum-section (*sensu* Pinto). Further morphological and molecular characterization is underway.

**Pelletier, D. & G. Boivin (Canada)**
Following lab trials, the suitability of two promising *Trichogramma* strains against the Cranberry Fruitworm (*Acrobasis vaccinii*) are being evaluated in commercial field conditions.

**Ram, Pala & S.S.Sharma (India)**
Egg parasitoid *Trichogramma chilonis* Ishii was recorded from the eggs of a sphingid moth, *Acherontia styx* Westwood on sesame in Hisar, Haryana, India. Rearing of collected sphingid moth eggs in 2001 revealed 76 per cent parasitisation by *T. chilonis*. Planting sesame near cotton plants enhanced parasitisation of *Helicoverpa armigera* eggs on cotton by 33 per cent.

**Virla, E. (Argentina)**
Since 1990, studies on the natural enemies of Auchenorrhyncha have been conducted. A survey of egg parasitoids against those economically important species as disease vectors is carrying on. The potential of these eggs parasitoids of leaf and planthoppers (Homoptera) is great. More studies will surely lead to using these species in biological control.
Practical use of egg parasitoids: Problems and suggestions

Almatni, W.M. (Sweida, Syria)
*Trichogramma* is released against cotton pests in small plastic containers (bird-egg shaped) which are left in fields after use. This strategy is applied since eight years in northern Syria. It caused severe earth pollution year after year. I need practical field experiences related to inundative release and to develop better release containers, which should be environment friendly and can stand high summer temperatures.

El-Heneidy, A.H., (Giza, Egypt)
Most of the problems associated with the practical use of Egg Parasitoids come from: The wide and misuse of insecticides, particularly in some economic crops such as cotton. In some developing countries, IPM programs still have not enough room for Biological Control agents.

Kabiri, Firouz (Valbonne, France)
We at BIOTOP are using two species of *Trichogramma* commercially: *T. brassicae* against the European Corn Borer on corn and *T. evanescens* against noctuid pests in greenhouses. On corn crop the efficacy is quiet good with about 80% parasitization and *Trichogramma* application can replace chemical treatment. In greenhouses the parasitization is at the same level, but the control of the pests is not satisfactory. The farmers must use other beneficials or Bt and chemicals to complete *Trichogramma* efficacy. So the difficulty is to find methods which technically and economically suitable could be used in combination with *Trichogramma* applications.

Usha Rani, P. (Hyderabad, India)
Problems associated with practical use of egg parasitoids in India are:
1. Lack of awareness of the farmers about the benefits of parasitoids
2. Difficult application of parasitoids (diversity of farming systems and small cropping areas)
3. Lack of research in the use of egg parasitoids, lack of support from the government
4. Farmers rely on pesticides as they seem to give immediate protection; pesticides also can be stored for a longer time
Abstracts on current research work

Biosystematics, Genetics

Two new European species of *Trichogramma* (Hym.: Trichogrammatidae)
Pintureau, B., C. Stefanescu & M. Kenis (Villeurbanne, FRANCE; Sant Pere de Vilamajor, SPAIN; Delemont, SWITZERLAND)

Two new *Trichogramma* species from Europe are described. One of these species, *T. gicai* sp. nov., was collected in Northeast Spain from eggs of *Iphiclides podalirius* (Lep.: Papilionidae). It belongs to the *perkinsi* group and shows a long ovipositor. The other species, *T. acantholydae* sp. nov., was collected in Northwest Italy from eggs of *Acantholyda* spp. (Hym.: Pamphiliidae). It belongs to the *fasciatum* group and has the particularity of being univoltine with an obligatory diapause.

Ecology, Behaviour

A *Trichogramma* species harmless for *Chrysoperla carnea* in Syria
Babi, A. & B. Pintureau (Aleppo, SYRIA, Villeurbanne, FRANCE)

*Trichogramma principium*, a species released in Syrian fields to control three species of cotton bollworms, does not parasitize the eggs of the predator *Chrysoperla carnea* in nature. Such a parasitism occurs only in the laboratory when no choice exists for the hosts. In Syria, as well as in other countries, *C. carnea* eggs are parasitized by a *Telenomus* species at variable rates.

Behavioural ecology and functional morphology of egg parasitoids (Hym.: Scelionidae, Mymaridae) of pentatomid bugs, mirid bugs and noctuid stemborers
Bin, F., E. Conti, N. Isidoro, R. Romani., G. Salerno (Perugia, ITALY)

Objectives of our current research work are:
- behavioural ecology of *Trissolcus simoni*, *T. brochymenae* and *T. basalis* towards their co-evolved hosts (pentatomid bugs) on different host plants
- evaluation of host specificity through laboratory tests of possible host shifts, in terms of host location, recognition and suitability
- evaluation of old vs. new associations through literature databases combined with laboratory tests (pentatomid bugs)
- foraging strategies and morphofunctional adaptations of parasitoid species attacking concealed eggs (*Telenomus busseolae* vs. *Sesamia nonagrioides*) and embedded eggs (different species vs. mirid bugs)
- definition of the host unit as the complex of the characters of the host itself, the plant and the associated material and/or organisms exploitable by parasitoids (Conti, Salerno, Bin)
- functional morphology of antennal sensilla and glands in relation to sex recognition and host recognition (Isidoro, Romani, Bin)

**Patch residence time in egg parasitoids: is innate estimate of patch quality always the best strategy?**

Boivin, Guy and Eric Wajnberg (Quebec, CANADA; Antibes, FRANCE)

The Marginal Value Theorem predicts that female parasitoids should exploit host patches until their instantaneous rate of gain reaches a marginal value. Patch residence time was measured in an egg parasitoid, Anaphes victus (Hymenoptera: Mymaridae), when patch quality and travel time varied. The females stayed longer and exploited the patch to a higher level when patch quality and travel time increased. However, the marginal value at which females left the patch decreased with these parameters. Contrarily to Trichogramma species, Anaphes females appear to base their patch quality estimate on the first patch encountered rather than on a fixed innate estimate. Such strategy may be optimal when inter-generation variability in patch quality is high.

**Studies on the biodiversity of East and West Palaearctic species of Trichogrammatidae**

Fursov, Victor (Kiev, UKRAINE)

The taxonomical study of East and West Palaearctic species of Trichogramma and other Trichogrammatidae is being continued. New data on the biodiversity of Trichogramma and other egg-parasitoids depends on studies of the biology of various hosts (Lepidoptera, Coleoptera, Diptera and others). Therefor a programme of survey and collecting of native Trichogramma species in various parts of the Ukraine (North, South, East, Center regions) is in progress. Several stored products pests such as Sitotroga, Ephestia and Plodia (hosts for Trichogramma) and Callosobruchus and Acanthoscelides (hosts for Uscana egg-parasitoids) are being reared in laboratory cultures. Field studies of the biodiversity of Trichogramma and Uscana are also in progress.

**Mechanisms regulating the interspecific competition of two sympatrically occurring species of Trichogramma**

Haider, N.; J.C. Monje & C.P.W. Zebitz (Stuttgart- Hohenheim, GERMANY)

Trichogramma evanescens Westwood (sensu Pintureau) and T. cacoeciae Marchal (sensu Pinto) occur sympatrically in fruit orchards and vineyards in temperate regions. The hosts are Cydia pomonella L. in fruit orchards and both Eupoecilia ambiguella Hb. and Lobesia botrana Schiff. in vineyards. T. cacoeciae appears to be dominant under natural conditions and hence, this species might be more suitable for attempts at controlling these insect pests. However, the mechanism that regulates the populations of both T. evanescens and T. cacoeciae is unknown. Former work was aimed at assessing behavioral parameters of both Trichogramma species that might explain why T. cacoeciae has an apparent advantage over T. evanescens. Furthermore, preliminary work was done on interspecific competition relationships. During the present project it could experimentally be shown that T. cacoeciae can gradually replace T. evanescens when host availability is not limited. Further work is aimed at clarifying the competition relationships when the number of hosts is limited, which is the case under natural conditions. It is hypothesized that interspecific competition within
the host egg might be the key factor responsible for the observed differences in species composition.

**Occurrence and distribution of *Trichogramma* spp. in vineyards**
Ibrahim, R. & H. Holst (Geisenheim, GERMANY)

An evaluation of the occurrence of *Trichogramma* spp. in five different vineyards was conducted in Geisenheim, Rheingau (Hessia, Germany). A new device containing *Sitotroga cerealella* eggs for monitoring *Trichogramma* species was used. The results show that from end of april until middle of september *Trichogramma* could be found in vineyards surrounded by hedges, house gardens or orchards. Baiting just in monoculture vineyard areas could not detect *Trichogramma*. Best results in baiting parasitoids had been made in a vineyard within a variety of hedges (blackberry, elderberry a.o.) and cherry trees. Here *Trichogramma* occurred in the vineyard and as well in the hedges. Until middle of july there was a pause in activity. At this period, the flight of the second generation of tortricid vine pests (*Lobesia botrana*, *Eupoecilia ambiguella*), *Trichogramma* occurred more often in the vineyard than in the hedges. From august until the end of the season the parasitoids could only be found in hedges. This suggests that the overwintering of *Trichogramma* is taking place in the hedges area surrounding the vineyards.

Species that could be found by baiting were *T. cacoeciae* that occurred more often and *T. evanescens*. Details of the results show that the activity of *Trichogramma* was highest at 80-120 cm and perferably on the underside of the leaves. In the vineyard there was a gradient of the parasitoids activity being higher the closer they were to the hedges.

**Spatial density dependent egg parasitism of *Delphacodes kuscheli* (Homoptera: Delphacidae) by *Anagrus flaveolus* (Hymenoptera: Mymaridae) in Tucumán province, Argentina**
Liljesthröm, G.G. & E. Virla (Cepave - La Plata, Tucumán, ARGENTINA)

Females of *Delphacodes kuscheli* Fennah, the only demonstrated vector of the Mal de Río Cuarto Virus (MRCV) that affects maize in Argentina, oviposit eggs in clusters beneath the epidermis of oat plants (among other hosts); usually a number of clusters can be found in the same plant as well as in neighboring plants. *Anagrus flaveolus* Waterhouse is an indigenous parasitoid that attacks eggs of *D. kuscheli* during the first days of development. We analyzed parasitism of *D. kuscheli* eggs by this parasitoid for spatial density dependence in Tucumán Province (Argentina). It was found that parasitism was direct density dependent. At the individual plant scale, and when only “homogeneous” (similar egg density) plants were considered, parasitism also increased significantly. When all individual plants were considered, parasitism was density independent, because plants with low, moderate or high egg density could be found in almost all groups. These results suggest that a patch (constituted by a small number of plants) could be recognized by the parasitoids, and that more parasitoids and/or more time were spent by each individual parasitoid in the more dense patches. More studies will surely lead to this species being used for control of economic plant and leafhopper species.
Competition between egg and larval-attacking parasites of tephritid fruit flies in Hawaii
Messing, R. & X. Wang, (Kapaa, Hawaii, USA)

_Fopius arisanus_ (Sonan) and _Diachasmimorpha tryoni_ (Cameron) are egg-larval and larval solitary endoparasitoids attacking the Mediterranean fruit fly, _Ceratitis capitata_ (Wiedemann), in Hawaii. This study investigated the outcomes of intrinsic competition between these two parasitoids, as well as characteristics of intraspecific competition within each species. Parasitization by _F. arisanus_ resulted in direct mortality of host eggs and prolonged development of host eggs or larvae. Superparasitism by _F. arisanus_ was uncommon when mean parasitism per host patch was <50%, but increased with rising parasitism. Superparasitism by _D. tryoni_ was more common. In superparasitized hosts, supernumerary individuals of _F. arisanus_ were killed as eggs (75%) or first instar larvae (25%) through physiological suppression, while supernumerary larvae of _D. tryoni_ were killed mainly through physical combat. In multiparasitized hosts, 81.6% of _D. tryoni_ eggs in the presence of _F. arisanus_ larvae died within three days, indicating physiological inhibition of egg hatch. Only 2.1% of _F. arisanus_ larvae died in the presence of _D. tryoni_ larvae. The ratio of _D. tryoni_ stings to ovipositions was higher in hosts not previously parasitized by _F. arisanus_ than in parasitized hosts, suggesting that _D. tryoni_ can discriminate against parasitized hosts.

Occurrence of _Trichogramma_ species in Haryana
Ram, Pala & S.S.Sharma (Haryana, INDIA)

We collected the eggs of three lepidopterous insects sphingid moth, _Acherontia styx_ Westwood on sesame; pierid butterfly, _Catopsilia pyranthe_ on _Cassia_ sp. and _Helicoverpa armigera_ on cotton in Hisar and adjoining areas from July to September, 2001. Rearing of these eggs under laboratory conditions revealed that 76 per cent eggs of _A. styx_ were parasitised by _T. chilonis_. On an average 20 adults of _T. chilonis_ emerged from a parasitised egg of _A. styx_. In case of _C. pyranthe_ average egg parasitism by _Trichogramma_ sp. was 84 per cent. Collection and rearing of _H. armigera_ eggs from cotton plants planted near sesame rows showed 33 per cent parasitisation by _T. chilonis_. No egg parasitism of _H. armigera_ was recorded in a nearby cotton field without sesame rows. Both the fields were frequently sprayed with insecticides by the farmers to control bollworms. Intercropping sesame in cotton may help in enhancing parasitisation of _H. armigera_ eggs by _T. chilonis_.

Biology, behavior, and genetic diversity of _Trichogramma aurosum_ Sugonjaev & Sorokina
Samara, R.; J.C. Monje & C.P.W. Zebitz (Stuttgart- Hohenheim, GERMANY)

_Trichogramma aurosum_ Sugonjaev & Sorokina has been collected from several hosts, including eggs of _Nematus_ spp. (Hymenoptera: Tenthredinidae), noctuids and also from a major insect pest of fruit orchards, _Cydia pomonella_ (L.). However, nothing is known about the biology and behavior of this species. Since _T. aurosum_ might be a potential candidate for attempts at controlling _C. pomonella_, research work has been started to assess its biology and behavior towards eggs of this pest. As a first step, _T. aurosum_ was collected in several locations in Germany. Studies on genetic diversity as well a molecular comparison with morphologically close related species have been started. Secondly, an appropriate factitious host has been found to reproduce _T. aurosum_ in quantities enough for mass release. Contrary to most _Trichogramma_ species, females of _T. aurosum_ do not accept eggs of _Sitotroga_
cerealella for parasitization, while this is not the case with eggs of *Ephesia kuehniella*. Populations of different geographic origin will be tested towards their parasitization capacity, fecundity, longevity, host age and host preference in order to obtain suitable strains for potential use in biological control. Furthermore, their adaptation to adverse biotic conditions will be assessed in form of life-table studies. As *T. aurosum* is of holarctic nature, the degree of conspecificity with North American populations might provide useful information for phylogenetic studies. For this, cooperation work with the University of California-Riverside is focussed.

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**Biology, Physiology**

**Role of Volatile Infochemicals in Host Orientation and Host Habitat Location of Parasitoid *Trichogramma ostriniae* (Hymenoptera: Trichogrammatidae)**

Bai, Shu-xiong, Wang, Zhen-ying, He, Kang-lai, Zhou Da-rong, (Beijing, CHINA; Dae-joon, KOREA)

Olfactory response of an egg parasitoid wasp, *Trichogramma ostriniae*, to the volatiles from 14 varieties of mungbean (*Vigna radiata*), sweet corn, moths and eggs of the host insect, Asian corn borer (ACB), *Ostrinia furnacalis* (Guenée), were studied in laboratory. Active bioassays of the components from volatiles of mungbeans and egg masses of ACB to *T. ostriniae* females were carried out in laboratory. Mechanisms of attraction and augmentation function of some creeping type mungbean for *T. ostriniae* were discussed. The results are as follows:

Volatiles emitted from different parts of mungbean and corn plants were extracted by a self-designed device. Olfactory responses of *T. ostriniae* to the volatiles were measured by a four-armed olfactometer. Results indicated that *T. ostriniae* was attracted to the most of creeping type mungbean plants volatiles, such as Do660, Do686, Do658. Higher attraction was observed in volatiles from whole plants and leaves of some creeping type mungbean. None tested erecting type mungbean plants volatiles could elicit any response. *T. ostriniae* females did not show any response to the volatiles from flowers of tested creeping and erecting type mungbeans. The female wasps only showed lightly response to the volatiles of young tassels, but no response to leaves and silks from sweet corn.

Olfactory response of *T. ostriniae* to volatiles emanating from the different stages of ACB adults, their accessory gland and eggs were measured. It have been demonstrated that airborne chemicals from egg masses, (E)-12-tetradecenyl acetate (E12-14:Ac) (main individual component of ACB sex pheromone), mated-female moths before their first oviposition and their accessory glands stimulated an intensive search behavior by *T. ostriniae* females, on the other hand, volatiles from virgin or females tested after their first oviposition and their accessory glands did not incite the parasitoid's movement.

**Host-feeding and synovigeny in Trichogramma spp.**

Boivin, Guy (Quebec, CANADA)

The Trichogrammatidae are generally described as a homogeneous group of egg parasitoids that are short-lived, pro-ovigenic and with diverse responses to temperature that are shaped by host and habitat. When fecundity and temperature responses (survival, parasitism) were
measured in host presence on 40 species and strains of *Trichogramma*, thelytokous species were homogenous in having a short longevity and performing better at lower temperature. Arrhenotokous species were less homogeneous. Species with short longevity (<72h) had a response similar to the thelytokous species while species that lived longer (>72h) had a higher optimal temperature. The hypothesis that longer survival in some arrhenotokous species was due to host-feeding was verified using two species per group (thelytokous, short-lived arrhenotokous and long-lived arrhenotokous). Results indicate that host-feeding occurred only in long-lived species and explained their higher longevity. When deprived of food and host, all species were short-lived. Species that host fed also produced eggs throughout their life, indicating that they are synovigenic. Wolbachia-induced thelytoky may occur more readily in species with low optimum temperature because species with higher optimum may be cured more often when exposed to high temperature. However, it remains unclear why *Trichogramma* genus seems to be divided into host-feeding, synovigenic species with high temperature optimum and non-host-feeding, pro-ovigenic species with lower optimum temperature.

**Egg management patterns of *Trichogramma dendrolimi* and *Trichogramma cacoeciae* under host deprivation.**

Hegazi, E. M. & W. E. Khafagi (Alexandria, EGYPT)

In cooperation with Dr. S. Hassan, Institute for Biological Control, Darmstadt, Germany, the effect of temporary host deprivation on parasitism rates of *Trichogramma cacoeciae* March. and *Trichogramma dendrolimi* Mats was studied (Biocontrol Science and Technology 11 (2001), 353-359). The production and management of eggs by the two species revealed to be completely different. The data suggest that *T. dendrolimi* is a typical proovigenic species, whereas *T. cacoeciae* is neither definitely proovigenic nor synovigenic. Concerning the use of these species in biological control, the efficiency of *T. dendrolimi* - females may be more sensitive to host deprivation than *T. cacoeciae*.

In an ongoing study, further biological and ecological traits of *T. cacoeciae*, when reared on a non-habitual host (*Spodoptera littoralis*) will be evaluated.

**Multiple mating in males and females *Trichogramma evanescens* (Westwood) (Hymenoptera: Trichogrammatidae)**

Jacob, Sebastien & Guy Boivin (Quebec, CANADA)

For the majority of parasitoid species, females are monoandrous and mate only once during their lifetime while males are polygynous (Baker et al. 1998). However, in some parasitoid species, females mate several times and are then qualified as polyandrous (van den Assem and Bruijn 1977, van den Assem 1986). We determined if the females of the egg parasitoid *Trichogramma evanescens* are monoandrous or polyandrous and if males are able to produce spermatozoids throughout their lifetime. Furthermore, we wanted to quantify how many females one male can fertilize over his lifetime as well as the quantity of sperm transferred per copulation.

In this study, we tested two major hypothesis: 1) *T. evanescens* males are prospermatogenic and 2) *T. evanescens* females are polyandrous and mate several times during their lifetime. Male spermatogenesis was established by verifying the number of females a male can fertilized per day and the progeny produced by these females. Secondly, the polygamy of females has been investigated by measuring both daily fecundity and sex ratio of females mated once or several times. We have demonstrated that males are polygynous and
prospermatogenic. They mate up to 20 females during their lifetime, among which 80% are mated in the first 24 hours. Their lifetime fertility is estimated between 300 and 600 spermatozoids. Females are polyandrous in spite of the fact that no difference was found in the sex ratio and the fecundity between multiple mated and simple mated females. Polygyny and prospermatogeny limit the quantity of spermatozoids that males can transfer to females. Nevertheless, at the first mating with a virgin male, a virgin female receives enough spermatozoids to produce an optimal sex and progeny allocation. But why are the females doing multiple mating if there are no apparent advantages? We suggest four explanations why polyandry should be advantageous. First, the cost for a mated female to simply accept the other males might be lower than those involved in repulsing them. Secondly, the polyandry might be an adaptative strategy to minimize the cost of mating with a male who has already emptied his sperm bank by mating several females. If females are unable to perform sexual selection, polyandry might increase their chances to mate with a virgin male with a full sperm bank, or enable them to accumulate enough spermatozoids from different males. Thirdly, the polyandry might also be adaptive by increasing genetic variability in the population. Finally, multiple mating by female T. evanescens could be an advantageous strategy to accumulate energy resources if males transfer a nuptial gift during mating.

Introduction of Enoggera reticulata as a possible biological control agent for the Eucalyptus tortoise beetle, Trachymela sloanei
Millar, Jocelyn G., Timothy D. Paine & Kathleen Campbell (Riverside, USA)

The Eucalyptus tortoise beetle, Trachymela sloanei (Coleoptera: Cerambycidae) was recently introduced into California, where it has caused considerable damage as a defoliator. Efforts are underway to establish the egg parasitoid Enoggera reticulata, obtained from collaborators in South Africa, as a biological control agent for this new pest species.

Addition of wsp sequences to the Wolbachia phylogenetic tree and stability of the classification
Pintureau,B., S. Chaudier, F. Lassablière, H. Charles & S. Grenier (Villeurbanne, FRANCE)

Wolbachia are symbiotic bacteria altering reproductive characters of numerous arthropods. Their most recent phylogeny and classification are based on sequences of the wsp gene. We sequenced wsp gene from six Wolbachia strains infecting six Trichogramma species that live as egg parasitoids on many insects. This allows to test the effect of the addition of sequences on the Wolbachia phylogeny, and to check the classification of Wolbachia infecting Trichogramma. The six Wolbachia studied are classified in the B supergroup. They confirm the monophyletic structure of the B Wolbachia in Trichogramma, but introduce small differences in the Wolbachia classification. Modifications include the definition of a new group, Sem, for Wolbachia of T. semblidis, and the merging of the two closely related groups Sib and Kay. Specific primers were determined and tested for the Sem group.
Effect of cold storage on the biological quality of Trichogramma nerudai (Hymenoptera: Trichogrammatidae)
Tezze, A. A. & E. N. Botto (Buenos Aires, ARGENTINA)

The recently discovered species *Trichogramma nerudai* Pintureau and Gerding (Hymenoptera: Trichogrammatidae), could be used in biological control programs of forest and agricultural insect pests. The possibility of storing *T. nerudai* at low temperature and the effects of such storage on the biological quality of the parasitoid and its progeny were studied. *T. nerudai* pupae were stored 25, 50, 75, 100, 125 and 150 days at 4°C ± 1°C in a refrigerator, RH = 75 ± 5% and full darkness. *T. nerudai* pupae were tolerant to cold storage. Important components of the biological quality in Trichogramma as the number of emerged adults, the proportion of deformed adults, and the flight and the mobility capacity were not seriously affected until 50 days of cold storage. However, the biological quality of the parasitoids was significantly affected by cold storage from 75 days onwards. Any effect was found on the progeny of the parasitoids. We conclude that cold storage is useful to store *T. nerudai* pupae up to 50 days.

Endogenous variations in photoperiodic influence on the progeny diapause in *Trichogramma embryophagum*
Reznik, S.Ya., T.S.Kats,T.Ya.Umarova & N.D.Voinovich, (St.Petersburg, RUSSIA)

A laboratory study was carried out with the isofemale parthenogenetic strain of *Trichogramma embryophagum* Htg. Experiments revealed long-day type response based on maternal influence on progeny prepupal diapause. Comparative analysis of photoperiodic responses in successive laboratory generations reared under constant conditions revealed significant fluctuations in the tendency to diapause. The maximum rate of progeny diapause was recorded at day length of 12 and 15 h, the estimated threshold photophase ranged from 6 to 10 h (left threshold) and from 16 to 17 h (right threshold). Thus, the left threshold day-length was very variable, while the right threshold day-length kept relative constancy (the possible reason is that the right threshold is subjected to stabilizing selection in the natural conditions, while the left threshold zone is a selectively neutral character revealed only in laboratory experiments). Experiments with individual females sequentially offered with new portion of host eggs demonstrated that the percentage of prepupal diapause was maximal in the progeny eclosed from the eggs laid during 1st - 2nd days of maternal life. Then the proportion of diapausing progeny decreased and then slightly increased in 14 - 18 days old females. We conclude that endogenous factors (maternal age and variation in generation sequence) play an important role in maternal influence on progeny diapause, particularly in the neighborhood of threshold temperature and photoperiodic conditions.

Diapause induction and cold storage in *Trichogramma nerudai* Pintureau and Gerding (Hymenoptera: Trichogrammatidae) pupae
Tezze, A. A. & E. N. Botto (Buenos Aires, ARGENTINA)

Diapause induction in egg parasitoids can be used as a storage technique. The effect of different cold storage periods on previously diapause induced *Trichogramma nerudai* pupae was evaluated on the parasitoid and its progeny. Diapause induction and breaking were obtained following the methodology developed in the Soviet Union for *T. evanescens* and *T. pintoi*. The experimental sequence followed in the treatments was: diapause induction – cold storage – diapause breaking – standard conditions.
Cold storage times were 60, 120 and 150 days (treatments). Non diapause induced pupae (control group) and emerged adults after breaking the diapause were maintained at rearing standard conditions (temperature: 25 °C; humidity: 80 ± 5 %; photoperiod: L14:D10). The female survival at 24 h, the proportion of deformed adults, the females proportion and the flight and the mobility capacity were not seriously affected by this storage method. The number of emerged adults decreased in the 120 and 150 days treatments until 60 %, which is a quite acceptable value in a mass rearing program.

The diapause induction admitted to cold store *T. nerudai* without altering the biological quality of the parasitoid and its progeny. This storage method allows a storage period three times greater than a simple cold storage technic but requires about a month for the diapause induction. Depending on the time the pupae must to be stored, one or the other method could be used.

**Ovipositional and orientation responses of two species of *Trichogramma* towards the chemicals from the rice (*Oryzae sativa*) plants as well as two major pests of rice**

Usha Rani, P (Hyderabad, INDIA)

Ovipositional preferences and orientation responses of two species of *Trichogramma*, *T. japonicum* and *T. chilonis*, towards the materials extracted from their host insects, Rice yellow stem borer, *Scripophaga incertulas* walker. (*Tryporyza incertulas*), Lepidoptera: Pyralidae, rice leaf folder: *Cnaphalocrosis medinalis* (Guenee) (Lepidoptera : Pyraustidae) were evaluated in the laboratory, semi field and field. Role of plant surface chemicals from the pest damaged and undamaged plants was determined. The active chemicals were isolated and identified using GC - Mass analysis. The orientation response of the parasitoid were carried out in olfactometer tests, while the success of parasitization was recorded in petri dish bioassays. Scanning Electron Microscopic studies were conducted to identify various sensillary population on the antennae of *T. chilonis* and *T. japonicum* and the morphology is compared between the two species of parasitoids.

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**Selection of species for use in biocontrol**

**Host preference of various strains of *Trichogramma cacoeciae* Marchal towards eggs of codling moth *Cydia pomonella* L. and grape berry moth *Lobesia botrana***

Almatni, W.; J.C. Monje & C.P.W. Zebitz (Stuttgart- Hohenheim, GERMANY)

The host preference behavior of four strains of *Trichogramma cacoeciae* Marchal (*sensu* Pinto, 2 from Sweida-Syria, 1 from Denmark and 1 from Germany), toward eggs of *Cydia pomonella* and *Lobesia botrana* was investigated in the laboratory in order to select candidate strain for inundative release against the codling moth in southern Syria. Experiments were carried out in two ways: (1) directly by continuous observation of the behavior of individual females and (2) by an indirect selection test. Test females were offered equal numbers of eggs of two host species arranged in grid. The Danish (Dan 99) and the German (Cac D90) strains strongly preferred *C. pomonella* over *L. botrana* eggs. Only a slight preference for *C. pomonella* eggs was found in the Syrian strains Syr1 and Syr2. The Syrian strain Syr2 showed no significant preference for either host. Percentage of parasitized eggs from the total provided eggs in the 1 hour observation experiments were 35.4%, 48.2%, 29.4%, and 29.6% for Syr1, Syr2, German and Danish strains, respectively. Rejections were found to be significantly concentrated directly after contact and during drumming in the Danish, the
German and the Syrian strain Syr1, whereas for the Syrian strain Syr2 rejections happened mostly during drilling and very few during drumming. The results suggest that the Syrian strain Syr2 is an suitable candidate for attempts at controlling the codling moth in southern Syrian where apple orchards are naturally mixed with grapevine yards.

Effects of Gamma Radiation to Some Biological Properties of Mediterranean Flour Moth Ephesia kuehniella Zeller (Lepidoptera: Pyralidae) and Egg Parasitoid Trichogramma evanescens Westwood (Hymenoptera: Trichogrammatidae), PhD Thesis. Ayvaz, A. (Kayser, TURKEY)

In this study we have tested the effectiveness of *Trichogramma evanescens* Westwood (Hymenoptera: Trichogrammatidae) to its factitious host *Ephesia kuehniella* Zeller (Lepidoptera: Pyralidae) under various conditions. Egg, larvae, pupae and adult stages of *E. kuehniella* were treated with gamma radiation doses between 50-550 Gy. Parameters such as fecundity, emergence, longevity and sex ratio were investigated. All experiments were undertaken in growth chamber and maintained at 27±0.5 °C, 70±5% r.h and 14:10 (L:D) h for *E. kuehniella* and 24±0.5 °C, the same relative humidity and photoperiod for *T. evanescens*. Data showed that emergence, fecundity and longevity were decreased with increasing doses in all stages, and sex ratio shifted in favor of males. When the egg and larvae were treated with gamma radiation, all the adults obtained from these stages were sterile at 200 Gy and above doses. This value was 300 Gy for pupae and adult stages. Using probit analyses SD50, SD99 and LD50, LD99 values were estimated. Irradiated 1-day-old host eggs were parasitized more than control at 40, 60, 80, 100 and 300 Gy doses. For two-day-old eggs, the same results were obtained at 20 and 40 Gy. In host preference tests with treated and untreated eggs, they were equally preferred by *T. evanescens*, except 100 and 140 Gy doses. Irradiated host eggs with 100 Gy were less preferred than untreated eggs, but treated eggs with 140 Gy. In host preference tests with untreated eggs and eggs from irradiated adults, they were equally preferred, the same result were also obtained for treated eggs and eggs from treated adults. When *T. evanescens* were irradiated with gamma radiation, emergence, female ratio and parasitization were decreased with increasing doses, but there were no differences in F1 and F2 generations compared with control regarding these parameters. Our results obtained from host egg storage indicate that parasitization and adult emergence were gradually decreased in the course of time in treated eggs, but this tendency was more obvious in control.

Comparison between *Trichogramma evanescens* Westwood and *Trichogrammatidea bactrae* Nagaraja as biological control agents against two irradiated and non-irradiated stored product pests

El-Mandarawy, Mona B.R. & Salwa A. Rizk (Dokki, Giza, EGYPT)

Studies on the effect of substerilizing doses of gamma radiation on the stored product insects *Callosobruchus maculatus* (Fabricius) and *Corcyra cephalonica* (Stainton) eggs before parasitization by *Trichogramma evanescens* Westwood and *Trichogrammatidea bactrae* Nagaraja were carried out. *C. maculatus* and *C. cephalonica* eggs were exposed to the respect calculated LD25 level 92.48 Gray and 1.39 Gray as substerilizing doses. The percent of parasitization and fecundity differed significantly between the two parasitoids species and the two hosts. They were higher in *T. evanescens* than in *T. bactrae*. However, the percent of parasitization and fecundity were insignificantly differed between the irradiated host eggs as compared to the non-irradiated ones. Highest emergence rate was recorded from irradiated and non-irradiated *C. cephalonica* eggs that parasitized with *T. evanescens*. Radiation had no
effect on the developmental period (days) and adult longevity of the two parasitoids reared from the two hosts.

Possibilities for using *Trichogramma turkestanica* for biological control of the Mediterranean flour moth in industrial flour mills

Hansen, Lise Stengaard (Kgs. Lyngby, DENMARK)

Life table parameters and other aspects of the biology (host-feeding, lower threshold for activity) of *Trichogramma turkestanica* Meyer have been investigated in the laboratory in relation to temperatures of 15, 20, 25 and 30°C. Results can be seen in Hansen 2000 and Hansen & Jensen 2001 (see list of publications). A field trial has been conducted in an industrial flour mill in 2000.

Host specificity studies with *Avetianella longoi*, a parasitoid of *Phoracantha* spp. (Coleoptera: Cerambycidae)

Paine, Timothy, D., Jocelyn G. Millar, Darcy Reed (Riverside, USA)

*Phoracantha semipunctata* and *P. recurva* have been introduced into California, and many other areas of the world where Eucalyptus are grown. The egg parasitoid *Avetianella longoi* is an effective biological control agent for the former species, but attack rates and survival of parasitoids are lower on the congeneric species *P. recurva*. Behavioral and biochemical mechanisms that might account for these differences are being investigated.


Schöller, Matthias & Paul Fields (Berlin, GERMANY, Winnipeg, CANADA)

Stored-product moths are among the major stored-product pests, infesting a wide variety of cereals and cereal based products. Traditional chemical control measures require the shut down of the facility, and there are restrictions to their use because of concerns of worker safety or residues on the finished product. In Germany and Austria, the control of the Indian meal moth *Plodia interpunctella* (Hübner) and the Mediterranean flour moth *Ephesia kuehniella* Zeller in food processing facilities is achieved by releasing large quantities of *Trichogramma evanescens* Westwood using the inundative strategy. In North America, despite the wide-spread use of parasitoids in field and glass house settings, this biological control method has not been used commercially to control warehouse and food processing moth pests.

We evaluated four species of *Trichogramma* native to North America: *T. deion*, *T. minutum* (2 strains), *T. pretiosum* (2 strains), *T. sibericum*, and the palaeartic introduction *T. brassicae* as candidates to control *P. interpunctella*. In a first step, we performed the indirect Hassan-test for host preference between the mass-rearing host *E. kuehniella* and the target host *P. interpunctella*, and the performance at 15°C. In these tests, a thelytokous strain of *T. pretiosum* performed the best, followed by an arrhenotokous strain of *T. pretiosum*, and *T. deion*, followed by a strain of *T. minutum*. *Trichogramma brassicae*, another strain of *T. minutum* and *T. sibericum* had the lowest acceptance of *P. interpunctella* eggs. In a second step, we determined the two species best suited to control *P. interpunctella* by applying the
direct Dijken-test for host preference and daily fecundity on *P. interpunctella*. Additional tests will be conducted with these two species in semi-commercial and commercial settings.

**Selection of *Trichogramma* spp. against the Common Clothes Moth *Tineola bisselliella***

Zimmermann, O., S.A. Hassan & Wührer, B. (Darmstadt, GERMANY)

In laboratory experiments suitable *Trichogramma* spp. were selected to control tineid moths. Acceptance and preference tests found *T. piceum* to be the most efficient among 30 species and strains that are available in laboratory rearing. The searching behaviour on cloth with natural egg laying in tubes and cages showed that *Trichogramma* could find eggs in cloth up to distances of minimum 40 cm from releasing point. Still the big surface of different kinds of stored products containing keratin in wool is a limiting factor. The experimental study will be continued with conducting life table tests of the three most suitable species. In order to find an efficient egg parasitoid to combine with the larval parasitoid *Apanteles carpatus* (Braconidae) the results with *Trichogramma* spp. in laboratory underline the potential of a combined use of egg and larval parasitoids in stored products protection.

**Mass production, artificial diet, nutrition**

**Corn pollen as a food source for *Trichogramma brassicae***

Zhang, G. R., O. Zimmermann & S. A. Hassan (Darmstadt, GERMANY)

*Trichogramma brassicae* Bezd. (Hymenoptera: Trichogrammatidae) females fed on corn pollen and water (wet filter paper dusted with pollen) were found to live longer (4.97 d) than females fed on water alone (2.67 d), but significantly shorter than 8.23 d or 8.37 d for feeding on pollen and honey or honey alone, respectively. In the presence of host eggs (*Ostrinia nubilalis* Hübner), the longevity of the females fed on pollen and water was 4.90 d, which was also significantly longer than 2.60 d for water alone, but significantly shorter than 12.17 d or 12.33 d for pollen and honey or honey alone, respectively. The cumulative lifetime fecundity (pupae number of the offspring per female) was 82.53 when fed on pollen and water, which was significantly higher than 61.70 for no food (only water) but lower than 99.97 and 95.70 for feeding on pollen and honey or honey alone, respectively. As a food source, corn pollen also increased the net reproduction rate (*R₀*), intrinsic rate of increase (*rₘ*), and finite rate of increase (*λ*), and reduced the doubling time (*T₂*, days), but had no effects on the emergence rate, sex ratio, and mean generation time (*Tₜ*). Feeding experiments with individual females proved that 13 out of 30 tested females notably consumed pollen grains and that the number of pollen grains ingested was quantitatively estimated to be 2.46 ± 0.40 per female in 48 h.
Utilization

First field release of *Trichogramma cacoeciae* Marchal (Trichogrammatidae, Hymenoptera) for the control of codling moth, *Cydia pomonella* at Sweida, southern Syria

*Trichogramma cacoeciae* Marchal (*sensu* Pinto) was released for the first time in an attempt at controlling the codling moth *Cydia pomonella* in Syria during the year of 2001. The experiment was carried out in a young commercial apple orchard in Jabal Orman, Sweida. *T. cacoeciae* Marchal (strain Syr2) was released two times at a rate of 150–parasitoids/tree/release. Efficacy was 34.37% reduction in fruit damage compared with untreated plots. This result showed that 2 applications at this rate on the second generation of *C. pomonella* were not efficient to prevent damage above the economic threshold.

Practical use of egg parasitoids in Turkey
Ayvaz, A. (Kayser, TURKEY)

The use of egg parasitoids as pest control agents in our country is not common yet. But some promising studies have been conducted currently. In Adana, also named Çukurova, there are some studies targeting this purpose. We are trying to improve the effectiveness of *Trichogramma evanescens* by using gamma radiation to enhance parasitoid quality, and present studies show that combining these two methods shall be effective for pest control. We are going to release *T. evanescens* experimentally in our laboratory. Following that we are going to implement the parasitoids on natural conditions.

Biological control using *Trichogramma* in Uruguay
Basso, C., B. Pintureau & G. Grille (Montevideo, URUGUAY)

Experimental inundative releases using *Trichogramma* wasps are performed in Uruguay against pest of economical importance in cotton (*Alabama argillacea* (Hubner), Lepidoptera: Noctuidae), Lotus (*Epinotia aporema* (Wals), Lepidoptera: Tortricidae) and apple (*Argyrotaenia sphaleropa* (Meyrick) and *Bonagota cranaodes* (Meyrick), Lepidoptera: Tortricidae). *Trichogramma* species are reared in the laboratory on *Ephestia kuehniella* Zeller eggs.

Trials to control the olive moth, *Prays oleae* (Bern.), with two *Trichogramma* species
Bento, A, Pereira, J.A., Torres, L.M & Torres, R. (Bragança, Trás-os-Montes e Alto Douro. PORTUGAL)

A study was carried out in north-eastern Portugal to establish whether inundative releases of *Trichogramma* were effective in reducing damage caused by *Prays oleae* (Bern). In 1997 and 1998 releases of *Trichogramma cacoeciae* March. alone and *T. cacoeciae* plus *T. dendrolimi* Mats, in equal numbers, were tested against the fruit generation of the pest, in an experimental olive grove, near Mirandela. Nine plots were established in the field, corresponding to one control and eight treatments (100 000, 200 000, 400 000 and 800 000 individuals of *T.*
cacoeciae and the same figures of T. cacoeciae plus T. dendrolimi, per hectare). Two releases were made at an interval of one week, in the olive moth ovipositional period. Rates of parasitism of eggs ranging from 46.9% and 28.4% have been achieved in the release trials, respectively in 1997 and 1998, following the release of 800 000 T. cacoeciae per hectare, while the parasitism obtained with the release of 400 000 T. cacoeciae plus 400 000 T. cacoeciae, ranged from 30.7% to 25.1%. The corresponding figures for the control were 2.2% and 0.8%, respectively in 1997 and 1998. The results suggest the potential of T. cacoeciae when used inundatively against the fruit generation of P. oleae in north-eastern Portugal. Further investigation is needed in the use of native strains of Trichogramma which may be better adapted to suppressing the pest in the summer high temperatures of the region.

Trichogramma exiguum and mechanical method to control tomato fruit borer Neoleucinodes elegantalis (Lepidoptera: Pyralidae)
Díaz, A. E., J. de J. Peña, G. Silva & A. Tróchez (Corpoica C.I, Palmira, COLOMBIA)

Tomato fruit borer (Neoleucinodes elegantalis) is one of the major insect pests, causing yield losses of 80% or higher. Control practices by farmers rely exclusively on the intensive use of chemical pesticides, which have low efficiency but increase costs and damage the environment. An experiment was established in 1999 A by CORPOICA at the Palmira Research Center (Palmira, Valle del Cauca) to evaluate mechanical (low and high density, clear polyethylene bags) and biological (the egg parasitoid Trichogramma exiguum) methods as alternatives for control of the tomato fruit borer. Floral structures were covered with polyethylene bags where 50% of the flowers were opened. T. exiguum (at a weekly of 678,000 wasps/ha) was released by cardboard device hunged on the plants carrying 0.125 g. of Sitotroga cerealella eggs each. The eggs was parasitized at five different dates. Data were taken on parasitism by T. exiguum fruit damage, fruit set index, fruit weight, fruit size, color, soluble solids, juice content and acidity. Plots treated with T. exiguum revealed parasitism levels higher (49%) than the unprotected controls (29%). Egg population (density) and parasitism in unprotected control plots exhibited a negative correlation. Fruit damage by the tomato fruit borer was significantly lower (p = 0.05) in bagged plots (2.3%), compared to plots treated with T. exiguum (19.4%) or the unprotected controls (37.7%). Fruit set index, determined at harvest was higher in control plots (17%) compared to T. exiguum treated plots (13.6%) or bagged plots (13.26%). In addition, bagged fruits exhibited lower sugar content, lower color at maturity and increased acidity. Unbaged fruits had 17% more fruit juice, higher weight and size.

Experiments for the control of cotton bollworms in Egypt
El-Heneidy, A.H., Abdel-Hafez, Alia & Mesbah, A.H. (Giza, EGYPT)

Cotton bollworms; the pink bollworm, Pectinophora gossypiella (PBW) and the spiny bollworm, Earias insulana (SBW) are the major economic cotton pests in Egypt. Trials to evaluate using several Trichogramma species to control the two competitive pests were carried out during the cotton season 2001. Four species of the egg parasitoids; Trichogramma embryophagum, T. brassicae, T. evanescens and Trichogrammatoidae bactrae have been tested against the two pests under field conditions at eastern Delta. This area is recognized by a low infestation of SBW. The four species were released three times in unsprayed cotton field (40 acres). All the species showed relative preference to the PBW eggs. Results showed an obvious reduction in the
PBW infestation, ranged between 56.5 and 81.7 %, compared with the control. *T. bactrae* was the most efficient among the tested species while *T. brassicae* was the least one.

A trial to control the two cotton pests, using only *Trichogramma evanescens* was carried out in northern Delta, where the SBW is very competitive. The control plot was sprayed with insecticides four times. Four releases of the parasitoid were used in the unsprayed cotton field (2 acres). Results showed 24 % reduction in the PBW infestation in the unsprayed plot compared with the sprayed one. On the contrary, SBW infestation in the unsprayed plot reached three folds that of the sprayed one, which means that the parasitoid is not effective against the pest.

**Trials for the biological control of the pyralid *Ectomyelois ceratoniae* (Lepidoptera, Pyralidae) by the use of *Trichogramma cacoeciae* (Hymenoptera, Trichogrammatidae)**

Jardak T., Ksantini M. & Njah A. (Sfax, TUNISIA)

The carob pyralid *Ectomyelois ceratoniae* is an important polyphagous pest which attacks several cultures in Tunisia (date palm, pomegranate fruit, almond, pistacia fruit, carob), causing serious damage, especially to date and pomegranate fruit. Particularly for this later culture, the important production losses caused by the pyralid (up to 80%) in the lack of effective control, induce growers to desert this cultivation. Since 1996, our attention was focused on the use of biological control by releases of *Trichogramma cacoeciae*, collected on the natural host eggs of the pyralid in an oasis. After promising results in a first trial in 1996 (Jardak and Ksantini, 1998) experiments were pursued during 2000. After rearing on *Ephesia kühniella*, *T. cacoeciae* has been released at the nymphal or adult stage on cardboard plates placed in the tree and protected from predation by small cages of wire mesh. Five treatments were tested : 3 doses of parasitoid eggs (3000, 6000 and 9000) placed in each tree, the dose of 27000 parasitoid eggs applied in the center (at one tree) of a plot of 9 trees (dose of 3000 parasitoids/tree) and the control plot. Releases were realised each week or every 12 days (in July and August) from april 22 to the harvesting period (end of september). Data on the fruit fall, fruit rotting and healthy fruit harvested without the presence of the insect were collected.

The main results were the following :

1) the parasitism rate seems to be comparable between the three doses per tree: it varies between 67.4 %, 61.3 % and 66.4 %, respectively, for 3000, 6000 and 9000 parasitoids / tree. The maximum rate varies from 86 to 100 %

2) the parasitism rate obtained with one release point for 9 trees is comparable (69.4 %) to that with 3000 parasitoids in each tree. This result demonstrates the dispersion ability of the parasitoid which can reach about 100 meters (high parasitism was observed in the control)

3) the harvested healthy fruit, suitable for consumption, represent an average of 45.2 % of the total fruit, present in the treated plots at the end of August, while it was only 24.4 % in the control plot though the case of the parasitoid dispersion

**Biological Control with *Trichogramma*: make it reliable and easiest possible**

Kabiri, Firouz (Valbonne, FRANCE)

Biotop started commercialization of *Trichogramma* against the European Corn Borer in 1985. The product was proposed with 3 releases to control one generation of the pest each year. Surfaces increased very slowly and reached about 20 000 ha of corn in 1996. Then the method was simplified and it became possible to make just one release with the same efficacy against the ECB. In 2001 about 70 000 ha were protected in France and other countries with our production. The keys of the success are: efficacy, easy way of use and simple logistics,
which make this method acceptable for farmers and also for distributors, even if the product is released by hand. Our market share in France is now more than 15%. It can be evaluated as a quiet good level if we consider that there are strong competitors selling several chemical insecticides and also the fact that farmers have not received financial help to use Trichogramma.

Utilization of Trichogramma for the Biological Control of the Cranberry and Sparganothis Fruitworms
Pelletier, D., F. Fournier & Guy Boivin (St-Jean-sur-Richelieu, CANADA)

The Cranberry Fruitworm (Acrobasis vaccinii) is a pest of major concern in cranberries across US and Canada while the Sparganothis Fruitworm (Sparganothis sulfureana) is considered as a secondary pest, mostly because it causes damage only when its natural enemies are eliminated by use of insecticides. In addition to the risk of pest resurgence, pesticide use increasingly rises concern with the consumers. An alternative to pesticides is the use of biological control methods, including parasitoids such as trichograms (Trichogramma sp.) that are minute egg parasitoids that are used as pest control agents in a variety of cultures. To evaluate the suitability of trichograms to control cranberry pests, strains have been collected in cranberry bogs in Québec during the summers 1998 to 2000. Following laboratory bioassays, two Trichogramma strains have been selected for field tests against A. vaccinii and S. sulfureana. Cumulated fruit loss caused by A. vaccinii, as well as damaged fruits at harvest and parasitism of S. sulfureana sentinel eggs, have been monitored. Three treatments were compared: two Trichogramma treatments (strains 7 and 9), and an insecticidal soap treatment. Results showed that, compared to control plot (4,1% cumulated damages), the two Trichogramma strains have significantly reduced the fruit loss caused by A. vaccinii with 1,8% and 2,1% for strains 7 and 9 respectively. Although the fruit loss monitored in the insecticidal soap plot (2,2%) was similar to that observed in the Trichogramma plots, it was not significantly lower than in the control plot. Damages at harvest evaluation showed no differences among treatments, although only strain 7 treatment resulted in less than 1% (0,8%) damage compared to 1,9%, 1,3% and 1,4% for strain 9, the soap treatment and the control plot respectively. We also tested parasitism of S. sulfureana sentinel eggs. Low rates of parasitism (4,7% and 1,3% for strains 7 and 9 respectively) were observed. We can explain this result by the low quality of the sentinel eggs used. However, we noted high predation rates (ca. 35%), which suggests that natural predators have a non negligible impact on borer populations in plots not treated with insecticides. Among the two Trichogramma strains monitored, the strain 7 showed better control against the Cranberry and Sparganothis Fruitworms. Great variation in fruit density and in A. vaccinii egg-laying activity among experimental sites may have attenuated differences between treatments and further field experiments are in progress.
Effects of pesticides, transgenic crops

Effects of Botanical Insecticides on the Egg Parasitoid Trichogramma cacoeciae Marchal (Hym. Trichogrammatidae).
Abdelgader, H. and S.A. Hassan (Darmstadt, GERMANY)

A study was carried out in the laboratory to investigate the side effects of two formulated products of each of two botanical insecticides, i.e. Azadirachtine (Neemazal T/S Blank and Celaflor®) and Quassin (alcoholic or water extracts), on Trichogramma cacoeciae. In one set of experiments the host eggs parasitized at different periods were sprayed at the same day. Results indicated that only Neemazal T/S-Blank formulation was slightly toxic regarding adult emergence when 3 and 8 days old parasitized host eggs were sprayed. Neemazal T/S-Blank formulation was also slightly toxic in term of pupation, when one day parasitized host eggs were sprayed. No other harmful effects were observed in these experiments.

The other azadirachtine formulation (Celaflor) was slightly toxic relative to the control in term of the parasitism rate per female, when sprayed eggs were offered to adults of T. cacoeciae for parasitism directly after drying. 24 h, 48 h and 6 days residues were not significantly different from the control for all treatments.

The results in general showed that Azadirachtine and Quassin were relatively safe to the tested parasitoid and could be used in combination with Trichogramma releases.

Side Effects of Plant Protection Products on Trichogramma cacoeciae Marchal (Hym. Trichogrammatidae).
Abdelgader, H. & S.A. Hassan (Darmstadt, GERMANY)

The side effects of 13 plant protection products (9 insecticides/acaricides, 2 fungicides and 2 herbicides) on adults and immature stages of the egg parasitoid Trichogramma cacoeciae Marchal (Hymenoptera, Trichogrammatidae) were studied. The results showed that one insecticide (Mimic) and one herbicide (Logran) were safe to the adults, whereas 6 insecticides and one fungicide were harmful. The other tested pesticides were either slightly or moderately harmful. Testing on immature stages of T. cacoeciae showed that only one insecticide (Phosdrin) was harmful and one (Masai) moderately harmful.

Preliminary trials against Ostrinia nubilalis Hb. (Lep,: Pyralidae) controlled by Trichogramma evanescens Westwood (Hym.: Trichogrammatidae) alone or in combination with Bacillus thuringiensis
El Mandarawy, Mona B. R., Saadia A. Abdael Samae and Moustafa A.Z. El Nagar (Dokki, Giza, EGYPT)

In Egypt, the European corn borer Ostrinia nubilalis Hb. is the major serious pest for maize fields planted after June, where reduced about 33.6% as general of the yield. The effectiveness of Trichogramma evanescens Westwood (Hym.: Trichogrammatidae) alone or with Bacillus thuringiensis on the target pest was evaluated under laboratory and field conditions. The parasitoid was mass reared on Ephestia or Sitotroga eggs and released in unsprayed or Bt sprayed maize fields (in Northern of Egypt) in season 2001. The integration of Bt as bioinsecticide with T. evanescens result in additional O. nubilalis control and induced a reduction in the infestation of plant nodes, ears and tassels.
No side-effects of gel-formulated cockroach insecticides on *Trichogramma evanescens*
Schöller, Matthias; Anke Reppchen, Sabine Prozell & Andreas Beckmann (Berlin, Hostmar, GERMANY)

In many situations, stored-product and urban pests occur simultaneously. Cockroaches like the German cockroach *Blatella germanica* or the Oriental cockroach *Blatta orientalis* are common pests in bakeries, food processing facilities and kitchens. As these cockroaches are potential vectors of diseases, they have to be controlled completely. Traditionally, cockroaches are controlled by spraying contact insecticides. Modern approaches include insecticides formulated within a gel. For the biological control of stored-product moths the egg-parasitoid *Trichogramma evanescens* Westwood is applied commercially in Germany and Austria. *T. evanescens* is known to be very susceptible to contact insecticides, and no strategies of integration have been described so far for stored-product protection. Therefore, possible side-effects of gel-formulated insecticides on *T. evanescens* have been tested. In Germany, three compounds have been shown to be effective against the German cockroach, Fenitrothione, Hydramethylnone and Fibronil. For testing side-effects of these insecticides in the laboratory, the guidelines of the IOBC were applied. However, as these guidelines are designed for sprayed insecticides, a suitable modification for the gel-formulated insecticides had to be found. All three insecticides were found to have no side-effects on *T. evanescens*, i.e. parasitism and emergence of progeny was not affected. Comparison of literature data on the active compounds showed that this is due to the formulation as a gel. Therefore, the release of *T. evanescens* and the application of the three mentioned insecticides are a promising strategy to integrate chemical control of cockroaches and biological control of stored-product moths.
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<tr>
<th>Country / reporter</th>
<th>species</th>
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<th>crops</th>
<th>host pest</th>
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<tr>
<td>Argentina</td>
<td>Anagrus flaveolus</td>
<td>Native</td>
<td>yes</td>
<td>maize</td>
<td>Dalbulus maidis (Cicadellidae), Delphacodes kuschelii, Peregrinus maidis (Delphacidae)</td>
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<td>Paracentrobia subflava</td>
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<td>Exitianus obscurinervis and others leafhoppers (Cicadellidae)</td>
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<td>Gonatocerus spp. (4x), Oligosita spp. (1x), Bloodiella spp. (1x)</td>
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<td>weeds, sugarcane, citrus</td>
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<td>Egypt</td>
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<td>yes</td>
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<td>yes</td>
<td>sugarcane, tomato, cotton, maize, citrus</td>
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<td>Trichogramma japonicum</td>
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<td>Trichogramma brasiliensis</td>
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<td>India</td>
<td>(about 20 species of Trichogrammatidae)</td>
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<td>USA, Hawaii</td>
<td>Fopius arisanus</td>
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</tbody>
</table>
List of publications on egg parasitoids
(from 1992 to 2000, not included in previous issues/
sorted by year and alphabetically according to first author)

**Mymaridae**

2001

2000


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**Scelionidae**

**2002**


Consoli, Fernando L. et al. (2001): In vitro culture of the teratocytes of Trissolcus basalis (Hymenoptera, Scelionidae) and their requirements for host-derived components. Biological Control 22 (2), 176-184.


(Scelionidae)


Trichogrammatidae

2002


2001

(Trichogrammatidae)


Chang, Shu-Chen; Hu, Nien-Tai; Hsin, Chu-Ying; Sun, Chih-Ning (2001): Characterization of differences between two *Trichogramma* wasps by molecular markers. Biological Control 21 (1), 75-78.


Honda, Jeffrey Y. et al. (2001): Interactions between host attributes and wasp size: a laboratory evaluation of *Trichogramma platneri* as an augmentative biological control agent for two avocado pests. Entomologia Experimentalis et Applicata 100. 1-3.


(Trichogrammatidae)


2000


Honda, Jeffrey Y. et al. (2000): Age and suitability of Amorbia cuneana (Lepidoptera: Tortricidae) and Sabulodes aegrotata (Lepidoptera: Geometridae) eggs for Trichogramma platneri (Hymenoptera: Trichogrammatidae). Biological Control 18 (1), 79-85.

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**Other groups of egg parasitoids**


(other groups of egg parasitoids)

Hu, Jing Sheng et al. (2001): In vitro rearing of *Edovum puttleri*, an egg parasitoid of the Colorado potato beetle, from egg to pupal stage in artificial diets devoid of insect sources: Effects of dietary amino acid and carbohydrate levels. BioControl 46 (1), 43-60.


2000


Meiners, Torsten et al. (2000): Specificity of chemical cues used by a specialist egg parasitoid during host location. Entomologia Experimentalis et Applicata 95 (2), 151-159.

(other groups of egg parasitoids)


<2000


(end of list)
Address list of research workers from 73 countries

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Short description of the IOBC Working Group
"Egg Parasitoids"

The Working Group “Egg Parasitoids” consists of about 200 research workers from 54 countries and aims to promote research on this group of beneficial arthropods.

Topics of interest:
1 Biosystematics and genetics
2 Host relation and biology
3 Physiology and behaviour
4 Ecology and population dynamics
5 Rearing (in vivo & in vitro), production and release
6 Compatibility (environmental, biological, chemical)
7 Effectiveness and assessment.

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A Symposium was also included as part of Section 8 of the Congress ”Entomopathgous Insects and Biological Control” on the **XXI International Congress of Entomology, Brazil, August 2000.**
Dear Colleagues,

this is the call for your contributions to the 14th issue of the Egg Parasitoid News. Please fill out the form and send it by e-mail, fax or letter to:

Dr. S.A. Hassan, Federal Res. Centre, Institute for Biological Control, Heinrichstr. 243, D-64287 Darmstadt, Germany, Fax +49-6151-407290 e-mail: s.hassan.biocontrol.bba@t-online.de

Please reply as soon as possible but before the end of the year 2002. The use of this form and sending it by e-mail is preferred. Please forward this form to further research workers specialised on egg parasitoids.

Best wishes and thank you for your cooperation.

Lab. S. A. Hassan

Your address:
name, institute
street, city, country
tel / fax / e-mail

A) Your main research work with egg parasitoids:
__ Systematics, Genetics; __ Selection of suitable beneficial parasitoids; __ Ecology, Behaviour
__ Mass production, Utilization; __ Biology, Physiology; __ Side effects of pesticides
I do not conduct research but I would like to be informed __.

B) Abstracts on your current research
Please write half a page abstract(s) on your current research project(s) with egg parasitoids giving the most interesting aspects on methods and results ( title; author(s), city, country ).

C) Publications
Please contribute with a list of your publications on egg parasitoids that did not appear in previous issues of Egg Parasitoid News.
(e.g.: El-Mandarawy, Mona B.R. (2001): Some biological parameters of Trichogramma cacoeciae Marchal, the egg parasitoid of lepidopterous pests. J. Egypt. Ger. Soc. Zool. 34 (E) 1-5.)

D) News in 30 words:
If you have interesting short news or call for cooperation please write a 30-words-abstract.

E) Practical use of egg parasitoids: problems & suggestions
Please write about max. 40 words.

F) Data on the occurrence of egg parasitoid species in your country
that did not appear in previous issues of Egg parasitoid News, e.g.:

<table>
<thead>
<tr>
<th>Country / reporter</th>
<th>species</th>
<th>native or imported (year / country)</th>
<th>reared (yes / no)</th>
<th>crops</th>
<th>host pest</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA, Hawaii</td>
<td>Fopius arisanus</td>
<td>imported (from Asia 1999)</td>
<td>yes</td>
<td>Fruits</td>
<td>Ceratitis capitata</td>
</tr>
</tbody>
</table>

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