International Organisation for Biological and Integrated Control
of Noxious Animals and Plants
West Palaearctic Regional Section

Organisation Internationale de Lutte Biologique et Intégrée
contre les Animaux et les Plantes Nuisibles
Section Régionale Ouest Paléarctique

Proceedings of the 8th General Assembly of the IOBC – WPRS

Vienna, Austria
September 30 - October 2 1997

Comptes Rendus de la 8ème Assemblée Générale de la OILB – SROP

Vienne, Autriche
30 Septembre - 2 Octobre 1997

Bulletin OILB / SROP
IOBC / WPRS Bulletin Vol. 21(7) 1998

The IOBC/WPRS Bulletin is published by the International Organization for Biological and Integrated Control of Noxious Animals and Plants, West Palaearctic Regional Section (IOBC/WPRS)

Le Bulletin OILB/SROP est publié par l'Organisation Internationale de Lutte Biologique et Intégrée contre les Animaux et les Plantes Nuisibles, section Régionale Ouest Paléarctique (OILB/SROP)

Address General Secretariat:
INRA - Centre de Recherches de Dijon
Laboratoire de Recherches sur la Flore Pathogène dans le Sol
17, Rue Sully - BV 1540
F-21034 DIJON CEDEX
France

ISBN 92-9067-101-7

1 – La « S.R.O.P. »

La SROP est une des six sections régionales de l'Organisation Internationale de Lutte Biologique qui a été fondée en 1956 sous les auspices de l'Union Internationale des Sciences Biologiques. Ses membres institutionnels, base de l'organisation, sont des Organismes gouvernementaux ou officiels qui souscrivent une adhésion annuelle. Il y a actuellement 42 membres originaires de 24 pays d'Europe, de la Région Méditerranéenne, du Proche et du Moyen-Orient. D'autres Organismes, au nombre de 25, publics ou privés, participent comme membres bienfaiteurs aux activités de la SROP.

Au sein du conseil est constitué un comité exécutif de 6 membres qui assure le suivi de la gestion de la section.

Les activités de la SROP sont animées par les chercheurs et les spécialistes phytosanitaires des pays membres. Ils participent aux travaux des commissions et groupes de travail et contribuent à l'élaboration de publications scientifiques et techniques ainsi qu'à l'organisation de symposiums, de conférences et de cours de formation.

Le français et l'anglais sont les langues officielles.

2 – Buts

La SROP a pour but d'encourager et de promouvoir des méthodes de protection des plantes à la fois valables pour la pratique et qui minimisent les dangers pour l'homme et l'environnement. Elle favorise les recherche et l'application pratique par la formation et par l'information sur les méthodes de lutte biologique, ainsi que sur toutes les méthodes, pesticides inclus, qui s'inscrivent dans le cadre de la lutte intégrée. Les activités principales comprennent le développement et la standardisation de méthodes permettant de tester les effets des pesticides sur la faune utile, l'évaluation des dégâts provoqués par les ravageurs, la mise au point de modèles prédictifs en relation avec la protection des plantes et l'implantation dans la pratique de méthodes de lutte biologique et intégrée contre les ravageurs et maladies de différentes cultures. Récemment, on a commencé à étudier la possibilité de développer des systèmes plus globaux de production agricole intégrée.

3 – Commissions

Les commissions sont instaurées par le conseil pour animer des activités permanentes importantes intéressant l'ensemble de la section.

4 – Groupes de travail

Les groupes de travail ont pour but de stimuler la collaboration entre les chercheurs qui s'intéressent à des problèmes communs à différents membres de la SROP.

5 – Publications

La revue internationale BioControl – revue de lutte biologique et intégrée – est publiée sous les auspices de l'OILB globale.

Une activité importante de la SROP consiste à publier des Bulletins. Ceux-ci servent à la diffusion des comptes rendus d'activité du Conseil, de l'Assemblée générale et en tout premier lieu des Commissions et Groupes.

« Profile » est le journal interne d'informations sur les différentes activités de la SROP. Il paraît deux fois par an.

Des brochures techniques faisant le point de sujet méthodologique sont également publiées de temps à autre.

6 – Enseignement

Des cours de formation sont organisés, souvent conjointement avec d'autres Organismes. Ces cours sont destinés à des personnes qualifiées ayant terminé leurs études et travaillant dans la recherche ou dans l'avertissement.

1 – The "W.P.R.S."

WPRS is one of six Regional Sections of the International Organisation for Biological Control which was established in 1956 under the auspices of the International Union of Biological Sciences. Institutional members, base of the Organisation, comprise governmental or other official Organisations which pay an annual subscription. At the present time there are 42 members from 24 different countries in Europe, Mediterranean Region, and the Near and Middle East. Other Organisms, public or private, participate, as "supporting members", in SROP activities.

WPRS is administered by an Executive Committee drawn from the Council which is elected every four years by the Institutional Members at a General Assembly.

The activities of WPRS depend on scientists and technical workers from member countries who participate in Working Groups and Commissions and contribute to the publications.

The official languages are French and English.

2 – Objectives

To encourage collaboration in promoting realistic and environmentally safe methods of pest control by fostering research and practical application, training and information, especially of biological methods of control, but also of all methods, including chemicals, within an integrated pest management context. Major activities include development and standardisation of methods of testing effects of pesticides on beneficial species, pest damage assessment, modelling in relation to pest management, and the practical implementation of biological and integrated controls for pests of particular crops. Recently an examination has begun of programmes of research where integrated pest management practices are studied as part of overall crop production systems.

3 – Commissions

These are set up by Council to provide a service or to catalyse important permanent activities.

4 – Working Groups

Working Groups aim to foster collaboration between scientists interested in problems common to several members of WPRS.

5 – Publications

The international journal BioControl – a Journal of Biological and Integrated Control – is published under the auspices of the Global IOBC.

A major activity of WPRS is the publication of Bulletins which include reports of the Council, the General Assembly, of the Commissions and of the Working Groups, particularly of Working Group Symposia.

"Profile" is the information Newsletter of WPRS activities. It is published twice a year.

Technical Brochures on methodologies are also published.

6 – Training

Training courses for young suitable qualified research and advisory postgraduate workers were initiated in collaboration with other organisms.

Contents / Table de matières

Opening Ceremony

Relevant Biological and Integrated Control Measures in Agricultural Plant Protection in Austria

S. Blümel
BFL, Institut für Phytomedizin, Spargelfeldstr. 191, A-1226 Wien

The importance of integrated and biological pest management in agricultural production in Austria has constantly increased during the last two decades. According to the evaluation of the Austrian programme for environmental friendly agriculture the area cultivated with regard to integrated plant production guidelines reached 46 % in vegetables, 77 % in vineyards (42,500 ha) and 100 % in fruit production (appr. 10.000 ha) (BMLF, 1996).
Austrian and European plant protection and environmental legislation (e.g. Federal Plant Protection Law, 1997; Federal Law on the Protection of Humans and the Environment from Chemicals, 1987; EU-Directive 91/414/EEC on the Placing of Plant Protection Products on the Market) support integrated and biological plant protection measures.

Research and development in Austria comprise basic requirements like investigations on **host plant resistance**, evaluation of economic tresholds and the development of forecasting systems. Investigations carried out at the BFL focus to detect resistant cultivars in cereals against powdery mildew, rust and leaf spot diseases (Zwatz, 1991; Zwatz et al., 1996), in maize (*Ostrinia nubilalis*), in vegetables (*Bremia lactucae*, *Colletotrichum lindemuteatum*) and in plums (Sharka-virus).

Evaluation studies on economic thresholds are conducted in pome fruits (*Panonychus ulmi*, *Aculus schlechtendali*), in lettuce (*B. lactucae*), in cabbage (aphids, caterpillars), in rape (*Phoma lingam*, *Psylloides chrysocephala*), in sugar beet (*Aphids fabae*) and in cereals (various fungal diseases). Activities in this area mainly intend to adapt existing recommendations for regional requirements.

Warning and advisory service including forecasting was established for more than 30 arthropod pests and for up to 15 diseases in various crops (tables 1-2) (Bedlan, 1995; Kahrer, 1986; 1992; Nieder 1992). Recently the development of warning services for *Diabrotica virgifera* in maize and for *Cameraria ohridella* on horse chest nut was set about. Observations for the warning service are reported to the BFL either by local observers all over Austria or by central stations at important production areas of the different crops. The BFL takes care of recording and analyzing the data to produce the warning advice, which is transferred via different media like phone, fax, and recently via internet to the local advisory services. These are concerned with the further distribution of the information. For the warning and advisory service of diseases partly forecasting models are applied, using automatic wheather stations to record the relevant climatic data. As a result of successful forecasting, the number of treatments against downy mildew in cucumber could be reduced from 12 per growing season in 1987 to 0-3 applications today. Also in grapevine the number of applications against *Plasmopara viticola* was reduced since 1989 from 8 routine treatments by 50%. Special emphasis is put on the actual research and development of forecasting models in grapevine (*Uncinula necator*) and in hops (*Pseudoperonospora humuli*).

To promote the **application of biological control agents** studies on the development and biology of both beneficial arthropods, entomopathogenic viruses, microrganisms and nematodes against arthropod pests, and on microbial antagonists of fungal diseases are carried out.

Table 1: Warning/Advisory service for arthropod pests in different crops in Austria

Crop	Pest
Cereals	cereal leaf beetle (*Oulema sp.*) cereal tortricid (*Cnephasia pumicana*)
Maize	European corn borer (*Ostrinia nubilalis*) **Western corn root worm (*Diabrotica virgifera*)**
Rape	rape flea beetle (*Psylloides chrysocephala*) turnip Ceutorrhynchus (*Ceutorrhynchus napi*) rape beetle (*Melighetes aeneus*)
Cabbage	cabbage seed weevil (*Ceutorrhynchus assimilis*) cabbage gall midge (*Dasyneura brassicae*) *Thrips tabaci*
Pea	pea moth (*Cydia nigricana*) pea seed beetle
Garlic	garlic fly (*Suillia univittata*)
Leek	leek moth (*Acrolepiosis assecetella*) leek minimng fly (*Napomyza gymnostoma*)
Apple	codling moth (*Cydia pomonella*) apple blossom weevil (*Anthonomus pomorum*)
pome fruits	San- José scale (*Quadraspidiotus perniciosus*)
Pear	pear gallmidge (*Contarinia pyrivora*) pear leaf bleastermite (*Eriophyes piri*) pear psyllids (*Psylla sp.*)
pome/plum	saw flies
plum cherry	*Cydia funebrana* European cherry fruit fly (*Rhagoletis cerasi*)
grapevine	grape berry moths (*Eupoecelia ambiguella, Lobesia botrana*) *Calepitrimerus vitis* spider mites
thuja	cedar leaf miner (*Argyresthia thujella*)
horse chestnut	***Cameraria ohridella* (Leafmining moth)**
stored products	*Plodia interpunctella, Ephestia kühniella* grain weevil (*Sitophilus granarius*)

In protected crops trials to adapt and develop mass rearing methods of macrobials as well as to evaluate their efficacy for the control of main pests occurring in greenhouse vegetables and ornamentals in Austria were conducted (Blümel, 1996; Blümel & Schausberger, 1996).

Studies on natural enemies of arthropod pests in field vegetables focused on the biology and application of parasitoids (*Microplitis tuberculifera / Trichogramma sp.*) of the cabbage moth (Jugovits, 1987)

In ornamentals the spectrum of natural enemies of important pests was determined for e.g. the cedar leafminer (*Argyresthia thujella*) (Shirvani, 1986), for the sycamore lace bug (*Corythuca ciliata*) (Zukrigl, 1989), and latest for the horse chestnut leafmining moth (*Cameraria ohridella*) (Stolz, 1997).

Table 2: Warning/Advisory service for fungal diseases in different crops in Austria

Crop	**Disease**
apple	powdery mildew (*Podosphaera leucotricha*)
pome fruits	scab (*Venturia sp.*)
orchards	blossom blight (*Monilia laxa*)
peach	peach leaf curl (*Taphrina deformans*)
apricot	*Apiognomonia erythrostoma*
cherry	Leaf scorch (*Blumeriella japii*)
grapevine	**Downy mildew (*Plasmopora viticola*)** **Powdery mildew (*Uncinula necator*)**
hop	***Pseudoperonospora humuli***
cucumber	*Pseudoperonospora cubensis*
weat, barley	*Pseudocerosporella herpotrichoides* *Septoria nodorum*
potato	*Phytophthora infestans*
celery	*Septoria apiicola*
rape	*Phoma lingam*

In orchards and in vineyards studies on beneficial arthropods especially considered the efficacy of predatory mites. Basic studies provided extensive information about the occurrence of the main phytoseiid species in Austria and the efficacy of *T. pyri* as biological control agent of spider mites and acarinosis on grapevine was successfully demonstrated and implemented into practice (El-Borolossy & Fischer-Colbrie, 1989; Fischer-Colbrie & El-Borolossy, 1989). In pome fruits most recent studies in the field dealt with the determination of the natural parasitization of San José-scale (*Quadraspidiotus perniciosus*) (Polesny, 1996) and with the efficacy of *Trichogramma sp.* for the control of codling moth (*Cydia pomonella*).

In arable crops the most important natural enemy is *Trichogramma sp.* which was shown to control successfully the European corn borer (*O. nubilalis*) (Berger, 1991).

Besides beneficial arthropods also studies with viruses and microorganisms for the control of arthropod pests were carried out at the BFL, including the codling moth granulosis virus (Polesny, 1995), *Bacillus thuringiensis* var. *kurstaki*, var. *tenebrionis*, var. *aizawai* against different pests in arable crops, in vegetables and in strawberry, and the fungi *Beauveria brongniartii* against cockchafers, and *Verticillium lecanii* against greenhouse aphids.

The potential of **microbial antagonists for the control of plant pathogens** has gained increasing importance during the last years also in Austria. Trials including 11 different antagonists were carried out for the control of important diseases in grapevine, ornamentals, vegetables and cereals with varying success (table 3) (Bedlan, 1996, 1997; Langbauer et al, 1996, Reisenzein & Tiefenbrunner, 1997).

Other topics of concern are trials with entomopathogenic nematodes, feeding capacity of collembolans against soilborne fungi, plant derived products (Quassia, pyrethrum silimurin) against phyotopathogenic fungi and pests in orchards, ornamentals and arable crops.

Table 3: Microbial antagonists investigated for the control of fungal and bacterial diseases in Austria

Crop	Disease	Antagonist
Cherry	scorch blight	*Trichoderma harzianum*
Grapevine	*Uncinula necator*	*Ampelomyces quisqualis*
Carnation	*Botrytis cinerea*	*T. harzianum, T. viride, Beauveria bassiana*
Cyclamen	wilt diseases	*Streptomyces griseoviridis*
Ornamentals	soilborne fungi	*S. griseoviridis*
Tomato	different pathogens	*T. harzianum, T. hamatum, T. koningii, B. bassiana*
	Cladosporium fulvum	*T. harzianum*
Cucumber	*Pseudoperonospora cubensis*	*T. harzianum*
	Fusarium wilt	*S. griseoviridis*
Redish	*Peronospora parasitica*	*T. harzianum*
Lettuce	*Rhizoctonia solani*	*T. harzianum*
Pea	*Thielaviopsis basicola*	*T. harzianum*
Wheat and barley	powdery mildew, Fusarium blight, Septoria leaf blotch, dwarf leaf rust, net bloch	*T. harzianum*

The area of use of biological control agents has constantly increased during the last decade in Austria mainly in protected crops, vineyards, orchards and maize.

In 1996 *Bacillus thuringiensis*, both *var. kurstaki* and *var. tenebrionis* were applied on an cumulative area of appr. 9000 ha and codling moth granulosis virus on 1160 ha. Beneficial arthropods (*Trichogramma sp.* and *Typhlodromus pyri*) were released in maize and vineyards on 900 ha. In greenhouse and horticultural production 17 different macrobials and entomopathogenic nematodes were used on 236 ha (Blümel & Womastek, 1997).

Biotechnical control agents like **pheromones** are as well considered for forecasting, mating disruption and mass trapping in orchards, vineyards and arable crops. Pheromones are used in Austria mainly for the warning service, although in vineyards and orchards mating disruption of [illegible] was very successful. Actually RAK 1 for mating disruption of grape berry moths and RAK 3 for codling moth are authorized in Austria. Broad range application in practice is however hampered by technical and economical obstacles.

Most recently pheromones were used in a newly established warning service for the horse chest nut leafmining moth applying the pheromone of *Lithocolletis blancardella* (Blümel & Hausdorf, 1997).

The possible use of incompatible and sterile insect techniques for the control of fruit flies was a main topic of research in Austria in the 70s and early 80s. Besides a number of basic laboratory studies on the biology of different *Rhagoletis* species and field survey about host plants, special emphasis was put on the investigation of the unidirectional crossing sterility of two different geographic origins of *R. cerasi* both occurring in Austria. Although RLO's which are known to cause crossing sterility were detected in the ovaries of females (of both geographical population origins) and although this infection could be reduced by heat and antibiotical treatment the incompatibility could not be removed (Blümel et al., 1991). In field trials overflooding with the incompatible population reduced cherry infestation from 70-100% to below 10% (Ranner, 1990).

Additionally to the direct application of biological and biotechnical control agents supplementary studies on **side-effects of pesticides on beneficial organisms** and the improvement of application techniques form part of the Austrian activities.

The BFL is actually involved in the development and standardization of laboratory and field testing methods for the detection of side effects of pesticides on predatory mites (*Typhlodromus pyri*) within the European joint validation initiative of governmental research centres, industry and contract laboratories to meet the requierements of the EU-Directive 91/414/EEC inclusive annexes (Blümel et al, 1998). Further tests about pesticide side effects are carried out with *Phytoseiulus persimilis*, *Encarsia formosa*, *Aphidoletes aphidimyza* and *Orius sp.*

Investigations on **application techniques** focus on electrostatic loading and tree row volume treatment in pome fruits and on crop adapted spray volume application in vineyards.

As **future aspects of research and development** of integrated and biological control measures in Austria are proposed:

- More trials with regard to Integrated Plant Production: better consideration of the interrelation of plant protection-plant production
- extension and improvement of warning services
- quality control of beneficial arthropods
- ecotoxicological aspects
- comparison of integrated production and organic production.

Acknowledgement

I gratefully acknowledge the special informations provided by G. Bedlan, H.K.Berger, P. Cate, A. Kahrer, M. Keck, E. Kurtz, B. Langbauer, C. Lethmayer, U. Persen, A. Plenk , F. Polesny, H. Reisenzein, M. Riedle-Bauer, P. Schausberger, R. Steffek, M. Stolz, B. Zwatz.

Literature

Bedlan, G. (1996) Biological control of *Cladosporium fulvum* Cke. on tomatoes in the greenhouse. Pflanzenschutzberichte, 56, 2, 136-141.

Bedlan, G. (1995) Experiences with the forecasting-system for the downy mildew of cucumbers (*Pseudoperonospora cubensis*) in Austria in the years 1987-1994. Pflanzenschutzberichte 55, 69-72.

Bedlan, G. (1997) Biological control of *Peronospora brassicae* Gäum. on radish in the greenhouse. Pflanzenschutzberichte, 57, 1, 59-61.

Berger, H.K. (1991) The use of *Trichogramma maidis* Pint. & Voegele in Austria since 1979. Proceedings 3rd Int. Symp. „*Trichogramma* and other egg parasitoids“ INRA Colloques Nr. 56.

Blümel, S., Keck, M., Nowotny, N.; Fiedler, W. and Russ, K.(1991) Detection and therapy of Rickettsia-like-organisms (RLO's) in the European Cherry fruit fly (*Rhagoletis cerasi* L; Trypetidae): an evaluation of their influence on the unidirectional crossing sterility. Pflanzenschutzberichte, 52, 1, 41-47.

Blümel, S. (1996) Effect of selected mass-rearing parameters on *O. majusculus* (Reuter) and *O. laevigatus* (Fieber). IOBC/WPRS-Bulletin, 19, 1, 15-18.

Blümel, S. & H. Hausdorf (1996) Erste Erfahrungen über die Bekämpfung der Roßkastanienminiermotte (*Cameraria ohridella*). Österreichische Forstzeitung, 5, 39-41.

Bümel, S., & P. Schausberger (1996) Current status of IPM in greenhouses in Austria. IOBC/WPRS-Bulletin, 19, 1, 19-22.

Blümel, S. & R. Womastek (1997) Authorization requirements for organisms as plant protection products in Austria. EPPO-Bulletin, 27, 1, 127-132.

Blümel, S.; B. Baier, F. Bakker, U. Bienert, M. Candolfi, S. Hennig-Gizewski, Ch. Kühner, B. Jäckel, F. Louis, A. Ufer and A. Waltersdorfer (1998) „Current status of a ring-tested method to determine pesticide effects on the predatory mite *Typhlodromus pyri* Scheuten (Acarina: Phytoseiidae) in the laboratory. in : Ecotoxicology; Pesticides and Beneficial Organisms, eds. P.T. Haskell and P. McEwen, Thomson Science, in press.

BMLF (ed.) 1996: Ökologische Evaluierung des Umweltprogrammes, (ÖPUL), 2 Bde.

El-Borolossy, M. & Fischer-Colbrie, P. (1989) A field survey of predaceous mites in Austrian orchards and vineyards. Pflanzenschutzberichte, 50, 2, 49-63.

Fischer-Colbrie, P. & M. El-Borolossy (1989) Investigations on the role of some ground-covering plants as a reservoir for predatory mites in fruit orchards. Pflanzenschutzberichte 50, 1, 34-37.

Fischer-Colbrie, P. & M. El-Borolossy (1990) Investigations on the influence of climatic conditions, different fruit species and prey mites on the occurrence of various species of predatory mites in Austrian orchards and vineyards. Pflanzenschutzberichte, 51, 3, 101-126.

Hennig, H. (1987) On the ecology of *Cnephasia pumicana* Zeller (Lepidoptera: Tortricidae). Pflanzenschutzberichte, 48, 1, 52-60.

Kahrer, A. (1986) Investigations on the biology and control of the garlic fly (*Suillia lurida* Meigen), (Helomyzidae; Diptera) in Austria. Pflanzenschutzberichte, 47, 1, 40.

Kahrer, A. (1992): Monitoring the timing of peak flight activity of *Thrips tabaci* in cabbage fields. IOBC/WPRS Bulletin, 15, 4, 28-35.

Jugovits, T. (1987) Development of *Microplitis tuberculifera* (Wesmael) (Hym[illegible] Braconidae), a parasitoid of *Mamestra brassicae* (Lepidoptera: No[illegible] Pflanzenschutzberichte, 48, 1, 24-32.

Langbauer, B.; Richter, S.; Tiefenbrunner, W. (1996) The growth inhibition of [illegible] of *Fusarium* by means of the entomopathogenic fungi *Beauveria* [illegible] Pflanzenschutzberichte, 56, 2, 119-135.

Nieder, G. (1992) Forecasting-system for *Plasmopara viticola* in Lower Austria [illegible] and observations 1989-1991. Pflanzenschutzberichte 53, 1, 1-50.

Polesny, F. (1995) Apfelwicklerbehandlung mit Granulosevirus. Besser [illegible]

Polesny, F. (1996) Situation and importance of San-José scale par[illegible] IOBC/WPRS Bulletin 19, 4, [illegible]7-379.

Ranner, H. (1990) Investigations on the biology and control of the European cherry fruit fly *Rhagoletis cerasi* L. (Diptera, Trypetidae). V. Experiments on the control of the European cherry fruit fly by means of the incompatible insect technique. Pflanzenschutzberichte, 51, 1, 1-16.

Reisenzein, H. and Tiefenbrunner, W. (1997) Growth inhibiting effect of different isolates of the entomopathogenic fungus *Beauveria bassiana* (Bals.) Vuill. to the plant parasitic fungi of the genera *Fusarium, Armillaria* and *Rosselinia*. Pflanzenschutzberichte, 57, 1, 15-24.

Shirvani, M. (1986) Studies on the biology and the control of the cedar leafminer (*Blastotere thujella* Packard) (Lep. Argyrestiidae) in Austria. Pflanzenschutzberichte, 47, 2, 1-12.

Zukrigl, S. (1989) Die Platanen-Netzwanze (*Corythuca ciliata* Say) in Österreich. Verbreitung, Entwicklungszyklus und natürliche Feinde. Diplomarbeit Univ. Wien.

Zwatz, B. (1991) Rust and mildew resistance of oats in Central and South Eastern Europe in 1983-1988. Cereal Rusts and Powdery Mildew Bulletin, 19, 1, 9-16.

Zwatz, B.; J. Sebesta; L. Corazza; H. Roderick; D.E. Harder and Stojanovic, S. (1996): Incidence and Resistance of Oats to Fungus Diseases in Europe in 1988-1994. Ochr. Rostl. 32, 2, 102-113.

Molecular Approaches for Improved Biological Control of Plant Diseases

Colum Dunne, Isabel Delany, Anne Fenton, Simon Aarons, Elisabetta Tola, Loraine Smith, Scott Lohrke and Fergal O'Gara.
Department of Microbiology, National University of Ireland, Cork, Ireland.

Summary: Environmental and consumer concerns and subsequent protective legislation have focused scientific interest on the development of microbial inoculants as environmentally acceptable methods of replacing or decreasing the use of chemical pesticides for crop protection. While potential biocontrol agents have been identified among fungal, actinomycete and bacterial species, molecular biology techniques are being increasingly employed to enhance the efficacy of these natural isolates. Such techniques include the development of improved inoculants capable of enhanced biocontrol metabolite production or with the ability to synthesise combinations of these metabolites. The exploitation of microbial inoculants as effective biocontrol agents involves the introduction of large numbers of microorganisms in to the soil environment. Ensuring that these procedures are compatible with sustainable, economically viable and environmentally friendly agricultural practice has involved monitoring and assessing the impact of microbial inoculants on phytopathogens and indigenous beneficial microflora.

Biological control of plant pathogens

Phytopathogenic fungi and nematodes, mediating a number of plant diseases, cause significant losses in crop yields annually. However, continued environmental and public health concerns related to the widespread use of chemically synthesised pesticides have resulted in protective legislation governing the use of some pesticides. With further more stringent controls expected in the near future (e.g. 1998 levels of fumigant methyl bromide use must be less than those of 1991), scientific interest has focused on the development of microbial inoculants for crop protection (Cook et al. 1995; Dunne et al. 1996, 1997a; Van Veen et al. 1997). Biological control, exploiting the naturally-occurring negative interactions between beneficial disease-suppressive microorganisms and phytopathogens, represents an effective and environmentally acceptable strategy for the replacement, or decrease, of chemical plant protection measures (Cook et al. 1995; Handelsman and Stabb 1996). Evaluation of the mechanisms mediating microbial plant protection has resulted in the identification of antifungal factors such as siderophores, a variety of secondary metabolites and hydrolytic enzymes (Becker and Cook 1988; O'Sullivan and O'Gara 1992; Fenton et al. 1992; Geremia et al. 1993; Dowling and O'Gara 1994; Kobayashi et al. 1995; Flores et al. 1997; Cronin et al. 1997a, 1997b; Dunne et al. 1997b) produced by fungi, actinomycetes and bacteria. Plant protection by bacterial inoculants may also occur due to the induction of plant resistance mechanisms (Leeman et al. 1995; Ryals et al. 1996; Van Wees et al. 1997).

The effective application of microbial inoculants as biological control agents against soilborne pathogens involves the introduction of large numbers of microorganisms into the rhizosphere. This environment is extremely complex and is subject to diverse physical and chemical fluctuations, in addition to intense microbial activity (Handelsman and Stabb 1996). Introduced microbial inoculants must therefore be capable of remaining ecologically competent while maintaining stable levels of biocontrol activity. The ecological impact of introduced metabolically active inoculants may influence the indigenous microbial community, affecting levels of pathogenic fungi and cyst and root knot nematodes in addition to arbuscular mycorhizal fungi and other beneficial microflora. Extensive analysis of the ecological effects of introduced inoculants is essential in determining their compatibility with sustainable, economically viable and environmentally friendly agricultural practices.

Biocontrol of pathogenic fungi and cyst nematodes by bacterial extracellular enzyme production

Pythium ultimum, a fungal plant pathogen causing damping-off of sugarbeet, and the potato cyst nematode *Globodera rostochiensis* are responsible for extensive damage to crop yields. Traditional crop protection measures against these pests have included crop rotation and the incorporation of chemical treatments into seed coatings. However, the exploitation of fungal or bacterial biocontrol agents, producing hydrolytic enzymes, has been proposed as an alternative protection strategy (Mankau 1980; Spiegel et al. 1991; Segers et al. 1994, 1995, 1996; Chernin et al. 1995; Dunne et al. 1997a). Bacterial strain *Stenotrophomonas maltophilia* W81 was isolated from the rhizosphere of sugar beet grown in a *Pythium*-suppressive soil (Dunne et al. 1997b). Using assay procedures described by Fenton et al. (1992), *S. maltophilia* W81 proved capable of inhibiting growth of the pathogenic oomycete *P. ultimum* under *in vitro* conditions (Dunne et al. 1997b). *S. maltophilia* W81 is unable to produce the fluorescent siderophores or secondary metabolites (e.g. phloroglucinol) often associated with bacterial biocontrol inoculants (Dunne et al. 1997a). However, the strain does produce copious amounts of the hydrolytic extracellular enzymes, protease and chitinase.

Further evaluation of the biocontrol efficacy of *S. maltophilia* W81 in soil naturally infested with *Pythium* spp. demonstrated that this biocontrol agent confers protection on sugarbeet seeds against colonisation by *Pythium* species (Dunne et al. 1997b). As *Pythium* sporangia respond rapidly to seed exudates (Nelson et al. 1988) and infect young plants within hours of their introduction into soil (Stasz et al. 1980) this early implementation of seed protection further translated into increased emergence of healthy plants under soil microcosm conditions (Dunne et al. 1997b).

Transposon mutagenesis of *S. maltophilia* W81 resulted in the isolation of an extracellular enzyme-deficient mutant, W81A1, unable to inhibit growth of *P. ultimum* under laboratory conditions. When applied as a seed coating, mutant W81A1 also proved incapable of conferring protection against *Pythium* colonization of treated sugarbeet seeds and subsequent damping-off disease in *Pythium*-infested soil (Dunne et al. 1997a, 1997b). Furthermore, genetic complementation and biochemical assessment demonstrated that the antifungal ability exhibited by *S. maltophilia* W81 is mediated by the enzymatic degradation and disruption of the *P. ultimum* cell wall (Dunne et al. 1997b).

In similar fashion, disruption of the structural integrity of the cyst nematode *Globodera rostochiensis* egg shell by purified commercial hydrolytic enzymes, particularly combinations of chitinases and proteases, can result in decreases in the emergence of healthy juveniles *in vitro* (Dunne et al. 1997a; Cronin et al. 1997c). The chitinolytic bacterial strains *Stenotrophomonas maltophilia* M1-12 and *Chromobacterium* UP1, like *S. maltophilia* W81, were isolated from the soil environment (Cronin et al. 1997c). When assessed under *in vitro* conditions, using procedures previously described by Cronin et al. (1997a), both bacterial isolates significantly decreased the ability of *G. rostochiensis* to hatch (Cronin et al. 1997c). Evaluation of *S .maltophilia* M1-12 and *Chromobacterium* strain UP1 under natural soil conditions also resulted in significantly reduced levels of juvenile cyst nematode hatch (Cronin et al. 1997c).

In conclusion, current studies investigating the biocontrol activity of the antifungal, lytic enzyme-producing strain *S. maltophilia* W81 against cyst nematodes may result in the development of a microbial inoculant capable of providing an alternative means of plant protection against multiple pests.

Biocontrol of plant pathogens through antifungal metabolite production

Soils which are suppressive to crop diseases such as take-all of wheat, black root rot of tobacco, Fusarium wilt of tomato and *Pythium*-induced damping-off of sugarbeet have been identified from many diverse geographic locations (Weller et al. 1988; Shanahan et al. 1992; Tamietti et al. 1993; Keel et al. 1996; Raaijmakers et al. 1996). Further studies have demonstrated the involvement of fluorescent pseudomonad production of antifungal secondary metabolites such as phenazines (Pierson and Thomashow 1992; Thomashow and Weller 1992), pyrrolnitrin (Homma et al. 1989), pyoluteorin (Howell et al. 1980; Kraus and Loper 1995) and c-acetylphloroglucinols (Shanahan et al. 1992; Keel et al. 1992) in suppression of root pathogens. In particular, 2,4-diacetylphloroglucinol (Phl) producing strains appear to be especially abundant in soils that are naturally suppressive to certain diseases (Keel et al. 1996). For example, Harrison et al. (1993) estimated that at least 20% of the fluorescent pseudomonads isolated from *G. graminis* var. *tritici* infected roots grown in a take-all suppressive soil had a phenotype characteristic of Phl producers. However, while Phl is seen to have a broad inhibitory spectrum the exact mechanism of action of this compound is still to be determined.

Pseudomonas fluorescens strain F113, isolated from the rhizosphere of field grown sugarbeet, is capable of inhibiting the growth of the fungus *Pythium ultimum in vitro* and confers protection on sugarbeet against damping-off disease under natural soil microcosm conditions (Fenton et al. 1992). In addition to a fluorescent siderophore, the *P. fluorescens* F113 produces a number of secondary metabolites including 2,4-diacetylphloroglucinol, hydrogen cyanide (HCN) and an iron-regulated protease. Characterisation of the transposon-induced mutant F113G22, defective only in its ability to produce Phl, revealed that it had lost the ability to inhibit fungal growth *in vitro* (Shanahan et al. 1992) and the ability to protect sugarbeet seeds against damping-off *in vivo* (Fenton et al. 1992). Further *in vitro* and microcosm assays implicated Phl production by F113 in the control of the cyst nematode *G. rostochiensis* and the soft rot potato pathogen *Erwinia caratovora* (Cronin et al. 1997a, 1997b).

The genetic locus containing the biosynthetic genes involved in the production of Phl has been cloned and characterised from a number of strains (Fenton et al. 1992; Bangera and Thomashow 1996). We have previously reported that a 6 kb genomic DNA fragment containing the Phl biosynthetic genes was sufficient to complement the F113G22 biosynthetic mutant (Fenton et al. 1992). Sequence analysis of this clone and of the biosynthetic locus of *Pseudomonas fluorescens* strain Q2-87 identified a number of genes involved in the production of Phl (Cook et al. 1995; Delany et al. unpublished). To date, six genes have been implicated in Phl biosynthesis. Of these, four have proved essential for the biosynthesis of the metabolite, and the other two may be involved in regulation of production and transport of the molecule out of the cell (Thomashow et al. 1996; Delany et al. unpublished).

Phl is thought to be synthesised via a polyketide pathway, with monoacetylphloroglucinol (MAPG) as the final precursor intermediate (Shanahan et al. 1992). A putative pathway for the synthesis of MAPG has been documented previously (Mann et al. 1987). The enzymatic activity responsible for the conversion of MAPG to Phl is coded for on the 6kb biosynthetic clone of F113 (Shanahan et al. 1993).

Research on antifungal metabolite production by pseudomonads has largely focused on understanding the biosynthetic and regulatory mechanisms of these strains. Generation of strains which have consistent performance and improved biocontrol activity through genetic modification may be essential to the effective and successful use of microbial inoculants. We have previously shown that the 6 kb biosynthetic clone of F113 is capable of conferring biological control ability when introduced into non-Phl producing *Pseudomonas* strain M114 (Fenton et al. 1992). This strategy not only allows the construction of novel biocontrol agents but also provides the opportunities for the improvement of currently available strains through the combination of multiple biocontrol traits.

The fungal pathogen *Pythium ultimum* affects gene expression in *Pseudomonas fluorescens* F113

Communication between members of the same species, as well as other species, is a major factor influencing the establishment and survival of organisms in their specific ecological niche. In many well characterized examples, such as the *Agrobacterium*-plant interaction and *Rhizobium*-legume symbiosis, the interaction involves a complex exchange of signal molecules (Clarke et al. 1992; Long 1996). This molecular communication can trigger responses and activate specific genes determining symbiosis, pathogenesis or disease resistance.

Fungal pathogens grow on a limited number of preferred hosts. Mechanisms mediating this host specificity involve the production of host-selective toxins and specific elicitors which allow recognition of the pathogen by the plant and the induction of the plant defense system (Kamoun et al. 1994; Knogge 1996). For successful pathogenesis, the fungal pathogen must elude the plant defense mechanisms, possibly through the production of suppressor molecules (Knogge 1996).

The regulation of bacterial physiological processes including bioluminescence, antibiotic production and expression of virulence factors in pathogens are regulated in a cell-density dependent manner through the accumulation of AHLs (quorum sensing; Salmond et al. 1995; Swift et al. 1996). However, recent reports have demonstrated that gene expression in one strain can be induced by signals produced by another. For instance, phenazine production in one strain of *Pseudomonas aureofaciens* may be influenced by signals produced by an alternative strain (Pierson and Pierson 1996). Such cross-talk indicates a high level of complexity in the interactions between organisms established in the same ecological niche, and that the production of diffusible molecules is a key factor in the ability of one organism to influence and regulate gene expression in another.

Studies in our laboratory have recently been extended to include the investigation of signalling between bacteria and fungi (Fedi [illegible]). In order to determine whether differential gene expression could be detected [illegible] *P. fluorescens* F113 in response to the presence of the fungal pathogen *Pythium ulti*[illegible] [illegible] transcriptional gene fusions were constructed by transposon Tn5-[illegible] reporter mutant bank was then screened [illegible] the presence and absence [illegible] in the isolation of five classes of mutants whose β-galactosidase act[illegible] of a diffusible factor released by the oomycete. F113 gene[illegible] would be an obvious t[illegible] for phytopathog[illegible] the reporter mutants continued to inhibit fungal growth, although under soil conditions 3 of the mutants were impaired in their ability to colonize the sugarbeet rhizosphere. These results indicate that *Pythium ultimum* is capable of affecting genes involved in the rhizosphere competence of *P. fluorescens* F113, possibly affecting its ability to establish itself in the environment and therefore overcoming the biocontrol activity of this antagonistic rhizobacterium (Fedi et al. 1997). These results allow an understanding of interspecies communication and have important implications for the development of effective biocontrol inoculants.

Ecological impact of microbial inoculants

The large-scale use of soil inoculants as biocontrol agents poses important ecological questions. A prerequisite for effective biocontrol of soilborne plant diseases is the ecological competence and the aggressive colonisation of the rhizosphere by the introduced biocontrol microbial spp. However, the introduction of large numbers of biological control agents may cause disruption of the abundance and diversity of indigenous microbial populations and this impact must be studied and understood. Studies have therefore assessed the effects of introduced microbial inoculants on resident bacterial and mycorrhizal populations (Barea et al. 1996; Tobar et al. 1996; Natsch et al. 1997; Niemann et al. 1997). In our laboratory, *P. fluorescens* F113 and the isogenic Phl-deficient mutant F113G22 were inoculated onto sugarbeet seeds singly and in combination so that both strains competed with one another in the rhizosphere (Carroll et al. 1995). Sugarbeet plants were grown under soil microcosm conditions for a period of 27 days, after which the sugarbeet seedlings were removed. The soil was then resown with uninoculated seeds for nine subsequent cycles of growth of new seedlings. Results indicated that there were no significant differences in colonization or long term survival between the *P. fluorescens* F113 wild-type and the transposon-induced mutant, suggesting that the ability of strain F113 to produce Phl does not provide an advantage in terms of ecological competence or colonization in the sugarbeet rhizosphere. In addition, while the biocontrol ability of *P. fluorescens* F113 requires establishment of the strain in the rhizosphere, this does not result in a lasting perturbation of the resident culturable bacterial microbiota.

Further evaluation of wild-type F113 under field conditions assessed the influence of the biocontrol inoculant on control of *Pythium*-induced damping-off of sugarbeet and on levels of selected indigenous soil microorganisms. A spontaneous rifampicin resistant derivative of *P. fluorescens* F113 was introduced as a sugarbeet inoculant and its effects evaluated by direct comparison with untreated and chemical fungicide controls (Moënne-Loccoz et al. 1997). Introduced at a level of 6.0 log CFU per sugarbeet seed the inoculant was below detection limits at 6 months after sowing and was not found to have had any significant effects on the total numbers of culturable aerobic bacteria in the sugarbeet rhizosphere (Moënne-Loccoz et al. 1997). One year following release, strain F113Rif was found to be capable of colonizing the rhizosphere of uninoculated red clover sowed at the same site. As the introduction of large numbers of biocontrol agents may effect non-target indigenous soil microorganisms contributing to natural suppression of pathogens or to disease fertility, experiments were performed to assess the effects of F113Rif on *Rhizobium leguminosarum* biovar *trifolii* (Meade et al. 1985) and its ability to effectively nodulate red clover (Moënne-Loccoz et al. 1997). Results demonstrated that there were no significant differences in any of the plant performance parameters assessed (e.g. total foliage biomass, nitrogen content of the clover foliage, etc.) between plots previously inoculated with F113, the commercial fungicides or an untreated control. In addition, there were no significant effects on the degree of nodulation between the three treatments. These observations suggest that inoculation of sugarbeet seeds with *P. Fluorescens* F113 did not affect the resident population of *Rhizobium leguminosarum* bv. *trifolii* from a funtional aspect.

Acknowledgements

This work was supported in part by grants awarded by the Irish Science and Technology Agency Forbairt (SC-96-349) and the Biotechnology programmes of DGXII of the European Commission (BIO2-CT92-0084, BIO2-CT93-0053, BIO2-CT94-3001, BIO4-CT96-0027, BIO4-CT96-0181, BIO4-CT96-5019, FMRX-CT96-0039 and BIO4-CT97-2227).

Literature

Bangera, M. G., and Thomashow, L. S. 1996. Characterisation of a genomic locus required for the synthesis of the antibiotic 2,4-diacetylphloroglucinol by the biological control agent *Pseudomonas fluorescens* Q2-87. Mol. Plant Microbe Interact. 9:83-90.

Barea, J. M., Tobar, R. M., and Azcón-Aguilar, C. 1996. Effect of a genetically modified *Rhizobium meliloti* inoculant on the development of arbuscular mycorrhizas, root morphology, nutrient uptake and biomass accumulation in *Medicago sativa.* New Phyto. 134: 361-369.

Becker, J. O., and Cook, R. J. 1988. Role of siderophores in suppression of *Pythium* species and production of increased growth response of wheat by fluorescent pseudomonads. Phytopathology 78: 778-782.

Carroll, H., Mo[illegible]nne-Loccoz, Y., Dowling, D. N., and O'Gara, F. 1995. Mutational disruption of the biosynthesis genes coding for the antifungal metabolite 2,4-diacetylphloroglucinol does not influence the ecological fitness of *Pseudomonas fluorescens* F113 in the rhizosphere of sugarbeets. Appl. Environ. Microbiol. 61:3002-3007.

Chernin, L., [illegible], Z., [illegible], S., and Chet, I. 1995. Chitinolytic *Enterobacter agglomerans* antagonistic to fungal plant pathogens. Appl. Environ. Microbiol. 61:1720-1726.

[illegible]arke, [illegible] Douglas, C. 1992. Molecular signals in the interactions be[illegible] Cell 71:191-199.

[illegible]ok, [illegible], Fujimoto, D., Mazzola, M., Bangera, G., and Ki[illegible]anisms of defense by rhizobacteria against root disease. Pr[illegible] 4197-4201.

[illegible]nin[illegible], C., Dowling, D. N., and O'Gara, F. 19[illegible] the interactions of the biocontrol strain F[illegible]ostochiensis*. Appl. Environ. Microbiol. 6[illegible]

[illegible]nin[illegible]ne, C., Dowling, D. N., and O'Gara, F. 1[illegible]*udomonas fluorescens* strain producing 2,[illegible] pathogen *Erwinia carotovora* subsp. [illegible]

[illegible] 1997c. Inhibition of egg hatch of [illegible] chitinase-producing bacteria. Eur. [illegible]

Segers, R., Butt, T. M., Kerry, B. R., and Peberdy, J. F. 1994. The nematophagous fungus *Verticillium chlamydosporium* produces a chymo-elastase-like protease which hydrolyses host nrmatode proteins *in situ.* Microbiology 140: 2715-2723.

Segers, R., Butt, T. M., Keen, J. N., Kerry, B. R., and Peberdy, J. F. 1995. The subtilisins of the invertebrate mycopathogens *Verticillium chlamydosporium* and *Metarhizium anisopliae* are serologically and functionally related. FEMS Microbiol. Lett. 126: 227-231.

Segers, R., Butt, T. M., Kerry, B. R., Beckett, A., and Peberdy, J. F. 1996. The role of the proteinase VCP1 produced by the nematophagous *Verticillium chlamydosporium* in the infection process of nematode eggs. Mycolog. Res. 100: 421-428.

Shanahan, P., O'Sullivan, D. J., Simpson, P., Glennon, J. D, and O'Gara, F. 1992. Isolation of 2,4-diacetylphloroglucinol from a fluorescent pseudomonad and investigation of physiological parameters influencing its production. Appl. Environ. Microbiol 58:353-358

Shanahan, P., O'Sullivan, D. J., Simpson, P., Glennon, J. D, and O'Gara, F. 1993. Liquid chromatographic assay of microbially derived phloroglucinol antibiotics for establishing the biosynthetic route to production and the factors affecting their regulation. Anal. Chim. Acta. 272:271-277

Speigel, Y., Cohn, E., Galper. S., Sharon, E., and Chet, I. 1991. Evaluation of a newly isolated bacterium, *Pseudomonas chitinolytica* sp. nov., for controlling the root-knot nematode *Meloidogyne javanica.* Biocontrol Sci. Technol. 1:115-125.

Stasz, T. E., Harman, G. E., and Marx, G. A. 1980. Time and site of infection of resistant and susceptible germinating pea seeds by *Pythium ultimum.* Phytopathology 70:730-733.

Swift, S., Throup, J. P., Williams, P., Salmon, G. P. C. and Stewart, G. S. A. B. 1996. Quorum sensing: a population-density component in the determination of bacterial phenotype. TIBS 21:214-219.

Tamietti, G., Ferraris, L., Matta, A., and Abbattista Gentile, I. 1993. Physiological responses of tomato plants grown in Fusarium suppressive soil. J. Phytopathol. 138:66-76

Thomashow, L. S., and Weller, D. W. 1992. Role of phenazine antibiotic from *Pseudomonas fluorescens* in biological control of *Gaeumannomyces graminis* var. tricitic. J. Bacteriol. 170:3499-3508

Thomashow, L. S., Bangera, M. G., Bonsall, R. F., Kim, D. -S., Raaijmakers, J., and Weller, D. M. 1996. 2,4-diacetylphloroglucinol, a key antibiotic in soilborne pathogen suppression by fluorescent *Pseudomonas* spp. In: Biology of Plant-Microbe Interactions. G. Stacey, B. Mullin, & P. M. Gresshoff, eds. IS-IPMI, St. Paul, MI., pp. 469-474.

Tobar, R. M., Azcón-Aguilar, C., Sanjuán, J., and Barea, J. M. 1996. Impact of a genetically modified *Rhizobium* strain with improved nodulation competitiveness on the early stages of arbuscular mycorrhiza formation. Appl. Soil Ecol. 4: 15-21.

Van Veen, J. A., Van Overbeek, L. S., and Van Elsas, J. D. 1997. Fate and activity of microorganisms introduced into soil. Microbiol. Mol. Rev. 61:121-135.

Van Wees, S. C. M., Pieterse, C. M. J., Trijessenaar, A., Van't Westende, Y. A. M., Hartog, F., and Van Loon, L. C. 1997. Differential induction of systemic resistance in *Arabidopsis* by biocontrol bacteria. Plant-Microbe Interact. 10:716-724.

Weller, D. M., Howie, W. J., and Cook, R. J. 1988. Relationship between *in vitro* inhibition of *Gaeumannamyces gramminis* var. tricia and suppression of take-all of wheat by fluorescent pseudomonads. Phytopathology 78:1094-1100.

Plant Engineering as an Integrated Control Strategy against Invertebrate Pests

Pierre Abad
INRA Laboratoire de Biologie des Invertébrés, BP 2078 06606 Antibes Cedex, France

Plant resistance to invertebrate pathogens is an easy cost effective and environmentally friendly method of control. However, resistance genes are scare and sometimes they can be overcome by virulent populations. Since the currently used methods based on traditional resistance genetics fail to control in some cases these pathogens, there is a strong need for new resistance methods. Recent advances in molecular biology have made possible the cloning of useful genes for invertebrate resistance from a number of sources and their introduction into plants of agronomical interest.

Two main types of genes have been used for this purpose :

- Natural resistance genes
- Bt and protease inhibitors genes conferring new genetic properties against insects and nematodes, and more specifically, plantibody and anti-feeding strategies against endoparasitic nematodes.

Natural resistance genes

Many natural resistance genes against insects (*vat* gene in melon against *A. gossipii*, with *H1 to H19* genes in wheat against hessian fly, etc...) and nematodes (*Mi* gene in tomato and *H*1gene in potato, ect...) have been identified in plants. Such genes are involved in monogenic and dominant resistances, and their cloning are in progress in different laboratories around the world. In our lab, we are working on the molecular cloning of the *Me3* gene from pepper, a gene confering resistance to the root-knot nematode *Meloidogyne incognita*.

Recently, the first resistance gene active against a pluricellular organism, the nematode *Heterodera schachtii*, was cloned in sugar beet against (Cai et al., 1997). However, natural resistance genes are not numerous and they are sometimes overcome by virulent populations of pathogens. Therefore, new strategies have been developed to engineer new forms of resistance.

Genes conferring new genetic properties

Bt toxins

The toxins produced by *Bacillus thuringiensis* against insects are among the most well known examples. The biological activity of the first toxin was discovered at the beginning of the century, and these toxins have been used in biological control for more than thirty years. Therefore, it is logical that these toxins became a model for trangenic plant strategies. The insecticidal activity resides in crystalline inclusion bodies produced during sporulation of the bacteria, which are composed of proteins specifically toxic against a variety of insects. These proteins are termed delta endotoxins. Most of them are active against lepidoptera, but some strains specific to diptera and coleoptera have been identified. However, none of these toxins are effective against plant-parasitic nematodes.

The first Bt toxin gene has been cloned ten years ago, and has been introduced into tobacco, tomato, and other crops (Vaeck et al., 1987). The resulting plants have been tested under both laboratory and field conditions, and some of them have been commercialized : maize from Novartis in the USA and Canada and cotton in the USA. However, resistant populations of insects have already been observed in field conditions. These insect resistances appear in areas where the variability of parasite is poor and therefore the selective pressure is great.

Protease inhibitors

The other group of molecule used in plant engineering is represented by the protease inhibitors (PI). Protease inhibitors are expressed naturally in plants and reduce the ability of some insects to use their dietary proteins. This delays their development and may reduce fecundity. Protease inhibitors are specific to the four main mechanistic classes of proteolytic enzymes : serine, cysteine, metallo and aspartyl proteases.

Until now, only serpins (PI of serine proteases) and cystatins (PI of cysteine proteases) have been tested for their works for testing the efficacy of protease inhibitors to protect plant from insect or nematode attacks.

Tests with PI against insects were mainly carried out on lepidoptera larvae and the effect observed varied from a very high mortality to a more generally observed decrease of larvae weight (in the case of *Manduca sexta*, 60% lose weight in larvae feeding on tobacco expressing PI from tomato (TI-II) or potato (PI-IIK)). The efficacy of the PI has been demonstrated in field conditions with the lepidoptera *Helicoverpa zea.* Recently, PI expressed in transgenic plants have also shown some efficiency against coleoptera and endoparasitic (for review Ryan, 1990).

However, this strategy presents some disadvantages :

- to obtain a good effect, high expression of the PI in transgenic tissues (a range of 0.5 to 1% of the total soluble proteines) is needed.
- there is a high specificity of each PI against each class of protease. In some cases, insects can have a combinaison of two types of proteases and therefore plant resistance was overcame by some insect species of coleoptera. This is due to the degradation of the PI by other classes of proteases or by overexpression of insensitive proteases.
- insects from very close families can react in a very different way to the ingestion of a same PI.

On contrary to Bt toxins strategy, no data exist on the durability in the field of a resistance strategy based on PI.

Plant / nematode interaction

The Heteroderidae can be divided into two groups with cyst nematodes, which include the genera *Heterodera* and *Globodera* and and root-knot nematodes (genus *Meloidogyne*).

Root-knot nematodes, so-called for the characteristic root galls or root knots they induce on many hosts, can infect thousands of plant species and cause severe losses in yield of many crops worldwide.

During the infestation process, they migrate intercellularly to the vascular cylinder in search of cells which can serve as an initial feeding site. The nematodes then inject secretions from their esophageal glands.

Secretions [illegible] released through the stylet. These secretions are thought to [illegible] for the induction of the feeding sites. In response to the [illegible] esophageal secretions, a series of dramatic cellu[illegible] initial feeding cell. In the case of the root-knot nematode *Meloidogyne*, procambial cells adjacent to the head of the nematode develop into 'giant cells'. Each nematode triggers the development of five to seven giant cells, each containing as many as 100 enlarged nuclei. The multiple nuclei in giant cells result from mitosis uncoupled from cytokinesis. In parallel, the division of cortical cells around the nematode leads to the formation of galls and the distorted root structure characteristic of *Meloidogyne* infection.

Plantibody strategy

In the first strategy to engineer new resistance method to root-knot nematodes, we have developed studies on the components involved in the pathogenicity of the nematode and more precisely on proteins of esophageal secretions.

We chose to develop a strategy based on antibodies. Transgenic plants resistant to *Meloidogyne* can be viewed by preventing essential steps of the nematode fixation into the plant. For example by blocking the action of the esophageal secretions (Schots et al., 1992). This was first carried out by characterizing the secretion proteins and then by making transgenic plants that produce inhibitory antibodies that are able to block activity of secretionsby simple binding. If the inhibition of esophageal proteins activities blocks the development of giant cells, the nematodes will then not be able to continue their development. This work has been started in close collaboration with the Nematology department of the Agricultural University of Wageningen in the Netherlands and with the Plant pathology departments of North Carolina and Georgia Universities in the USA.

Polyclonal antibodies have been obtained by immunizing mice with total homogenates of nematodes. With immunofluorescence microscopy, polyclonal antibodies that specifically react on salivary glands were selected. From these selected polyclonal antibodies, monoclonal antibodies were obtained. More than 500 monoclonal antibodies have been produced and screened by immunoflorescence microscopy in order to select those binding to esophageal glands. Several monoclonal antibodies have thus been obtained against esophageal glands secretions of *M. incognita* at different stages of the parasitism. We focused our attention on the monoclonal 6D4 which recognizes esophageal glands in all the parasitism stages : pre-parasitic and parasitic stages(larvae and female) and which recognizes stylet secretions. This monoclonal antibody is being used for*in planta* expression in order to test its activity against endoparasitic nematodes.

However, the mechanisms of action of the esophageal secretions and the cellular compartment where they act remain unknown. They can act in the extracellular compartment through a receptor, which then transduces the signal to the nuclei, or they can act through cytoplasmic receptors and in this case they only act inside the cell. In order to express this antibody in all plant compartments, we constructed a modified antibody from the entire 6D4 monoclonal antibody ie : a single-chain antibody. Single-chain antibodies are small proteins consisting only of the binding domain to the antigen. In contrast to entire antibodies which are big molecules which need disulfide bridges to assemble the heavy and light chains, single-chain antibodies are able to be expressed in different compartments of the plant. As mentinned above, the possibility to express single-chain antibodies in the cytoplasmic compartment is of a great interest in the case of sedentary nematodes, because they most probably induce their feeding site by injecting esophageal secretions inside the cells of xylem tissues.

A single chain antibody consists of the assembly of the variable domains of heavy chains and light chain by a linker peptide of about 15 AA long. Only the variable domains are involved in the recognition of the antigen. The single-chain antibody represents therefore the minimal structure sufficient for binding to a target protein. Single-chain antibodies can block the action of enzymes when they recognize their catalytic or the substrate binding sites.

In order to characterize the 6D4 single-chain antibody and to compare its activity to the activity of the parental monoclonal antibody, we have expressed the 6D4 single-chain antibody in bacteria and we have shown that it is expressed in all the different compartments (cytoplasmic and periplasmic) and that it presents the same activity on total nematode homogenate than the entire monoclonal. In a second step, we have demonstrated its good stability in plant cells with transient expression assays into tobacco and cowpea protoplasts (Rosso et al., 1996). At the moment, the expression the 6D4 single-chain *in planta* is under study in our lab and transgenic tobacco plants are under regeneration. After analysis of its expression level and its localisation in the different compartments of the plant, transgenic tobacco will be tested for their activities against endoparasitic nematode.

Anti-feeding structure strategy

The other strategy developed in our laboratory concerns the local expression of phytotoxic genes that would inhibit the development of the feeding sites. If no feeding sites develop, the endoparasitic nematodes can not perdure into the plant, and the plant becomes resistant. This strategy is called the 'anti-feeding structure strategy'. However, this strategy is directly dependent on the availability of nematode-responsive promoter sequences that exhibit expression exclusively in the developing feeding site. The genetic mechanisms controlling formation of the nematode feeding site are still poorly understood and no key genes encoding proteins with known functions have been isolated or characterized in detail.

The recent availability of *Arabidopsis* as a host for plant-parasitic nematodes provides new opportunities to analyze the pattern of gene expression in nematode feeding site.

To identify these genes, a collection of mutageneized *Arabidopsis* with promoter trap vectors through random T-DNA-mediated insertion of a promoter-less *gus*A gene were generated in the INRA laboratory at Versailles. Two selected markers have been added in the T-DNA vector : a gene encoding for kanamycine resistance and a gene encoding for an herbicide resistance, the Basta gene. These two genes allow the selection of mutageneized plants carrying the T-DNA (Bechtold et al., 1993).

The T-DNA has the property to integrate at random into the plant genome. Therefore, it can inactivate in theory all the genes of the plant. When an insertion is located into or near a gene that is expressed during some development stages or after infection by pathogens, the promotor of this gene will be activated, but due to the T-DNA insertion, the promotor will activate the GUS gene instead of its gene. This expression is visualized by a blue coloration.

In the case of plant/*Meloidogyne* interaction, we work on mutageneized lines which are growed during 2 weeks on selective medium with Basta. A week after infestion, the different lines were analyzed for GUS expression in order to detect the promotors and therefore the genes expressed in galls. From the first 2000 T-DNA tagged lines tested for GUS expression within *Meloidogyne incognita* induced galls, 19 transgenic lines showed an increased GUS expression and 3 showed a repressed GUS expression. Further studies were carried out on the A3 line, a line that showed an increase of GUS activity in galls 3 days after infection. However, and like all other tagged genes, GUS expression was also observed at least in root apex and/or meristematic tissues. This was predicted since it unlikely that the plant would develop a specific response with genes only involved into the response to root-knot nematode attack. However, the presence of a blue coloration into galls does not mean that this coloration is restricted to the giant cells, which alone constitute the feeding site of the nematode. GUS expression may also be present in the cells surrounding the feeding site.

Microscopy analysis by cryosectionning indicated that in the case of this line, the expression of GUS activity was restricted to the giant cells.

Therefore, we have undertaken the molecular cloning of this gene. The molecular characterization indicates that this line has a single T-DNA insertion copy. Using Kanamycin plasmid rescue and inverse PCR, the 3' and 5' flanking sequences of the insertion were then recovered. The relatively long fragments obtained, 600 bp from each part of the insertion provided consistent sequence data. Database search indicated a strong homology with potato and spinach sequences coding for an enzyme of the pentose phosphate pathway. Comparison of the flanking sequences of the mutageneized plant with the original plant DNA revealed a deletion resulting from insertion of the T-DNA, and the comparison of the genomic DNA to cDNA allowed us to analyse the gene structure with the localization of introns. The pentose phosphate pathway plays a crucial role in cells by maintaining the NADPH pool and by generating carbohydrate intermediates which are used in nucleotides and diverse biosynthetic pathways. The involvement of this pathway and this enzyme in the giant cells is in accordance with the previously described active metabolism of giant cells. Now, in order to isolate the promoter of this gene, we are screening a genomic library using a 5' end cDNA fragment.

However, to conclude with this strategy, it is important to notice that the isolation of nematode feeding site-specific promoters needs further studies. In these studies, we will construct artificial promoters expect to be able to respond to nematode infection but not during the development of the plant. Only this kind of promoters will be further used to engineer nematode resistant plants by expressing anti-nematodes (protease inhibitors, or plantibodies) or suicide genes for the plant cell (ribonuclease).

In conclusion, several approaches are being evaluated as anti-insect and anti-nematode strategies. However, different considerations have to be addressed to these strategies when using insecticidal or anti-nematode genes in transgenic crops in the field: durability, efficacy and environmental impact.

Concerning durability and efficacy, it is of extreme importance that these anti-insect or anti-nematode genes will be managed effectively so as to reduce the selection of resistance breaking and thereby prolong their field life. Resistant breaking insects capable of overcoming selected Bt endotoxin genes are already emerging and others will surely follow. Cultural practices such as non-transgenic refugia for non-resistant pest genotypes and seed mixtures are being evaluated as strategies to delay the emergence of resistance breaking populations of insects. Nematodes being less mobile, it is not immediately obvious whether such practices would be of value in this case. Another approach to increase the durability of transgenes is gene pyramiding, in which, two, three or more anti-insect or anti-nematode genes, preferably of different modes, are expressed together in the same plant. This not only decreases the risk of selecting for resistance breaking but could also increase the efficacy and broaden the spectrum of species controlled by any transgenic line.

Concerning the environmental impact, the release of transgenic plants into the environment and the expression and wideaspread use of anti-insect or anti-nematode genes asks the question of their impact on non-target or beneficial organisms. The consensus of scientific opinion is that any deleterious effect on non-target organisms are likely to be negligible and certainly much less important than the effect of current pesticides, but experiments are under way to test this.

However, in any case, constitutive expression of trangenes should be avoided and, in the case of nematodes, the anti-feeding structure strategy we develop in the lab can be very helpful to direct gene expression in a very precise localisation in the plant.

Literature

Cai D., Kleine M., Kifle S., Harloff H.J., Sandal N.N, Marcker K.A., Klein-Lankhorst R.M., Salentijn E.M., Lange W., Stikema W.J., Wyss U., Grundler F.M., Jung C. (1997). Positional cloning of a gene for nematode resistance in suger beet. Science. 275, 832-834.

Vaeck M., Reynaerts A., Hofte H., Jansens S., Debeuckeler M., Dean C., Zabeau M., VanMontagu M., Leemans J. (1987). Transgenic plants protected from insects attack. Nature. 238, 33-37.

Ryan C.A. (1990). Protease inhibitors in plants: genes for improving defence against insects and pathogens. Ann. Rev. Phytopathol. 28, 425-449.

Rosso M-N., Schouten A., Roosien J., Borst-Vrenssen T., Hussey R.S., Gommers F.J., Bakker J., Schots A., Abad P. (1996). Expression and functional characterization of a single-chain Fv antibody directed against secretions involved in plant nematode infection process. Biochemical Biophysical Research Communications. 220, 255-263.

Schots A., De Boer, J., Schouten A., Roosien J., Zilverentant J.F., Pomp H., Bouwman-Smits L., Overmars H., Gommers F.J., Visser B., Stiekema WJ, Bakker J. (1992). Neth. J. Pl. Pathol. 98, 183-191.

Bouchez D., Camilleri C., Caboche M (1993). A binary vector based on Basta resistance for *in planta* transformation of *Arabidopsis thaliana.* C.R. Acad. Sci. Paris. 316, 1188-1193.

Council Activity Report

8th IOBC/wprs General Assembly, Vienna 1997
Report of the President

D.J. Royle
IACR-Long Ashton Research Station, Department of Agricultural Sciences, University of Bristol, Long Ashton, Bristol BS18 9AF, UK

Introduction

My report has two objectives: (1) to consider the major lines of progress and achievements made by and within our organisation during the last 4 years, and (2) to suggest some of the important issues for the future. Inevitably, each of these goals contain a personal perspective, perhaps even an idiosyncratic one, and I welcome this opportunity to try to frame some of the broad, essential issues within the short time available.

As a guide to my analysis, I offer you the perspective of IOBC/WPRS shown in Fig.1. There are, of course, a number of ways to depict the relationships shown in this diagram. None is perfect and completely satisfying. Even so, this will hopefully suffice as an "aide memoire" of the major elements of WPRS and indicate the main thrusts of my report. If I have any theme it is probably: "a scientific strategy for WPRS and its communication to the outside world"

WPRS is one of 6 regional sections under the umbrella of the Global IOBC. IOBC was founded on our territory, in Antibes, France in 1956, and became WPRS in 1971 with our first General Assembly in Rome; we are therefore the oldest Regional Section. Judging by the number and range of our Working Groups and other activities, we are also the most active and outgoing. In addition, we are arguably the most influential body representing biological and integrated control in W. Europe and the Mediterranean - or if we are not, then we should be! Whilst many of our Working Groups focus on fundamental aspects of biological control, we deliberately add "integrated control" to the biological control of our IOBC title. There is a sound reason for this since, unlike some other Regional Sections, we have made our *raison d'etre* the application of biological control in integrated protection and production, and the spectrum of disciplines within our Commissions, Working and Study Groups clearly testifies to this. Although we were founded on entomology we have by now long recognised that neither is biological control limited to pests nor can integrated control (or IPM in its many guises) be accomplished without acknowledging the need to manage pathogens and weeds also. We have thus evolved for ourselves a relatively complex organisation with interests in basic and applied sciences and with members and working scientists from a wide range of countries and backgrounds representing many different ways of doing things and opinions about how we should do them.

Scientific strategy

Particularly because of these considerations, it has been my view that our future competitive prosperity, especially within Europe, depends on establishing a more sound and coherent scientific framework than has previously been the case. This is not easy, both because of our intrinsic internationalism and because of our history. Nevertheless, as President during the last 4 years, I have tried to influence Council's thinking about our scientific strategy, both as an instrument of internal policy and because of its increasing importance for our scientific credibility and public image (Fig. 1) in the outside world. This is partly judged by the quality of our science and partly by the operational success of biological and integrated control.

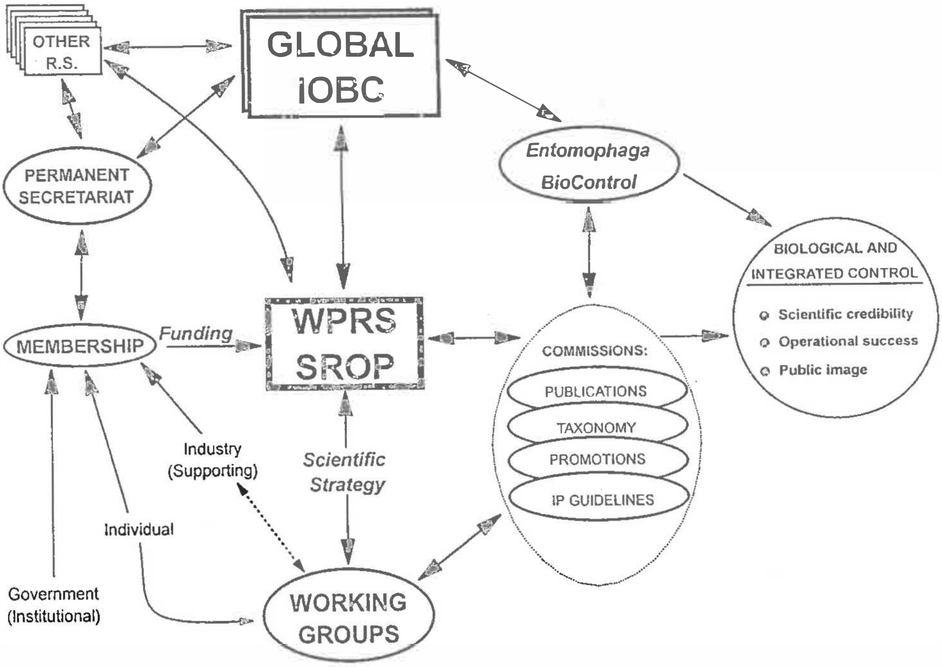


Figure 1: An IOBC/WPRS chart depicting scientific strategy in relation to some objectives of the Organisation

I believe that we can claim substantial progress in the last 4 years towards this more coherent scientific strategy for WPRS. In September 1995, we held the first ever workshop between Council and Working Group Convenors when many issues of scientific policy were considered in a fair amount of detail. We made an attempt to define the scope of our Working Groups and the inter-relationships which exist between them and with WPRS Council; in my opinion we made significant advances in harmonising these relationships. The Convenors were generous in their co-operation and provided structured information that is contributing towards identifying common areas of interest, important gaps in biocontrol science which we currently neglect, and where further work is needed to establish a better balance between areas of interest within Groups. We have today some outstanding Working Groups. They are the backbone of WPRS and are to be acclaimed. However, there is a continual need for Council, in consultation with the Convenors, to review their scope and goals in relation to modern needs, and to act accordingly. In the past, WPRS Councils have been reluctant to modify radically or to terminate Working Groups, although there is occasional precedence for this. This may largely have been because of tradition, though possibly another explanation lies in the way our Council has to function. This situation must change if we are to secure a well-defined, flexible scientific strategy, (and also for reasons of deploying scarce monetary resources).

Although, quite rightly, pest control still dominates within WPRS, it is significant that, to some extent, plant diseases are now included in 10 of the 17 Working Groups. We have one

Group which is dedicated to plant disease biocontrol and, having abandoned an outmoded Modelling Group some years ago, we have re-established a new Study Group with new objectives to address quantitative issues. The Fungal and Bacterial Working Group, now 4 years old, is highly productive in liaison with the European Federation of Plant Pathology, and the Study Group on Quantitative Approaches in IPM has made an impressive start working within other commodity-oriented groups. Weed science is more of a problem and future effort is needed not necessarily to create new Working Groups on weed biocontrol but rather to establish productive links with outside organisations.

Implementation of biological and integrated control

Many Working Groups and one of our 4 Commissions are, of course, actively interfacing with the agricultural, horticultural and food industries. The Convenors' reports later in this General Assembly will undoubtedly illustrate this. These interactions have a major influence on our scientific and management policies and on our image to the outside world. I would like to mention especially the great interest by commerce of the testing methods for determining the side-effects of pesticides on beneficials which have been developed by that Working Group. Thanks to the efforts of Drs Hassan, Boller, Bigler, Bluemel and others we have possibly the first ever option to draw in worthwhile finances from industrial membership in exchange for testing services.

A great deal of Council's time in the last 8 years has been spent on issues relating to the Commission on IP Guidelines (originally under Dr El Titi, now Dr Boller). After many earlier difficulties, endorsement procedures have been defined and are now about to be put into operation. The Guidelines produced by the excellent work of this Commission, in co-operation with the appropriate commodity Working Groups, attract a lot of interest and enthusiasm from producers in some countries, and the food industry which is seeking to establish its own standards for quality produce. The EU has also taken interest in our guidelines in relation to their own policy statements on integrated production. However, WPRS must safeguard its leading contribution in this field and I am sure that the Convenor will have more to say about this later on.

Involvement of industry in WPRS activities has always been a tricky issue. Some years ago we erected the non-voting "Supporting Member" ("Bienfaiteurs") category largely to accommodate members with vested interests and to draw in modest amounts of funding from them. However, it is clearly apparent that there is now more opportunity to involve commercial interests in the work of WPRS. I am as aware as anyone else about the cautions needed, but nevertheless believe that the next Council should actively explore ways to engage industrial and other outside interests, if we want to be seen to be an organisation which is competitive and relevant in promoting biological and integrated control. Some commercial enterprises are also potentially a source of revenue to WPRS and I will go no further than to suggest that the new Council considers the issue seriously. One idea that the outgoing Council have had is to explore the possibility of some kind of WPRS Scholarship Fund. This could be for graduate or post-doctoral study in an aspect of biological/integrated control and could be linked to an industrial partner or partners. There could be a large number of benefits to WPRS from such a venture.

Collaborations

Collaborations of various kinds have been an essential part of our activities in the last 4 years and have contributed significantly to the pursuit of our science and to wide respect that much of our work enjoys. Working Group Convenors themselves have been seeking more opportunities to join with related WPRS Groups, and outside bodies, for meetings and for developing their programmes. In April 1995, the first joint meeting between the Executive Committees of WPRS and the East Palaearctic Regional Section (EPRS) was held in Budapest. This was in response to ever increasing requests from EPRS to benefit from WPRS activities, and the meeting was fruitful. As outcomes, I visited EPRS in Moscow in May 1996 by their invitation, several of our WGs have held their meetings either close to or within an EPRS country, e.g. Poland, and we are now providing 40 copies of every WPRS Bulletin and PROFILE to EPRS. At this time, however, we would like to see more evidence of the reciprocal gestures from EPRS that were agreed at these meetings.

Thanks largely to the enterprise within Global IOBC of Dr Franz Bigler, its immediate past Secretary-General, and to whom I pay tribute, we have enjoyed a harmonious and highly productive liaison with Global IOBC over the last 4 years, and this is sure to continue. The benefits have been manifold but I would highlight, naturally, the successful IOBC conference in Montpellier in 1996, the recent establishment of a Permanent Secretariat in Montpellier and the creation of the new IOBC journal "*BioControl*", in all three of which WPRS has played a major role. The new Council will presently be considering with Global specific ways by which WPRS can benefit from the Permanent Secretariat and we will, in Dr Albert Minks, have strong representation on the Management Board of *BioControl*.

During my term I also made a visit in 1995, with Dr El Titi, the then Convenor of the IP Guidelines Commission, to DGVI of the EU to examine ways by which WPRS could collaborate and perhaps in the process identify ways to draw funding from the EU. Our response was mixed but there was no doubt about the substantial interest by the EU policy divisions in our work with integrated farming systems and, as I have recalled before, also in the WPRS IP Guidelines. Several Working Groups have utilised the collaboration within their group already to win EU research contracts or concerted actions and this will surely be developed further. Certainly, there is scope to establish closer contact with the EU generally, though for WPRS as a body, this will take some patient and dedicated exploration on the part of the new President and his Council.

Promotion

Communicating the WPRS identity and our scientific work to the outside world rests, to a large extent, with the Publications and Promotions Commissions. [illegible] the outstanding experience and efforts of Dr Minks, supported by [illegible] with his colleagues in the University of Gent, we have [illegible] which describe the work of our Groups in a topical and high-quality [illegible] Newsletter, PROFILE, to become an eminently [illegible] year. Together with *BioControl*, these publicat[illegible] communication pathways.

Your outgoing Council also set great [illegible] to up-scale their work for the new electroni[illegible] Commission has produced an admirabl[illegible] WPRS, and it has also been responsibl[illegible] glad to say, will be adopted also by G[illegible] In addition, Dr Gessler has hosted [illegible] could also help to meet the aspiration[illegible]

Table 1. Have we fulfilled the 23 Recommendations of the 7th General Assembly, 1993, Lisbon?

YES! to 20:	
Scientific strategy:	
8*	Avoid restrictions in **Working Group (WG) participation**
14	Change **size** and **focus** of some WGs
16	Encourage **collaboration between WGs**
10	Encourage WGs of WPRS to **collaborate with WGs of EPRS**
17	Hold a **workshop** with WG Convenors
15	More attention to **plant pathology** and **weed science**
11	Explain WPRS activities in **PROFILE**
1	Resolve common WPRS – **Global WG** interests
18/19	Start Study Groups on (i) control of **nematodes** (ii) **modelling**
21	Investigate incorporation of **5 new topics** as WGs
Implementation of biocontrol	
7	**IP Guidelines**: sort out endorsement procedure
Scientific and wider image of WPRS	
2/3/4	Elevate **WPRS image** through better contact with **EC**, FAO, EPPO, OECD; **Go public!**
12	Improve cover of **Bulletins** and change **LOGO**
20	Problem with *Entomophaga*
Industry	
9	More **Supporting Members** from commercial companies
Training	
22	More involvement through **co-operation**
General Assembly	
23	Clearer definition of **objectives** for 8th General Assembly
NO! To 3:	
5	Role for WPRS in **registering biocontrol agents**
6	With Global IOBC, produce **"White Paper"** on positive aspects of biological control
13	Produce **list of specialisms** among WG participants

* Number of the Recommendations of the VIIth General Assembly of IOBC/WPRS, Lisbon, Portugal 1993. *IOBC/WPRS Bulletin* **17** (7), 1994, pp.179-185.

Have we fulfilled the recommendations of the previous GA at Lisbon in 1993 ?

At each General Assembly, we make the considerable effort to produce, as a statutory requirement, a list of recommendations for the future which are duly accepted by the Assembly and then published in the Proceedings. In my experience, apart from within Council itself, little attention is ever given subsequently to these recommendations. Therefore, it seemed to me that it might be useful to summarise this report by assessing the state-of-the art of WPRS in terms of the recommendations made in Lisbon in 1993.

I believe that we can safely say that of the 23 recommendations made in Lisbon we have fulfilled, or else made substantial progress towards fulfilling, 20 of them. Table 1 briefly lists these successes, grouped under 6 headings. Table 1 also acknowledges the three recommendations in which we have perhaps not made the progress we had hoped.

Acknowledgements

I would like to pay tribute and thank most warmly my Executive Committee and Council for all their excellent work in the service of IOBC/WPRS during the last 4 years. In particular, Dr Serge Poitout has carried out the huge task of Secretary-General for 8 years with patience, thoroughness and dedication. As Treasurer, also for 8 years, Dr Jurg Huber has managed our budgets with skill and effectiveness. Dr Albert Minks, Vice-President, has carried out many critical tasks for WPRS with exceptional willingness and ability. We have all appreciated his work as Convenor of the Publications Commission and for utilising his experience for WPRS and for the broader benefit of IOBC on the *ad hoc Entomophaga* Committee, and in the establishment of the new IOBC journal *"BioControl"* where he will be continuing as WPRS representative on the Management Board. Finally, thanks to Dr Pedro Castanera, Dr Cesare Gessler and Dr Peter Esbjerg for assisting in a number of valuable ways and to the other members of Council and all the Convenors of our Commissions, Working and Study Groups for their substantial contributions to WPRS.

I now complete my term as President. Thank you all for entrusting this office to me. It has been a great honour, satisfying, frustrating at times, but always immensely enjoyable. I was the first plant pathologist to become President of WPRS; I sincerely hope that I will not be the last! I wish the IOBC/WPRS every success in future under its new Council and President.

8ème Assemblée Générale de l'OILB/SROP
Vienne 30 Septembre - 1er Octobre 1997
Rapport du Secrétaire Général

S.H. Poitout
INRA, Centre de Recherche Agronomique d'Avignon, Domaine St Paul, Site Agroparc, 84914 Avignon cedex 9, France

Monsieur le Président,
Mesdames, Messieurs les Représentants officiels,
Cher Collègues,

En conformité avec les statuts et le règlement intérieur de la Section Régionale Ouest Paléarctique de l'Organisation Internationale de Lutte Biologique et Intégrée contre les Animaux et Plantes nuisibles a lieu, aujourd'hui 30 Septembre 97, l'Assemblée Générale quadriennale de l'Organisation. La précédente a eu lieu à Lisbonne les 19-20 Octobre 1993.

Sans plus attendre, je voudrais personnellement renouveler les remerciements, exprimés déjà ce matin par notre Président, au Ministère Fédéral de l'Agriculture et des Forêts Autrichien qui nous a offert son accueil pour cette 8 ème Assemblée Générale. Je les adresse tout particulièrement à l'Office Fédéral et Centre de Recherche pour l'Agriculture où a lieu cette manifestation et auquel a incombé la charge de l'organisation locale. Au nom de l'OILB/SROP, j'exprime particulièrement ma gratitude à Harald BERGER, Responsable du Comité local d'organisation, ainsi qu'à toutes les personnes qui ont contribué de près ou de loin à la réussite de cette manifestation.

Le Conseil n'a pas jugé nécessaire de proposer à l'Assemblée Générale de modification de statut. Il n'y aura donc pas d'Assemblée Générale extraordinaire lors de cette Assemblée.

Comme ce fut le cas à Lisbonne et pour les mêmes raisons (nombre élevé de membres individuels ayant droit de vote), le vote pour l'élection des futurs Conseil et Comité de Gestion a eu lieu par correspondance.

Le Comité Exécutif sortant a désigné deux Scrutateurs (Jean Michel Rabasse, Rédacteur en Chef de la Revue Entomophaga, et Friedrich Polesny, Convenor du Groupe de travail "Vergers fruits à pépins"). Ceux-ci ont eu pour mission d'effectuer le dépouillement des votes reçus par correspondance pour l'élection du Conseil et du Comité de gestion en Assemblée Générale ordinaire. Ils proclameront dans un instant les résultats de ces élections.

Les nombres respectifs de Membres, avec prise en compte de toutes les modifications survenues avant fin Juillet 97, sont respectivement de:

38	Membres Institutionnels
42	Membres Bienfaiteurs
220	Membres Individuels
3	Membres Honoraires

L'examen comparé de ces chiffres avec ceux d'il y a 4 ans permet 3 constatations:

1 – Une légère diminution (38 au lieu de 42) du nombre de Membres Institutionnels en rapport avec les restructurations survenues pour certains Organismes nationaux et les difficultés pour d'autres d'assurer le règlement de leur adhésion.

2 – Un accroissement du nombre de Membres Bienfaiteurs (42 au lieu de 25).
3 – Le maintien d'un nombre élevé de Membres Individuels, malgré la réduction de 4 à 2 du nombre de leurs types en 95, se traduisant notamment par l'annulation du type 1 à faible montant d'adhésion (220 au lieu de 275).

Pour la présente Assemblée Générale, le Comité Exécutif a arrêté le nombre des votants, lors de sa réunion à Vienne les 21/22/03/97, à partir des listes actualisées à la date considérée des Membres ayant droit de vote . Il est de 241 (38 Membres Institutionnels, 200 Membres Individuels plus 3 Membres Honoraires). Le nombre de Membres ayant voté (120/241) permet de satisfaire le quorum exigé par les statuts pour l'élection du Conseil et du Comité de Gestion, soit 1/3 des votes exprimés. Par ailleurs, le nombre de Membres Institutionnels ici présents ou réglementairement représentés (19/38) , donc plus du tiers, donne à l'Assemblée Générale pouvoir pour délibérer.

Ces considérations statutaires ayant été abordées, je souhaiterais vous exposer quelques points essentiels concernant le fonctionnement général de notre Organisation durant ces quatre dernières années.

Il est sans doute utile de constamment rappeler que pour assurer les missions qui lui ont été dévolues, l'OILB/SROP s'appuie principalement sur les activités déployées au sein de ses Commissions et Groupes, qu'ils soient Groupe de travail ou d'études. Le Conseil, mandaté lors de la dernière Assemblée Générale, a donc constamment oeuvré pour stimuler, favoriser, améliorer l'action des Commissions et Groupes. Il a notamment agi pour une meilleure communication dans l'ensemble constitué par le Conseil et les différentes Structures de l'OILB/SROP. Malgré tout, il y a encore beaucoup à faire pour que les interactions et la coordination, donc l'efficacité globale, donnent pleinement satisfaction.

Comme informations au chapitre du fonctionnement général de notre Organisation, j'indiquerai aussi :

1 – Le soin particulier apporté par le Conseil pour fixer à chacun de ses Membres une tâche de suivi des Groupes: Ce dispositif s'est montré très efficace au plan du renforcement de la cohésion du fonctionnement. Il nécessite certainement encore un meilleur investissement de la part des Membres du Conseil qui sont chargés de cette mission, notamment en acceptant d'y consacrer un peu plus d'un temps, qui pour chacun je le sais est précieux.
2 – L'importance particulière donnée aux publications de l'OILB/SROP sous l'impulsion de deux de ses vice-Présidents (A.K. Minks, Responsable de la Commission "Publications" et D. Degheele, Coresponsable de la dite Commission, plus particulièrement chargé de l'édition et de la diffusion des Bulletins): les publications ont ainsi constamment bénéficié de toute l'attention et du soutien du Conseil.
3 – L'incitation près d'adhérents à l'OILB/SROP [illegible] du Comité Exécutif de la Globale dont l'élection [illegible] de la Globale (Montpellier 9/09/96): Des Représentants [illegible] Comité Exécutif les fonctions de Président [illegible] Wajnberg), de Trésorier (H. Berger).
Qu'ils soient ici sincèrement remerciés de [illegible]
4 – La tenue, durant cette période de [illegible]
10 Réunions du Comité [illegible]
03 Réunions du Conseil
02 Réunion conjointe Conseil [illegible]
01 Réunion conjointe Comité [illegible]

01 Réunion de concertation Secrétariat Général de la Globale - Comité Exécutif de la SROP.

Je voudrais préciser que les travaux, au cours de ces différentes manifestations, ont toujours eu lieu dans un climat de sérénité, dans un souci de recherche d'efficacité et d'arriver à la meilleure solution possible, lorsqu'il convenait de faire un choix. J'indiquerai en outre que c'est toujours avec grand soin et discernement que les demandes et les attributions financières ont été aussi bien examinées que décidées. A ce sujet, je signalerai que la procédure de demandes financières des Commissions et Groupes pour 1998- 1999 a été initiée par l 'ancien Conseil pour que le prochain puisse rapidement mettre en place les financements des activités des deux prochaines années.

Je continuerai en attirant l'attention sur la continuité des orientations prises au cours du précédent mandat:

1 – La cohésion avec l'OILB Globale a été renforcée par une concertation suivie et amicale entre SROP et OILB Globale. La création d'un Secrétariat permanent de la Globale, mis en place à Agropolis à Montpellier depuis Juin 97, devrait encore favoriser ce resserrement de liens entre l' OILB Globale et les différentes Sections dont la SROP.
2 – La procédure d' adhésion des Membres Individuels a été améliorée en réduisant le nombre de types (comme je l'ai signalé précédemment de 4 à 2). Ce dispositif, mis en place en 95, a permis de simplifier quelque peu la gestion des Membres. Il a peut-être permis aussi une participation de Membres plus motivés. De ce fait, le nombre de Membres individuels a grandement fluctué au cours des ans : 276 en 93, 322 en 94, 197 en 95, 216 en 96, 220 en 97.
3 – La politique d'adhésion de Membres bienfaiteurs a été poursuivie et leur nombre s'est globalement accru au cours des quatre années passées: 25 en 93, 26 en 94, 38 en 95, 38 en 96, 42 en 97.

Je dois maintenant vous signaler diverses manifestations où l'OILB/SROP s'est impliquée :

1 – En septembre 96 a eu lieu la Conférence Internationale de l'OILB GLOBALE qui a traité " des transferts en technologie en lutte biologique, de la recherche à la pratique ". Ses objectifs essentiels étaient de montrer l'efficacité de la lutte biologique par des exemples concrets pris de part le monde, souligner l'importance fondamentale de la lutte biologique dans tout programme de protection et de production intégrées selon une agriculture durable, de mettre en présence les différentes acteurs (chercheurs, techniciens de développement, industriels), de cerner les problèmes faisant obstacle au développement de la lutte biologique. Cette Conférence s'est tenue à Montpellier (France), en zone géographique de la SROP, et en un lieu suffisamment proche de son Secrétariat pour que celui-ci apporte une contribution dans l'organisation de la manifestation.
2 – Par ailleurs l'OILB/SROP a officiellement parrainé et/ou participé à différents Conférences et Séminaires.
   - En janvier 97 : parrainage de la 4ème Conférence Internationale sur les ravageurs en agriculture organisée à Montpellier (FRANCE) par la Commission " ravageurs " de l'ANPP (Association Nationale française de la Protection des Plantes).
   - En Octobre 96 : parrainage et participation à la Conférence "Ecotoxicologie : Pesticides et Organismes utiles " organisée à Cardiff (UK) par The Welsh Pest Management Forum.

– En Mai 97 : parrainage et participation au Symposium International d'Agadir (MAROC) sur le thème " Production et Protection Intégrées en cultures Horticoles ".

3 – En outre, l'OILB/SROP a contribué au cours international et atelier de formation organisé par l'OILB/GLOBALE en MALAISIE à Serdang (en mars 95) dont le titre était " Evaluation of Pesticide Effets on Natural Enemies and its implications for Pesticide Registration ". Ce cours a bénéficié de la collaboration de différents Organismes : OILB, International Institute of Biological Control (IIBC), Institut für Biologischen Pflanzenschutz in Darmstadt (ALLEMAGNE), Malaysia's Department of Agriculture (DOA) et de Malaysian Agriculture Research and Developpement Institute (MARDI).

Il est dans mes attributions de Secrétaire Général de vous informer certains aspects généraux et essentiels de la vie des Commissions et des Groupes. Cet après-midi et dans le jour suivant plus de détails vous seront donnés sur leur fonctionnement par leur Responsable respectif.

L'OILB/SROP comprend à ce jour 4 Commissions, 17 Groupes de travail, 4 Groupes d'études.

Sans mésestimer le travail réalisé par l'ensemble des Commissions, une attention et importance particulière ont été attribuées aux activités de la Commission "Directives pour la production intégrée". Je pense ne pas trahir les idées du Conseil si j'en évoque ainsi les diverses raisons :

1 – Intérêt manifesté à cet égard à différents niveaux (production, industrie agro-alimentaire, distribution, consommation).

2 – Dans une période où la commercialisation souhaite de plus en plus l'emploi de signes de qualité, il est extrêmement important que des textes donnent une assise aux concepts de protection et production intégrées.

3 – Dans une période aussi où sous l'impulsion de la demande publique une démarche législative risque d'être entreprise, la nécessité de textes précis émanant d'une réflexion scientifique et technique paraît tout aussi évidente.

Depuis la dernière Assemblée Générale le Groupe d'étude "Lutte biologique contre les champignons et bactéries phytopathogènes " sous la responsabilité de N. Fokkema est devenu Groupe de travail.

Dans ce même intervalle de temps plusieurs Responsables de Commissions, Groupe de Travail et d'Etude ont changé:

- E. Boller et J. Freuler ont remplacé comme Responsables respectifs des Commissions " Directives pour la production intégrée" et " Promotion et développement ", A. El Titi et H. Audemard.
- P. Witzgall, C. Adler et C. Villemant sont devenus respectivement Responsables du Groupe de Travail " Utilisation des phéromones et autres médiateurs chimiques en lutte intégrée " et des Groupes d'étude " Protection intégrée des denrées alimentaires stockées " et " Protection intégrée des forêts à ***Quercus sp*** " à la place de H. Arn, G. Domenichini et P. Luciano.
- Le Groupe de travail " Protection intégrée en verger ", anciennement sous la responsabilité de E. Dickler, a donné naissance à deux Groupes " Protection intégrée en verger " Responsable: F. Polesny et " Protection intégrée des fruits à noyau " Responsable: P. Cravedi.
- Enfin je signalerai les perspectives de changements des Responsables des Groupes "Mouche des fruits d'importance économique "; Responsable: J. Piedade-Guerreiro et " Lutte intégrée en agrumiculture " Responsable: V. Vacante par respectivement M.

Afellah et S. Barbagello, Groupes qui, par ailleurs, nécessitent aujourd'hui d'être redynamisés.

Nous devons déplorer l'arrêt d'activité du Groupe d'étude " Lutte intégrée en Oléiculture ", compte tenu de ses difficultés de fonctionnement.

Dans le même temps un nouveau Groupe d'études a vu le jour " Approches quantitatives en protection intégrée contre les ravageurs et maladies ", dont l'objectif est de travailler en collaboration étroite avec les Groupes de la SROP qui solliciteront une approche en modélisation.

Enfin il existe toujours un projet de Groupe d'étude " Lutte intégrée contre les mauvaises herbes. Celui-ci n'a pu être jusqu'à ce jour concrétisé, par absence de réponse à la demande d'activité coordonnée faite près du Groupe de travail " Lutte biologique contre les mauvaises herbes " de la Société Européenne de Recherche de Malherbologie. Ce projet à mon sens devrait-être poursuivi par le prochain Conseil.

Dans la conjoncture actuelle, se traduisant par une diminution des crédits des Organismes, il faut souligner les difficultés de financement des déplacements de plus en plus souvent rencontrés par les participants aux réunions. Ceci pourrait certainement à terme porter préjudice aux activités des Groupes de l'OILB/SROP.

Je ne m'attarderai pas sur les publications de l'OILB/SROP de la période écoulée dont le rapport complet vous sera donné par le Responsable de la Commission (A.K. Minks). Un point particulièrement important fera part des réflexions conduites concernant la revue Entomophaga et des changements qui en sont issus et qui intreviendront dès 1998. En bref, de nombreux Bulletins sont parus ce qui est démonstratif de la bonne activité des Groupes et Commissions.

J'évoquerai comme dernier point l'urgence d'établir des relations et de travailler en convergence avec différents Organismes (CE, FAO, OCDE, OEPP etc...) dont les champs d'activités se recoupent avec ceux de la SROP. Notamment, il conviendra de voir à l'avenir par quelle procédure la SROP pourra reprendre les cours de formation réalisés conjointement avec la CE qui, dans le passé, ont eu tant de succès.

Je ne saurais terminer mon rapport sans lui donner une teinte moins formelle et plus chaleureuse :

- Tout d'abord au chapitre des tristesses je souhaite honorer ici la mémoire de grands serviteurs de l'OILB/SROP qui nous ont quitté : Raffaele Cavalloro, Danny Degheele, Jost M. Franz, David Rosen.
- Personnellement, je voudrais exprimer combien j'ai apprécié Raffaële et Danny, pour leur valeur humaine et dans le cadre de nos relations professionnelles au sein de l'OILB/SROP.
- Ensuite je voudrais très sincèrement et amicalement remercier tous ceux qui m'ont entouré et avec lesquels j'ai collaboré au sein de l'OILB, de son Conseil, du Comité Exécutif: David, Jürg, Albert, Pedro. Nous avons partagé les longs moments de travail soutenu de fin de quelques semaines mais il y eut aussi les instants appréciés où a pu prendre place un peu de convivialité.

Au terme de mes mandats, j'ose espérer avoir servi convenablement la cause de l'OILB/SROP.

Ce n'est pas sans un petit pincement au coeur que je vais prendre mes distances avec l'Organisation.

Pleine réussite et bon courage au nouveau Conseil. Dans cette période de grandes réformes et de restructuration assez généralisées, il est certes nécessaire que l'OILB/SROP se modernise. Il est toutefois tout aussi indispensable qu'une part de l'esprit de la SROP demeure car il semble avoir été depuis plus de 40 ans, et restera encore, le garant de sa réussite.

Merci beaucoup de votre attention.

8th IOBC/wprs General Assembly, Vienna 1997
Report of the Treasurer

J. Huber
Institute for Biological Control, BBA, Heinrichstr. 243, D-64380 Darmstadt, Germany

A more or less stabile income of around 200'000 CHF per year was more than capable of covering the expenses of IOBC/WPRS, so that the overall assets were even increasing (fig. 1). More than 85 % of the income came from membership fees, 3/4 of it from Institutional Members. Supporting, as well as Individual Members contributed equally 1/8 to the membership fees.

Of the expenditures, 2/3 have been used for the work of the groups and commissions and for the publication of their results in the Bulletin and other publications. There were some major fluctuations in the expenditures during the last four years, for the following reasons:

a) Irregularities in the delivery of Entomophaga led to the situation that in some years no subscriptions had to be paid. In 1994, on the other hand, even two subscriptions were due.
b) Many workings groups have larger meetings only every second year. Therefore, major funding is requested at a biannual rate. The same is true for Bulletins, as they reflect the activities of the groups (fig. 2)

On the average, the annual accounts could be closed with a benefit of 16'000 CHF. This increase led to an asset of IOBC/WPRS at the beginning of 1997 of more than 330'000 CHF. With this, IOBC/WPRS has a very high safety deposit for its activities in the future.

Fig. 1 Accounts of IOBC/WPRS

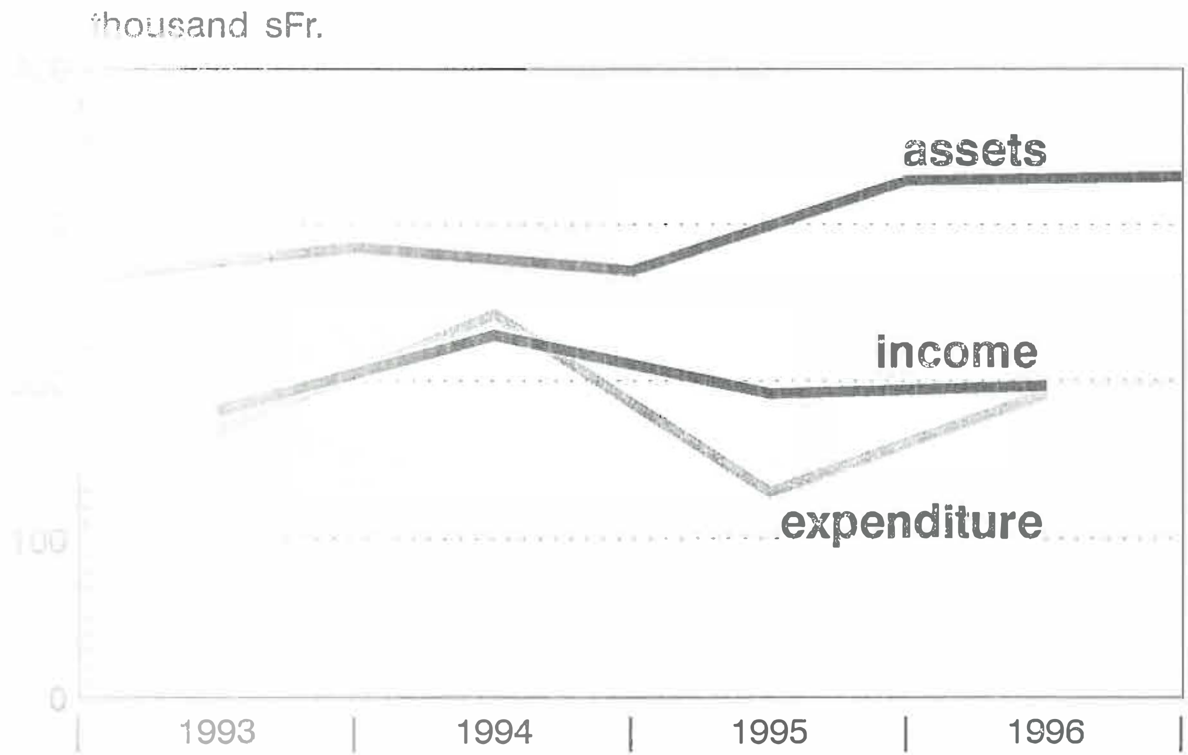
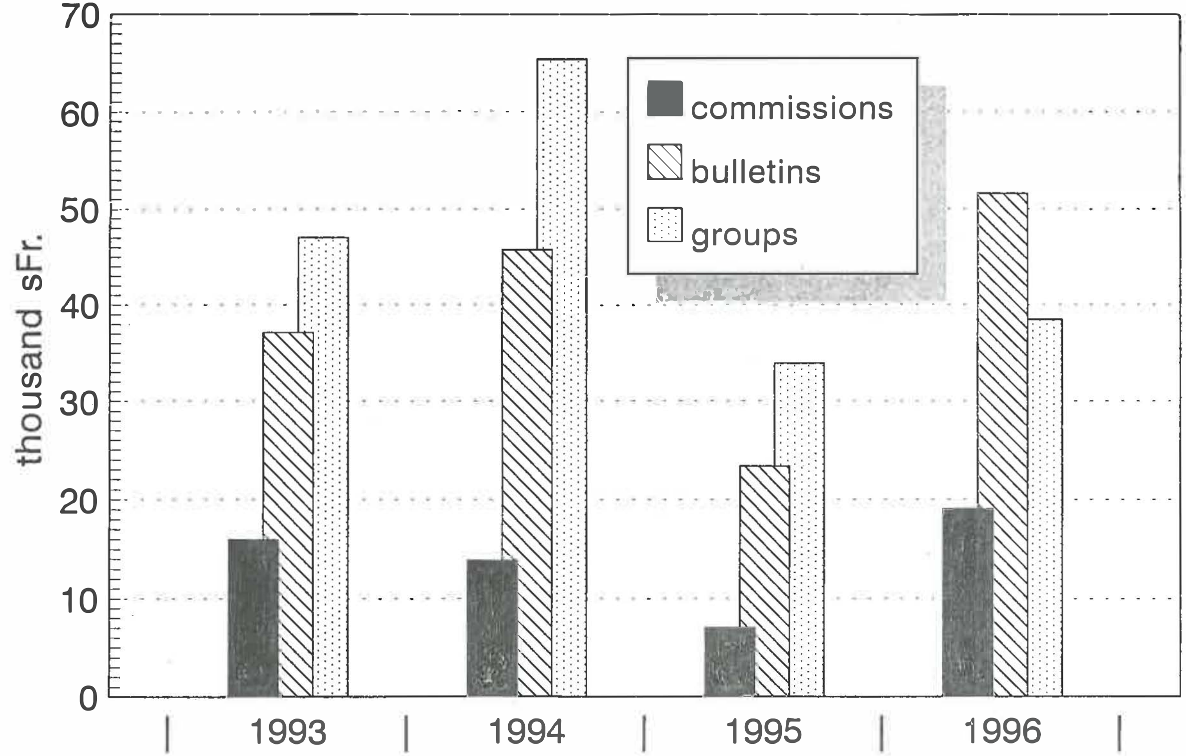


Fig. 2

scientific expences



OILB/SROP	COMPTE 1993		COMPTE 1994	
Comptes	Charges	Produits	Charges	Produits
Commissions	15.891,60		13.840,00	
Groupes de travail/d'étude	47.025,23		65.372,59	
Conseil	0		12.701,57	
Comité exécutif	9.164,00		9.377,12	
Liaison	9.616,23		4.106,05	
Provision Ass. gén.	26.837,93		15.944,80	
Bulletins, Sting	37.150,21	1.959,72	45.751,80	1.463,04
Brochures	491,80	7.207,00	0	18.540,50
Mat. de promotion	2.096,25		0	
Abo. Entomophaga	356,00		56.196,00	
Formation, cours	0		0	
Administration	4.658,97		6.652,66	
Frais bancaires	3.094,79		2.874,65	
Cotisation à la Mondiale	11.700,00		9.150,00	
Contributions membres		155.416,40		191.020,13
Intérêts		16.517,22		14.360,10
Bénéfice brut	13.017,33			
Déficit brut				16.583,47
Total	**181.100,34**	**181.100,34**	**241.967,24**	**241.967,24**

OILB/SROP	COMPTE 1995		COMPTE 1996	
Comptes	Charges	Produits	Charges	Produits
Commissions	7.019,94		19.061,85	
Groupes de travail/d'étude	33.930,19		38.473,70	
Conseil	10.244,14		0	
Comité exécutif	7.271,13		19.487,95	
Liaison	8.413,40		6.327,14	
Provision Ass. gén.	15.000,00		15.000,00	
Bulletins, Sting	23.356,80	2.053,16	51.601,50	3.405,40
Brochures	0	3.550,00	0	7.967,10
Mat. de promotion	0		0	
Abo. Entomophaga	1.784,88		23.338,91	
Formation, cours	0		0	
Administration	5.767,26		6.064,07	
Frais bancaires	3.118,29		2.377,99	
Cotisation à la Mondiale	13.365,00		10.140,00	
Contributions membres		168.963,29		174.966,99
Intérêts		17.279,23		10.550,07
Bénéfice brut	62.574,65		**5.016,45**	
Déficit brut				
Total	**191.845,68**	**191.845,68**	**196.889,56**	**196.889,56**

Account IOBC/WPRS: Summary 1993 - 1996

	1993		1994		1995		1996		Average	
Income	**SFr.**	%	**SFr.**	%	**SFr.**	%	**SFr.**	%	**SFr.**	%
Membership fees	155'416	85.8	191'020	84.7	168'963	88.1	174'967	88.9	172'591	86.8
Publications	9'167	5.1	20'004	8.9	5'603	2.9	11'372	5.8	11'536	5.8
Interest	16'517	9.1	14'360	6.4	17'279	9.0	10'550	5.3	14'676	7.4
Total	**181'100**	100.0	**225'384**	100.0	**191'845**	100.0	**196'889**	100.0	**198'803**	100.0
Expenditure	**SFr.**	%	**SFr.**	%	**SFr.**	%	**SFr.**	%	**SFr.**	%
Groups / Commissions	62'917	37.4	79'213	32.8	40'950	31.7	57'536	30.0	60'154	32.9
Publications	40'094	23.8	101'948	42.1	25'142	19.4	74'940	39.0	60'531	33.1
Management	18'780	11.2	26'185	10.8	25'929	20.1	25'815	13.5	24'177	13.2
Administration	4'659	2.8	6'653	2.7	5'767	4.5	6'064	3.2	5'785	3.2
General assembly	26'838	16.0	15'945	6.6	15'000	11.6	15'000	7.8	18'195	9.9
Contributions to IOBC Global	11'700	7.0	9'150	3.8	13'365	10.3	10'140	5.3	11'088	6.1
Banking costs	3'095	1.8	2'875	1.2	3'118	2.4	2'378	1.2	2'866	1.6
Total	**168'083**	100.0	**241'969**	100.0	**129'271**	100.0	**191'873**	100.0	**182'799**	100.0
Net assets	**284'908**		**270'087**		**328'182**		**330'587**		**303'441**	

Report of the Auditing Committee of IOBC/WPRS

Pedro Amaro
Instituto Superior de Agronomia, Tapada da Ajuda, 1399, Lisboa Codex, Portugal

A well organised accounting allowed an easy examination of the incomes and expenditures during the financial period of 1994 to 1997.

No irregularities were observed, the records of the Treasurer are in perfect order and it was verified, every year, a good balance between budget and account.

The progressive increase of the net assets is a good sign, but it may be desirable, in the futre, to expand expenses for the most dynamic Commissions / Working Groups or to take new important initiatives for IOBC/WPRS to allow, with efficiency, the use of the increase of the net assets.

The auditing Committee wishes to express gratitude to the Treasurer, Dr Jürg Huber, for his excellent and rigorous work and proposes his honorable discharge.

General Assembly

Proces Verbal de l'Assemblée Generale Ordinaire de l'OILB/SROP Vienne, 30 septembre 1997

Sur 38 Membres institutionnels, 19 sont présents ou officiellement représentés. Le quorum du tiers des membres institutionnels pour que l'Assemblée Générale Ordinaire puisse délibérer (**Article XVI, alinéa 1** des statuts) est donc atteint.

La préparation de l'Assemblée Générale Ordinaire s'est déroulée en conformité avec les statuts et le règlement intérieur :

- L'information officielle annonçant l'Assemblée Générale Ordinaire a été diffusée aux différents types de membres en avril 1997, soit 5 mois avant la date fixée pour l'Assemblée générale, comme le prévoit l'**Article 9, alinéa 4** des statuts.
- Aucune candidature libre n'a été proposée pour le renouvellement du Conseil et du Comité de gestion.
- Le Conseil sortant, après une longue concertation, a soumis le 23 juillet 1997 au vote par correspondance, soit plus de 2 mois avant l'Assemblée Générale, comme le stipule l'**Article XI** du règlement intérieur, une liste de candidatures équilibrée et porteuse de dynamisme pour les 4 prochaines années.

Le Président, avec l'agrément du Comité Exécutif, a désigné deux scrutateurs : MM. les Drs F.Polesny et J.M.Rabasse. Ceux-ci ont dépouillé le scrutin et annoncé les résultats lors de l'Assemblée Générale.

Le quorum des votants est atteint puisque 120 membres (28 membres institutionnels, 2 membres honoraires, 90 membres individuels) sur 241 (38 membres, 3 membres honoraires, 200 membres individuels) ont voté, soit plus du tiers. Compte tenu du décompte respectif des voix des membres institutionnels et des membres individuels ou honoraires, 372 voix ont été exprimées sur un potentiel de 583.

Les résultats du vote font apparaître que tous les candidats sont élus, tous ayant obtenu un nombre de voix très supérieur à la majorité absolue.

L'Assemblée Générale Ordinaire approuve la gestion de l'ancien conseil et lui donne son quitus. Elle approuve aussi la modification du Règlement intérieur présenté par le Conseil. Il sera ajouté à la fin de **l'Article 17** la phrase suivante :

« Un responsable de Groupe sera nommé, en premier lieu pour une période de 5 ans. Celle-ci sera renouvelable une seule fois, sans aucune dérogation possible à cette règle ».

« A convenor shall be nominated initially for a period of 5 years, renewable for a further period of 5 years, after which this mandate cannot be renewed ».

Le nouveau Conseil et le nouveau Comité de gestion sont donc ainsi composés :

CONSEIL

Président	ESBJERG P. (Danemark)
Vice-présidents	HUBER J. (Allemagne) LAVADINHO A.P. (Portugal)
Secrétaire général	ALABOUVETTE C. (France)
Trésorier	GESSLER C. (Suisse)
Membres	AFELLAH H. (Maroc) ALBAJES R. (Espagne) BAAYEN R. (Hollande) BATHON H. (Allemagne) BIGLER F. (Suisse) BLÜMEL S. (Autriche) BUCHELOS C. (Grèce) KERRY B. (Grande Bretagne) MALAVOLTA C. (Italie) TIRRY L. (Belgique)
Suppléants	KOZAR F. (Hongrie) PETTERSSON J. (Suède) ROSSLER Y. (Israël)

COMITE DE GESTION

Président	ROYLE D.J. (Grande Bretagne)
	CASTANERA P. (Espagne) FRAZAO A. (Portugal)
Suppléants	FREULER J. (Suisse) POITOUT H.S. (France)

Commissions' Reports

Publication Commission

Activity Report 1993-1997

Convenor / Responsible:
A.K. Minks, *Research Institute for Plant Protection (IPO-DLO), P.O. Box 9060, 6700 GW Wageningen, The Netherlands*

Member / Membre:
D. Degheele, *Laboratory of Agrozoology, Department of Crop Protection, Faculty of Agricultural and Applied Biological Sciences, University of Gent, Coupure Links 653, B-9000 Gent, Belgium*

Introduction

Based upon a decision of the Council in 1987 the Publication Commission supervises and carries the final responsability of all publishing activities in IOBC/WPRS. It plays an advisory and coordinating role between Council, Convenors and Publisher.

Main realisations / Principales réalisations

The following publications are included in the activities of the Commission:

Brochures

Brochures usually contain guidelines or methodologies useful for daily practice in integrated plant protection. The Brochures are published at irregular intervals. No Brochures were published in this period.

Bulletins

In this period 36 IOBC/WPRS Bulletins have appeared. I feel the need to express my great appreciation to the Convenors for their efforts to improve the scientific quality as well as the presentation of the Bulletins. It is encouraging to note that contributions from the Bulletins are cited in the scientific literature with increasing frequency. However, I like to repeat here that it is not our aim to transfer the Bulletin series into a journal *in sensu stricto*. The Bulletins are meant primarily for rapid distribution of research reports within IOBC/WPRS.

Again I want to draw your attention to the continuing invaluable help of our colleagues from the Laboratory of Agrozoology of the University of Gent, Belgium. They provide us with the possibility to make use of their printing facilities, so that a cheap production of the Bulletins can be realized. After the sad loss of our friend Danny Degheele, his younger colleague Prof. Luc Tirry has smoothly taken over the supervision of this operation, so that the production of the Bulletins could proceed without notable interruption.

Below I present the complete list of Bulletins that have appeared during the term of this Council. Apart from the usual proceedings of Working- and Study Group meetings, I like to mention the increasing number of guidelines on Integrated Production in various crops that are published under the auspices of the 'Guidelines' Commission, illustrating the increasing importance of this WPRS-activity.

Year	Volume	Issue	
1993	Vol.16	(10)	Pheromones, *Chatham (UK)*
"	"	(11)	Biol. Control of Plant Pathogens, *Wageningen (NL)*
1994	Vol.17	(1)	1st Conf. Microorganisms in Grassland, *Paderborn (D)*
"	"	(2)	Subgroup Pear, *Cesena (I)*
"	"	(3)	Insect Pathogens, *Zürich, (CH)*
"	"	(4)	IPM Cereals, *Le Rheu (F)*
"	"	(5)	Protected Crops, Mediterr. Region, *Lisbon (P)*
"	"	(6)	Fruit Flies, *Lisbon (P)*
"	"	(7)	7th General Assembly, *Lisbon (P)*
"	"	(8)	IPM Field Vegetables, *Einsiedeln, (CH)*
"	"	(9)	IPM Pome Fruit Orchards-Technical Guideline III
"	"	(10)	Pesticides/Beneficials: Side-effects
1995	Vol. 18	(1.1 & 1.2)	General Guidelines: Spanish and Italian versions
"	"	(2)	IPP Stone Fruit Orchards, *Nîmes, (F)*
"	"	(3)	Subgroup Biol. Contr. Slerot.-forming Pathogens, *Wellesbourne (UK)*
"	"	(4)	IPM Oilseed Crops, *Zürich (CH)*
"	"	(5)	IPM Citrus, *Antibes (F)*
"	"	(6)	IPM Cork-oak Forests, *Tempio Pausania (I)*
1996	Vol.19	(1)	IPM Protected Crops, Northern Region, *Vienna (A)*
"	"	(2)	Subgroup Melolontha, *Freiburg (D)*
"	"	(3)	IPM Cereals, *Hannover (D)*
"	"	(4)	IPP Orchards, *Cedzyna (LP)*
"	"	(5)	Breeding for Resistance, *Arnhem (NL)*
"	"	(6)	Subgroup Biol. Control Root Diseases, *Dijon (F)*
"	"	(7)	2e Conf. Microorganisms in Grassland, *Paderborn (D)*
"	"	(8)	Special Issue: Abstracts IOBC Int. Conf., *Montpellier (F)*
"	"	(9)	Insect Pathogens, *Poznan (PL)*
"	"	(10)	Guidelines IP Viticulture in 6 languages
"	"	(11)	IPM Field Vegetables, *Guitté (F)*
1997	Vol.20	(1)	Pheromones, Proc. Conference *Montpellier (F)*
"	"	(2)	Commission Identification: Determination List Nr 13
"	"	(3)	Guidelines IP Stone Fruit Techn. Guidel. III, *Piacenza (I)*
"	"	(4)	IPM Protected Crops, Mediterr. Region, *Tenerife (E)*
"	"	(5)	Guidelines IP Arable Crops, Techn. Guideline III (in 6 languages)
"	"	(6)	IPM Stone Fruit Orchards, *Zaragoza (E)*
"	"	(7)	IPM Citrus Crops, *Florence (I)*

Newsletter Profile

Profile is a biennual newsletter, produced by the Commission reporting on all current activities in IOBC/WPRS and related areas. In this period 8 issues (Nrs 17-24) were published. I like to thank the Convenors and Council Members for their excellent collaboration in supplying interesting news items.

From Entomophaga → BioControl: short report of activities with regard to the launching of the new IOBC scientific journal

According to a decision of the Executive Committee at the General Assembly of IOBC Global in September 1996, the contract with Lavoisier will not be extended and publication of *Entomophaga* will be terminated by 31 December 1997. A new scientific IOBC journal with a broader scope comprising all disciplines in crop protection will appear from spring 1998 onwards, with an organizational structure according to the recommendations of the Ad-hoc Entomophaga Review Committee (see IOBC Newsletter Nr 64, pp 8-11).

A Management Board has been constituted to prepare the operations of the new IOBC journal. The Board consists of 6 members: 1) The Editor-in-Chief of the new journal, 2) the Secretary-General of the IOBC Global, 3) a WPRS representative (A.K.Minks), 4) a NRS representative, 5) a representative of the non-represented regional sections and 6) a representative of the publisher (see below).

Recently a very competent Editor-in-Chief has been found: Dr H.Hokkanen, Professor of the Department of Applied Zoology, University of Helsinki, Finland. He is currently Head of the Cooperative Research Programme on Biological Resource Management at OECD Directorate of Agriculture (Paris, France).

In consultation with the new publisher (Kluwer Academic Press, Dordrecht, The Netherlands) the Management Board has decided on the name of the new IOBC journal. It will be **'BioControl'**, with a subtitle 'Journal of the International Organisation of Biological Control', and in the first year of appearance there will also be mentioned: 'formerly Entomophaga'.

Contract negotiations started with Kluwer Academic Press in April 1998, resulting in draft agreements in June and July. After scrutinization of the July draft agreement by the Management Board, the definitive contract was signed in August by the President of IOBC Global, Dr Jeff Waage, and Dr D.J.Larner, publishing director of Kluwer.
Major points in the contract were:

1) IOBC owns the title of the journal and has licensed the publisher to publish the journal for an initial period of 10 years.
2) IOBC shall purchase copies of the journal for distribution among their members. IOBC shall pay a reduced price to the publisher per member subscription.
3) The publisher shall pay IOBC 7.5% royalties on the net sales receipt of the institutional library subscriptions above 250 (so NOT over the IOBC subscriptions!).

An editorial board, consisting of 8 Associate Editors, has recently been formed. The Associate Editors will cover the following subject areas: (1) parasitoids, J.Brodeur (Canada); (2) predators, K.D.Sunderland (UK); (3) insect pathology and microbial control, A.Hajek (USA); (4) nematodes, R.-U.Ehlers (Germany); (5) weeds, H.Müller-Schärer (Switzerland); (6) plant diseases, L.Orlikowski (Poland); (7) semiochemicals, P.Witzgall (Sweden); (8) integrated control strategies, J.Trumble (USA).

Let me conclude with conveying many good wishes to my successors, H.Bathon (Germany) and L.Tirry (Belgium).

A.K. Minks, Convenor Publication Commission (1987-1997)

Entomophaga

J.M. Rabasse & A. Dufay
INRA, Laboratoire de Biologie des Invertébrés, 37 boulevard du Cap, 06606 Antibes Cedex, France

Since last General Assembly, the publication of *Entomophaga* has shown increasing delays, which have been finally resorbed in 1997. Reasons of these delays are obvious *a posteriori* and need, in order to be clearly understood, to examine the global evolution of the journal on a longer period. Since nearly the beginning, the number of pages published each year was about 450. After 1987, this number was progressively increasing to reach more than 600 pages (fig. 1). In 1990, two new journals, with a similar scope, were launched, one in Great Britain, the other in the USA. This fact is probably the reason of the decrease by 30% in the number of manuscripts submitted to *Entomophaga*, number which became stable from 1992 (fig. 2). We did not realize soon enough this new situation and the number of pages published was maintained at a too high level till the volume 38. As a result of this situation, the following volumes were published with an important delay. To absorb this delay, the number of pages in the volume 39 was limited to 413 pages and the Proceedings of two Symposia organized by IOBC, with a reviewing committee, have been published in an issue of volume 41 and in an issue of volume 42 respectively (table 1). Therefore the number of pages per volume has reached its normal level again and the publication schedule is restored, since the volume 42 will be effectively published in 1997.

From 1993, English has become recommended language in *Entomophaga* and in the last two years, despite some difficulties that choice caused to some authors (especially authors from South America) only papers in English have been accepted (table 2).

The different scientific fields are inequally covered: many deal with entomophagous organisms but very few deal with pathogens. Concerning weeds, this field was not as well represented in the last three years as it was before. Papers included under the heading 'integrated control' are in most cases papers about side-effect of pesticides (table 3).

The rejection rate in the last years presents some variations, but was comprised between 23 and 44% (table 4).

Entomophaga presents a unique characteristic among journals dealing with biological control: the geographic repartition of the authors which is always uniform, i.e. 1/3 from Europe, 1/3 from North America and 1/3 from the others countries. In the recent years, the participation of Australia, New Zealand and South Africa was important, when South America was very little represented. Countries from Eastern Europe and China were also weakly represented (table 5).

In conclusion, before giving up our job in this journal, we would like to thank all those who provided help and support during these 7 years. WPRS and INRA provided an appreciated logistic and financial support. The list of the reviewers is given at the end of the last issue in each volume. Many of them not only reviewed the manuscripts and discussed the scientific aspect of the papers, but also spent time in improving the style, the language or the form. Thus many colleagues year after year have contributed to make *Entomophaga* what it is.

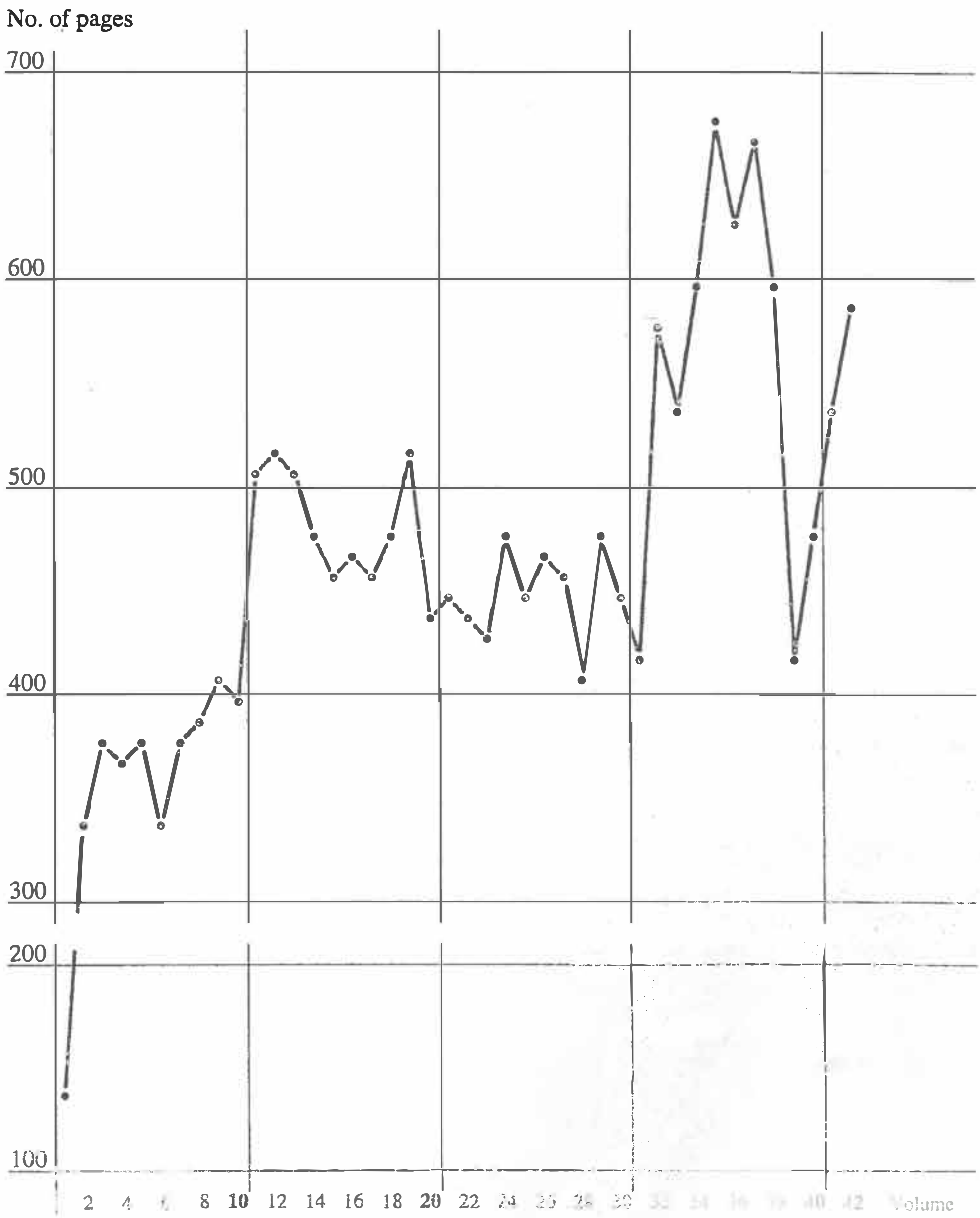


Figure 1: Evolution of the number of pages per volume

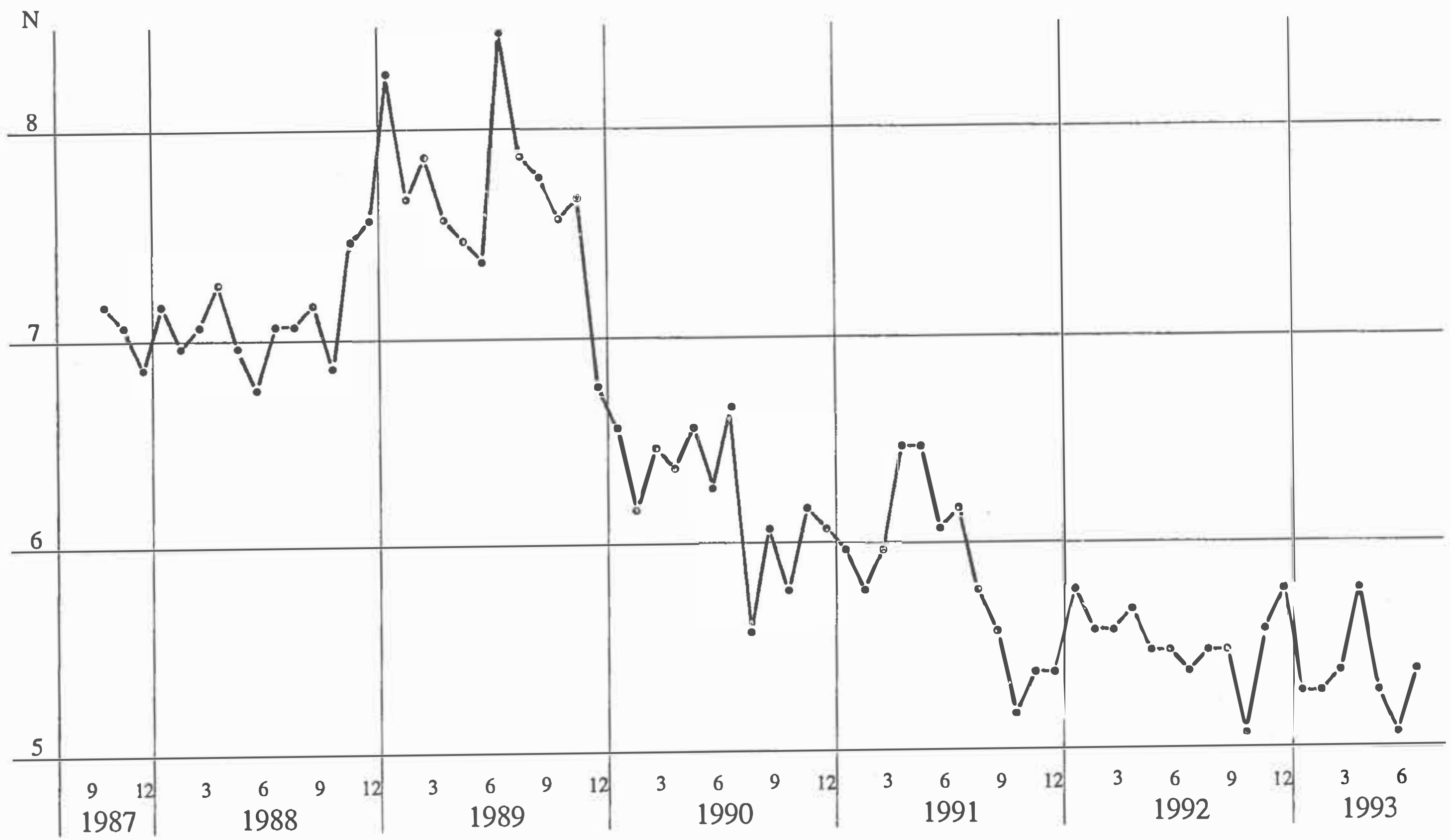


Figure 2: Number (N) of manuscripts submitted to *Entomophaga* in the month (m)

$$N = \frac{N_{m-6} + \ldots + N_m + \ldots + N_{m+6}}{13}$$

Table 1

Year	**1990** vol. 35	**1991** vol. 36	**1992** vol. 37	**1993** vol. 38	**1994** vol. 39	**1995** vol. 40	**1996** vol. 41	**1997** vol. 42
No. of manuscripts received	73	75	65	60	62	59	67 (+18*)	(→ oct.) 49 (+32*)
No of published pages	669	626	662	594	413	475	531	≈ 590

* manuscripts originating from IOBC Symposia

Table 2

	1990 vol. 35	**1991** vol. 36	**1992** vol. 37	**1993** vol. 38	**1994** vol. 39	**1995** vol. 40	**1996** vol. 41	**1997** vol. 42
No. of papers/volume	73	61	69	65	41	41	44	65
Number of pages	669	626	662	594	413	475	531	≈590
No. of papers ≤ 8 pages	37	30	34	34	13	15	15	34
> 8 pages	36	31	35	31	28	26	29	31
Language :								
English	66 90 %	50 82 %	58 84 %	59 91 %	40 98 %	40 98 %	44 10 %	65 100 %
French	5 7 %	11 18 %	9 13 %	5 8 %	1 2 %	0	0	0
German or Spanish	2 3 %	0 0 %	1 1.5 %	1 1 %	0	1 (S) 2 %	0	0

Table 3

	1990 vol. 35	1991 vol. 36	1992 vol. 37	1993 vol. 38	1994 vol. 39	1995 vol. 40	1996 vol. 41	1997 vol. 42
Fields:								
Entomophagous organisms	71 %	74 %	65 %	82 %	56 %	68 %	64 %	85 %
Pathogens of arthropods	11 %	6 %	14 %	6 %	22 %	15 %	14 %	6 %
Weeds & Coprophagous insects	15 %	15 %	18 %	8 %	12 %	7 %	2 %	8 %
Integrated control	3 %	5 %	3 %	5 %	10 %	10 %	20 %	1 %
Total numbers of papers/volume	73	61	69	65	41	41	44	65

Table 4

Year	Number of papers Accepted (A)	Refused (R)	R A + R
1990	50	15	23 %
1991	40	28	41 %
1992	40	17	30 %
1993	40	16	29 %
1994	30	24	44 %
1995	32	10	24 %
1996	45 (+18*)	14	24 %
1997	35 (+32*)	15	30 %

* manuscripts originating from IOBC Symposia

Table 5

Year / volume	1990 vol. 35		1991 vol. 36		1992 vol. 37		1993 vol. 38		1994 vol. 39		1995 vol. 40		1996 vol. 41		1997 vol. 42	
No. of Papers / vol.	73		61		69		65		41		41		44		65	
Country	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No	%	No.
USA	30	19	36	19	35	16	17	10	17	4	22	8	27	12	17	8
Canada		2		3		8		1		3		1		-		3
Austria		-		1		-		-		-		-		-		-
Belgium		-		-		2		1		1		1		2		4
Cyprus		-		-		-		-		-		-		1		-
Danmark		1		-		1		1		-		3		-		2
Finland		-		1		-		-		-		-		-		1
France		9		8		10		17		7		4		3		7
Germany		2		1		-		2		2		-		1		1
Greece		1		-		1		2		1		-		1		6
Ireland		-		-		-		-		-		1		-		-
Italy	23	1	28	-	35	3	43	1	54	1	34	-	32	-	48	2
Normay		-		-		-		-		-		1		-		-
Portugal		-		-		-		-		1		1		-		-
Spain		1		1		3		-		2		-		2		2
Sweden		-		-		1		-		1		1		1		-
Switzerland		1		1		-		-		1		-		1		-
The Netherlands		-		1		-		1		-		-		1		1
U.K.		1		3		3		3		5		2		1		5
Bulgaria		-		1		-		-		-		-		-		-
Czech Rep.	3	-	3	-	0	-	15	1	0	-	25	1	4	-	6	4
Russia		2		-		-		-		-		-		2		-
Poland		-		1		-		-		-		-		-		-
Australia		9		3		8		4		5		4		1		6
New Zealand	15	-	10	-	15	1	11	1	12	-	17	2	7	-	125	-
South Africa		2		3		1		2		-		1		2		2
Egypt		-		2		-		-		-		1		1		-
Irak		1		-		-		-		-		-		-		-
Israel		1		1		-		3		1		-		1		-
Jordan	7	1	5	-	15	-	8	-	25	-	5	-	7	-	0	-
Morocco		-		-		1		-		-		1		1		-
Syria		1		-		-		-		-		-		-		-
Tunisia		1		-		-		-		-		-		-		-
Turkey		-		-		-		2		-		-		-		-

Benin		1		-		-		-		1		-		1		-
Burkina Faso		-		-		-		1		-		1		-		1
Congo		1		1		2		-		-		-		-		-
Gabon		-		1		-		-		-		-		-		-
Ivory Coast	5.5	1	6.5	-	45	-	15	-	5	-	25	-	7	-	3	-
Kenya		1		1		1		-		-		-		-		-
Nigeria		-		-		-		-		1		-		-		1
Senegal		-		-		-		-		-		-		1		-
Tanzania		-		-		-		-		-		-		1		-
Togo		-		1		-		-		-		-		-		-
Argentina		-		1		-		-		-		2		-		2
Brazil		1		1		-		2		-		-		1		-
Chili		-		-		-		-		-		1		-		-
Columbia		-		-		-		-		-		-		-		-
Costa Rica	3	-	3	-	15	-	8	-	5	-	10	-	7	-	3	-
Honduras		-		-		1		-		-		-		-		-
Mexico		1		-		-		1		2		1		2		-
Uruguay		-		-		-		1		-		-		-		-
Trinidad & Tobago		-		-		-		1		-		-		-		-
Bangladesh	7	-	6.5	-	6	-	15	-	0	-	25	-	2	-	15	-
India		5		4		4		1		-		1		1		1
China		2		1		-		2		1		1		1		-
Indonesia				-		-		-		-		-		1		-
Japan	3		2	-	3	1	3	-	25	-	5	1	7	-	9	5
Malaysia		-		-		-		-		-		-		1		1
Philippines		-		-		1		-		-		-		-		-

Commission " Promotion and extension of WPRS activities "
" Action de promotion et de développement des activités SROP "

Activity Report 1993-1997

Convenor:
J.A. Freuler, *Station fédérale de recherches en production végétale de Changins, CH-1260 Nyon, Suisse*

Members:
J. Huber, P. Castanera, C. Gessler

The aim of the commission is to make the activities of WPRS better known within and outside the organisation.

For that purpose we explore all types of communication vehicles and produce documents and material of attractive quality available also by electronic media to elevate the image of WPRS.

Beyond the catalogue of possible promotional objects several points have been realised in the past. In that respect one will remember the overhead sheets produced on behalf of the convenors as internal way of communication to present our organisation to new participants at working group meetings. At this occasion it is also the idea that an updated institutional member list and inscription form is available in order that new participants can check their affiliation and eventually become a new member.

One will also remember the presentation of the poster by the past president of the commission H.Audemard at the last general assembly in Lisbon. He also continues publishing regularly extension articles on WPRS in the journal Adalia, an experience we would like to extent to other countries.

During more recent time the need to build up a pressfolder available for internal and external communication became very urgent. The base of the pressfolder is the collection of the presentations of the commissions, working and study groups. Thanks to the collaboration of the convenors a first booklet could be handed out to all participants of the assembly. This document will be improved and standardised in the near future. It will be regularly updated and is used as a whole or as detached pages for individual groups.

The commission has just started a project on a WPRS homepage which will be steadily enlarged serving as electronic information and communication tool and who knows even for administration in the long term. This activity needs to be co-ordinated with IOBC global and within WPRS.

Other documents will be part of the pressfolder such as a pleasant leaflet to attract new members, a general description of WPRS as basic information for various categories of members and a list of addresses of the Council.

In order to achieve a professional standard the commission has been working temporarly with a private firm to work out a promotion concept for WPRS. At that time IOBC global was looking for a new logo to demonstrate the coherence of the organisation. WPRS took the opportunity to submit a logo project, which was accepted.

The logo will appear on all our documents like letterheads, enveloppes and visiting cards, but also on a cover which will contain all documents of the pressfolder or of all kind of meetings.

For the future there are some other ideas like the creation of a WPRS award for scientific excellence.

Commission "Identification service of entomophagous insects" "Service d´identification des insectes entomophages"

Convenor:
Stefan Vidal, *Institute for Phytopathology and Applied Zoology, Justus-Liebig-University, Alter Steinbacher Weg 44, D-35394 Giessen, Germany*

Introduction

Public concern about the use of pesticides stimulated the interest in the possibilities of classical biological control programs. One foundation of this discipline is the proper knowledge of the organisms involved. Therefore, the first step in any attempt in this respect involves a taxonomist, which is able to identify the natural enemies to species level. The objective of the commission is to help those people with the identification of natural enemies, which did collect these species during a survey on pest species. However, this is only one aspect of the story. On the other hand, the compilation of the host records serves as an additional data basis on the natural enemies complexes of herbivorous insects and could thus serve as a first indication on the knowledge status of the species involved.

Participants

Determinations of predators and parasitoids were carried out by 17 specialists from several countries in western and eastern parts of Europe (Tab. 1).

Table 1: Taxonomists, which contributed to the 13th determination list of entomophagous insects

Taxon	Taxonomist(s)
Ceraphronoidea	P. Dessart
Diapriidae	D. Notton
Chalcidoidea	R.R. Askew; H. Baur; S. Hassan; P.B. Jensen; B. Pintureau; S. Vidal; G. Viggiani
Ichneumonidae	K. Horstmann, R. Jussila
Braconidae	C. van Achterberg; J. Papp; P. Stary
Staphylinidae	V. Assing
Tachinidae	H.-P. Tschorsnig
Anthocoridae	A. Melber

These taxonomists cover a wide range of different families or taxa; however, several parasitoid species, which were sent to the identification service, could not be identified to species level, either because no specialists were available for these specific taxa, or the taxonomic status of the species were unclear or under revision. Although the catchment area for the identification service is restricted to the western Palearctic region, the knowledge of the European species is still restricted in several taxa. This lack of taxonomic specialists is not a new problem; it has been addressed several times before. However, the problem will increase, because some outstanding taxonomists retired in recent years and the few, who are still willing to do this job, are faced with an increasing demand for determinations. Therefore, I would like to thank again all participants, which contributed generously to the determination list in the past.

This is especially true for H.-P. Tschorsnig, who alone determined and compiled the host records for the tachinids.

Projects
The 13th determination list of entomophagous insects, published within the Bulletin Series of the West Palearctic Regional Section in 1997, gives the records of parasitoid species or predators, which have bee compiled within the previous 4 years.

Table 2: Some examples of research projects on natural enemies of insect herbivores, for which the IOBC Identification Service has been consulted

Pest species	**Plant species**	**Country**	**Head**
Aphids	processing tomatoes	Greece	Lykouressis
Lobesia botrana *Sparganothis pilleriana*	vineyards	Germany	Schirra
Spodoptera exigua; *Helicoverpa armigera*	tomatoes	Spain; Portugal	Vargas Osuna; Figueiredo
Phyllonorycter spp.	orchards	Germany	Vogt *et al.*
Elachistidae	grasses	Italy	Varalda
Prays oleae	olive	Syria	Yakti
Cameraria ohridella	horse chestnut	Austria	Stolz *et al.*
Lymantria dispar	deciduous woods	Germany	Bathon *et al.*
Thaumetopoea pityocampa	pine	Greece, Syria	Breuer, Yakti
pod and stem weevils	rape	Germany	Ulber *et al.*
Coccinellids	cereals	Germany	Triltsch *et al.*
Cassida rubiginosa	artichoke	Turkey	Ghavami
Agromyzidae	glasshouse cultures	Austria, Germany	Stolz *et al.*
Phytomyza orobanche	*Orobanche* spp.	Iran	Nasrollahi
Resseliella theobaldi	raspberries	Germany	Stockrahm

More than 300 entomophagous species are listed, reared from about 300 different host species. Most of these hosts are serious pest species on crops world-wide (e.g. aphids, curculionids, leaf mining moths, noctuids, tortricids or agromyzids), but there are many herbivorous species listed which are either minor pests or even rare species and for which host records have not been available up to now. However, these species could act as a reservoir for natural enemies in situations, in which the target host species is not available and could therefore play an important role in the biological regulation of these pests. Table 2 compiles some of the major projects, the pest species, their host plants, the country and the head of these projects, for which the identification service could provide information on the reared parasitoids or sampled predators.

Commission: "Integrated Production Guidelines and Endorsement" "Directives pour la Production Intégrée et Agréement"

Activity Report 1993-1997

Convenor:
Ernst F. Boller, *Swiss Federal Research Station, CH-8820 Wädenswil, Switzerland*
(A. El Titi until 31.12.1995)

Members:
Jesus Avilla (Spain), Jean-Paul Gendrier (France), Erich Jörg (Germany), Carlo Malavolta (Italy)

Introduction

Having been re-activated by WPRS in 1990 this Commission started its active work in 1991. Its main task is to up-date the conceptual frame for Integrated Production (principles and general technical guidelines I and II), to assist WPRS working groups in establishing crop specific guidelines III as well as offering an endorsement procedure to regional IP-organisations that wish their guidelines and organisational structures to be evaluated and endorsed by IOBC. Another important objective is to assist WPRS with technical documents and expertise for the discussions at the EU level.

Main realisations

Based on the IP-principles and general technical guidelines I and II published in 1993 (IOBC/WPRS Bulletin Vol.16 (1), 1993) the activities of the Commission focused primarily on the establishment of crop specific guidelines III and to open the respective endorsement procedures.

Crop specific guidelines

Up to now there are 4 crops specific guidelines III that have been reviewed by the Commission and put into effect:

- IOBC/WPRS 1994. Cross, J.V. & Dickler, E. (eds). Guidelines for Integrated Production of Pome Fruits in Europe. Technical Guideline III. IOBC/WPRS Bull. 17 (9), 1994, 40 pp.
- IOBC/WPRS 1996. Schmid, A. (ed.). Guidelines for Integrated Production in Viticulture. Technical Guideline III. IOBC/WPRS Bull. 19 (10), 1996, 36 pp.
- IOBC/WPRS 1997. Cross, J.V., Malavolta, C., & Jörg, E. (eds). Guidelines for Integrated Production of Stone Fruits in Europe. Technical Guideline III. IOBC/WPRS Bull. 20 (3), 1997, 51 pp.
- Production of Arable Crops in Europe. Technical Guideline III. IOBC/WPRS Bull. 20 (5), 1997, 115 pp.

These guidelines show some variation in the degree of regulation by defined strict rules, prohibitions or mere recommendations according to the approach taken by the working groups concerned. However, the review by the Commission ascertained that no IOBC principles were violated and that all major issues were addressed. In order to equalise the impact of the guidelines and to provide concrete assistance to regional IP-organisations adapting their guidelines to IOBC standards the Commission prepared for each guideline a detailed IOBC evaluation scheme for regional guidelines that have been distributed to all regional IP-organisations requesting the information package of the Commission. This information package available in 5 languages does not only contain the published IOBC documents, but also a contract form for the procedure, the list of tariffs of the endorsement as well as recommendations on how to proceed when preparing regional guidelines for submission to the Commission. The numerous requests for the published guidelines and information packages reaching our secretariat indicates a strong and world-wide interest in these documents.

Endorsements

First requests for endorsement by the Commission have been filed and are now in the process of evaluation. So far the instruments established for handling endorsement requests have proven to be effective but we have to fine-tune the procedure in certain technical details. Of importance is the definition of the modus operandi with respect to the crop specific evaluations that concerns the interface between Commission and the Working group involved. The second aspect to be elaborated is the protocol for the inspection on site of the regional IP-organisation that has successfully passed the evaluation of its documents.

The Commission has been contacted by IP-organisations practising or intending to practise IP according to IOBC rules (e.g. in Central Europe, North and South America, New Zealand). These regional organisations have either asked for technical assistance or endorsement by IOBC. Although the Commission holds a positive view on these international ramifications it realises that this matter is certainly beyond its responsibility and needs discussion and negotiations between WPRS and Global IOBC bodies. The Commission has discussed this aspect and recommends that this type of technical assistance could and should be supported.

Information transfer between WPRS and EU concerning Integrated Production standards

This important aspect was handled in behalf of the Commission by its former chairman Adel El Titi.

A discussion between WPRS represented by David Royle and Adel El Titi and EU representatives from several General Directorates took place in January 1996 at Brussels. The EU is aware of our work and showed interest in an intensified communication. However, this communication is not institutionalised as yet and needs improvement.

Members of the Commission participated in 4 meetings organised by various organisations addressing the need for international harmonisation of IP standards.

Projects

Updating of the Technical Guidelines I & II and endorsement procedure

The basic documents (IOBC/WPRS Bull. Vol. 16 (1), 1993) have been written in 1991-1992 and still can be considered as valid in the general approach. However, certain technical details must be adapted to the present state of knowledge. This revision is scheduled for 1998.

Preparation of further crops specific guidelines III

It is highly desirable to close the remaining gaps in due course. We encourage especially working groups in the field of soft fruits, citrus, vegetables and possibly olives to consider the preparation of guidelines III in close collaboration with the Commission. An aspect that seems to be outside the aims of IOBC but does constitute an important part of sustainable agricultural systems is animal production. The Commission will investigate this aspect.

A synoptic publication on IP

with the working title "Integrated Production in Europe: 20 years after the declaration of Ovrannaz" is in preparation and could to be published in adequate form by end of 1997.

Improving the information flow between Commission and EU

The Commission will give this aspect very high priority and seek solutions in close contact with the WPRS Executive Committee.

Technical assistance to non-WPRS regions in the field of Integrated Production standards

This topic will also receive the proper attention of the Commission and we anticipate fruitful discussions within WPRS and the Global IOBC. We do believe that the international recognition of the collaborative work carried out by the Commission and Working Groups provides a fruitful basis for adequate solutions in the future.

Working & Study Groups

Working Group "Integrated Plant Protection in Orchards" Report to the 8th General Assembly, Vienna/Austria, October 1997

Convenor:
F. Polesny, BFL, Institut für Phytomedizin, Spargelfeldstr. 191, A-1226 Wien, Austria

The 7th General Assembly in 1993 resulted in a radical change in the structure of the fruit sector of IOBC/WPRS. The proposal to the council to divide the orchard group into two independent working groups was agreed. Since this time two neighbouring working groups exist: the WG STONE FRUIT and a WG ORCHARD, which covers all other fields of fruit production, pome fruits as well as soft fruits. Many institutes as well as scientists are active in the scientific field of both working groups and there is still a very close co-operation between both groups. For example the sub group "IFP-GUIDELINES" is active in both WGs depending on the actual subject, which is discussed.

Following the tradition of the old orchard group in organising a big symposium on integrated fruit production all five years in 1995 the "International Conference on Integrated Fruit Production" took place in Cedzyna, Poland, as a joint activity of both WGs. The meeting was excellently organised by the colleagues from the institute in Skierniewice and more than 150 paying participants attended it.

This symposium did not only show an actual scientific overview on the present state of art of integrated and biological plant protection in orchards with a lot of fruitful discussions on actual problems. It was even the frame to start the reorganisation of the structures in the working group in accordance to the decisions of the council and the wishes and needs of the working group members as well.

Sub group activities

The SG "Diseases" organises specialised workshops every three years. The last took place in South Croydon Kent, UK, in August 1996. Scab (Venturia), powdery mildew (Podosphaera), canker (Nectria) and similar fungal diseases, storage rots and even fire blight (Erwinia) are the main topics. Since 1993 C. Verheyden, Belgium chairs this subgroup.

In the last years many colleagues looked at the activities of the SG "IFP-Guidelines" (scientific secretary J. Cross, UK). This sub group started the discussion on crop specific frame guidelines for integrated production within IOBC/WPRS in the early nineties. In 1994 the subgroup succeeded in publishing the second edition of a technical guideline (guideline III) for integrated pome fruit production. This was the result of a workshop in Oeschberg, Switzerland, in this year. The discussions of the 1995 symposium showed that it is necessary to start the work on IP guidelines for soft fruits. In a small expert meeting in 1996 in Vienna the principal difficulties of integrated production in soft fruits were discussed. All 6 participants agreed in the need of organising a specialised workshop on integrated production of soft fruits, which will take place in October 1997 in Vienna. The elaboration of a draft version of a technical guideline on integrated soft fruit production will be one goal of this meeting. The scientific presentations and discussions there will even focus on the position of soft fruits in the frame of the working group and will perhaps result in a new sub group for soft fruits.

The General Assembly of 1993 transferred the activities of the former sub group "Package/apple" to the direct responsibility of the convenor. There is scientific need to have a forum to discuss and co-ordinate research activities in the field of arthropod pests in pome fruit. The existing subgroup “PEAR“ takes special care on the research on Psylla sp.. Within the working group there have been long discussions about the handling of the arthropod pests’ topics in pome fruit. A specialised workshop on arthropod pest problems will take place in November/December 1997 in Einsiedeln, Switzerland. Monitoring, economic injury levels, resistance management, beneficials, use of new plant protection compounds and special pear problems are some of the headlines of the planned sessions. Discussions of all interested participants will show, what structures within the working group will be most efficient, to fulfil all needs and wishes of working group members.

Since more than five years there is a close co-operation between the orchard group of IOBC/WPRS and the Working Group Integrated Fruit Production of ISHS (International Society for Horticultural Sciences). In the last four years nearly all activities of the working group have been joint meetings with this organisation or took place in a reconciled way. This co-ordination is a benefit for both groups and for the scientists working in the field of fruit sciences.

It is the intention of the working group to cover all fields of integrated and biological plant protection in fruit crops (except stone fruit). There have been a lot of success in arthropod pests including natural enemies, diseases and IP-guidelines. In some topics it will be necessary to start new activities to fulfil the demand mentioned above. Weed control, soil management and rodents as pests are only three examples. The co-operation with other working groups of IOBC/WPRS and even with other organisations can help to be really “integrated“.

Working Group "Integrated Plant Protection in Stone Fruits" Groupe de Travail "Protection Intégrée des Plantes en Fruits à Noyaux"

Convenor:
Prof. Piero Cravedi, *Istituto di Entomologia e Patologia vegetale – Università Cattolica "Sacro Cuore", 29100 Piacenza, Italy*

Number of participants: 50

Introduction

The group was set up in 1994 and derives from a transformation of the peach subgroup of the W.G. "Integrated Plant Protection in Orchards". It deals with various aspects of the integrated production of peach, plum and cherry.

The members come mostly from the Mediterranean countries in which peach cultivation is concentrated. Over the year interest in plum and cherry has also increased, with the involvement of researchers from central and northern Europe (Poland and the U.K.).

Main Realizations

In 1994 the first meeting was organised by Mr J.P. Gendrier in Nîmes. There were thirty participants, who were mostly French and Italian but with representatives also from Spain and Croatia. Twenty-one papers were presented, mainly about entomology.

In France, Italy and Spain, research was carried out into the method of mating disruption of *Cydia molesta*, and the damage caused by *Frankliniella occidentalis* recently introduced into Europe. It was also a chance to compare the different ways integrated production is applied in some regions of Europe. The discussions also dealt with the subject of genetic improvement for resistance to difficult conditions.

From the meeting emerged the importance of increasing the attention paid to the problems of *Integrated Fruit Production* and the importance of having IOBC-approved IFP Guidelines also for Stone fruit.

C. Malavolta, J.P. Gendrier and R. Balduque were charged with the job of preparing a document, and contact was made with Jerry Cross, scientific secretary of the "Guidelines" subgroup.

In 1995 we took part in the organisation of the *International Conference on Integrated Fruit Production* (Cedzyna - Poland, 28 August - 2 September 1995) where a first draft of the *Guidelines* was presented.

In 1996 the subgroup met in Piacenza and worked on a document which, after being approved by the relevant committee, was published in IOBC wprs Bulletin Vol. 20 (3) 1997.

The publication of the *IFP Guidelines* is one of the most important results, since it contributes to the application of the criteria of integrated production on an industrial scale in the same way as those for *Pome Fruit*.

In 1996 the second meeting was held in Zaragoza (E), the twenty-seven participants came from seven countries (Spain, France, Italy, United Kingdom, Poland, Croatia and Hungary). Nineteen papers were presented and the Proceedings are being printed.

At this second meeting the results were presented of work on *Pseudaulacaspis pentagona* carried out in collaboration between Italy and Hungary, and the subjects of damage caused by rodents and orchard management strategies for the reduction of insecticide use were dealt with for the first time.

The group's work was conducted in close collaboration with the Working Group "Integrated Plant Protection in Orchards" and many plans were discussed and agreed on.

The *Workshop for working group Convenors* was useful to aline our different activities.

Projects

In Zaragoza certain research subjects of common interest were identified:

- scale insects: pheromones; natural enemies; control
- management of insecticide resistance
- diffusion of new peach diseases

General programmes were outlined, but the difficulty is the lack of relevant funding. A move by the European Union in support of the IOBC for the funding of projects developed in the Working Groups would be very useful.

The Working Group's next job will be to organise the biannual meeting in Hungary in August 1998. Its aim is to promote collaboration with the IOBC/eprs and to encourage the exchange of experience.

Organisms Tested and Guidelines Developed:

Parasitic insects	
1. *Trichogramma cacoeciae*	Hassan, Germany
2. *Encarsia formosa*	van de Veire, Belgium
3. *Leptomastix dactylopii*	Viggiani, Italy
4. *Cales noacki*	Vivas, Spain
5. *Aphidius matricariae*	Polgar, Hungary
6. *Phygadeuon trichops*	Moreth, Germany
7. *Coccygomimus turionellae*	Bogenschütz, Germany
Predatory mites	
8. *Phytoseiulus persimilis*	Calis & Bakker, Netherlands; Blümel & Stolz, Austria
9. *Amblyseius andersoni*	Calis, Netherlands
10. *Amblyseius finlandicus*	Sterk, Belgium
11. *Typhlodromus pyri*	Calis, Netherlands; Englert, Germany; Boller, Switzerland
Predatory insects	
12. *Chrysoperla carnea*	Bigler, Switzerland; Vogt, Germany
13. *Aphidoletes aphidimyza*	Helyer, United Kingdom
14. *Syrphus vitripennis*	Rieckmann, Germany
15. *Semiadalia undecimnotata*	Brun, France
16. *Coccinella septempunctata*	Brun, France
17. *Aleochara bilineata*	Samsoe-Petersen, Denmark; Moreth, Germany
18. *Pterostichus melanarius*	Lewis, United Kingdom
Pterostichus cupreus	Heimbach, Germany
19. *Forficula auricularia*	Sauphanor, France
20. *Anthocoris nemoralis*	Schaub, Switzerland
Spiders	
21. *Cheiracanthium mildei*	Mansour, Israel
Fungi	
22. *Verticillium lecanii*	Tuset, Spain
23. *Beauveria bassiana*	Hokkanen, Finland
Beauveria brongniartii	Coremans-Pelseneer, Belgien
24. *Metarhizium anisopliae*	Hokkanen, Finland
Nematods	
25. *Steinernema feltiae*	Vainio, Finland

b) To functional and ecological groups

Effects on beneficials may give an indication about the potential effects on species of the same functional and ecological group. Based on the present knowledge, the extrapolation from results obtained in tests with sensitive indicator species to species from the same taxonomic order appears to be feasible, at least in some groups. Results from experiments with Hyminoprerus species and predatory mites are given in Table 1 and 2.

c) Of laboratory and semi-field data to field situations

Whereas harmlessness of pesticides can easily be shown by laboratory experiments, harmfulness can only be confirmed under practical conditions in the field. Pesticides found to be harmless to a particular beneficial in the laboratory test are most likely to be harmless to the same organism in the field and no further testing in semi-field or field experiments is therefore recommended. Because behaviour and ecology are restricted in controlled laboratory tests, extrapolation between species is more justified at this stage of testing. Work to compare results of the different types of standard tests (laboratory, semi field and field) was recently published in a IOBC/WPRS Bulletin (Vogt 1994). Information included in the Bulletin should help research workers to interpret the results of the different types of tests.

In semi-field conditions, extrapolation between species will be more difficult than in the laboratory because behaviour becomes more relevant. Even similar species can behave quite differently, which may result in different exposure, and thus different susceptibility.

For the majority of cases harmlessness as demonstrated in laboratory assays can be extrapolated to field conditions for the test species. However several factors can influence this prediction e.g.-body size, ecology, behaviour, sensitivity of the strain tested, the test method (overspray vs residual method), the temperature at which the test is concucted, the presence of food, the life stage tested in the laboratory test, particularly in the case of IGR products.All these may affect the degree of exposure. It was recommended that a review of existing data, especially from field trials, would allow evaluation of the validity of extrapolation of results for one organism, to predict likely effects on another organism.

Selective Pesticides

The joint testing programmes includes beneficial arthropods, entomopathogenic fungi and nematodes. All the pesticide chosen for the tests were registered in at least one of the IOBC member countries. This testing programme is not only meant to provide valuable information on the side effects of pesticides on beneficial organisms but it also gives the testing members an opportunity to improve testing techniques, compare results and exchange experience with colleagues.

Whereas harmlessness of pesticides can easily be shown by laboratory experiments, harmfulness can only be confirmed under practical conditions in the field. Pesticides found to be harmless to a particular beneficial in the laboratory test are most likely to be harmless to the same organism in the field and no further testing in semi-field or field experiments is therefore recommended.

Among the 124 pesticides tested till now, the following compounds were found to be harmless to nearly all the beneficial organisms tested or have limited persistence:

1) The insecticides and acaricides Dipel (*Bacillus thuringiensis*), Applaud (buprofezin), Shell Torque (fenbutatin oxide), Azomate (benzoximate), Dimilin (diflubenzuron), Spruzit-Nova-flüssig (pyrethrum and piperonylbutoxide), Pirimor Granulat (pirimicarb), Cesar S.L. (hexythiazox), Apollo SOSC (clofentezine), Kelthane (dicofol), Tedion V 18 (tetradifon).
2) The fungicides Nimrod (bupirimate), Saprol (triforine), Sumisclex (procymidone), Dyrene flüssig (anilazine), Bayfidan (triadimenol), Anvil (hexaconazole), Calixin (tridemorph), Bayleton (triadimefon), Ronilan (vinclozolin), Orthocid 83 (captan), Cercobin-M (thiophanate-methyl), Ortho Difolatan (captafol), Derosal (carbendazim), Daconil 500 (chlorothalonil), Plondrel (ditalimfos), Pomarsol forte (thiram), Dithane Ultra (mancozeb), Baycor (bitertanol), Delan flüssig (dithianon), Vitigran (copper-oxychlorid), Impact (flutriafol), Rovral PM (iprodion).
3) The herbicides Illoxan (diclofop-methyl), Semeron (desmetryn), Betanal (phenmedipham), Kerb 50 W (propyzamid), Cycocel Extra (chlormequat), Luxan 2,4-D amine (2,4-D aminesalt), Ally (metsulfuron-methyl and Grasp (tralkoxydim), Basagran (bentazone).
4) The plant growth regulators Rhodofix (naphthyl acetic acid), Dirigol-M (alphanaphthyl-acetamid).

Literature

Hassan, S.A.; Bigler, F.; Bogenschütz, H.; Boller, E.; Brun, J.; Calis, J.N.M.; Chiverton, P.; Coremas-Pelseneer, J; Duso, C.; Lewis, G.B.; Mansour, F.; Moreth, L.; Oomen, P.A.; Overmeer, W.P.J.; Polgar, L.; Rieckmann, W.; Samsoe-Petersen, L.; Stäubli, A.; Sterk, G.; Tavares, K.; Tuset, J.J. and Viggiani, G., 1991: Results of the fifth joint pesticide testing programme carried out by the IOBC/WPRS-Working Group "Pesticides and Beneficial Organisms". Entomophaga. 36, 55-67.

Hassan, S.A.; Bigler, F.; Bogenschütz, H.; Boller, E.; Brun, J.; Calis, J.N.M.; Coremans-Pelseneer, J.; Duso, C.; Grove, A.; Heimbach, U.; Helyer,N.; Hokkanen, H.; Lewis, G.B.; Mansour, F.; Moreth, L.; Polgar, L.; Samsoe-Petersen, L.; Sauphanor, B.; Stäubli, A.; Sterk, G.; Vainio, A.; van de Veire, M.; Viggiani, G. and Vogt, H., 1994: Results of the sixth joint pesticide testing programme of the IOBC/WPRS-Working Group "Pesticides and Beneficial Organisms". Entomophaga. 39, 107-119.

Samsoe-Petersen, L.; Bigler, F.; Bogenschütz, H.; Brun, J.; Hassan, S.A.; Helyer, N.L.; Kühner, C.; Mansour, F.; Naton, E.; Oomen, P.A.; Overmeer, W.P.J.; Polgar; L.; Rieckmann, W. and Stäubli, A., 1989: Laboratory rearing techniques for 16 beneficial arthropod species and their prey/hosts. Z. Pflanzenkrankh., Pflanzensch. 96, 289-316.

Sterk, G.; Hassan, S.A.; Baillod, M.; Bakker, F.; Bigler, F.; Blümel, H.; Bogenschütz, H.; Boller, E.; Bromand, J.; Brun, J.; Calis, J.N.M.; Coremans-Pelseneer, J.; Duso, C.; Garrido, A.; Grove, A.; Heimbach, U.; Hokkanen, H.; Jacas, J.; Lewis, G.; Moreth, L.; Polgar, L.; Rovesti, L.; Samsoe-Petersen, L.; Sauphanor, B.; Schaub, L.; Stäubli, A.; Tuset, J.J.; Vainio, A.; van de Veire, M.; Viggiani, G.; Vinuela, H. and Vogt, H. 1998: Results of the seventh joint pesticide testing programme carried out by the IOBC/WPRS-Working Group "Pesticides and Beneficial Organisms". BioControl, in print.

Vogt, H. (ed.), 1994: Side effects of pesticides on beneficial organisms: Comparison of laboratory, semi field and field results IOBC/WPRS Bulletin 17 (10), 178 pp.

IOBC/WPRS Bulletin, XV (3), 1992: Working Group "Pesticides and Beneficial Organisms", Guide-lines for testing the effects of pesticides on beneficial organisms: description of test methods, 186 pp.

IOBC/WPRS Bulletin, XI (4), 1988: Working Group "Pesticides and Beneficial Organisms", Guide-lines for testing the effects of pesticides on beneficials: short description of test methods, 143 pp

Working Group: "Integrated Control in Cereal Crops"

Convenor
Hans-Michael Poehling, *Universität Hannover, Institut für Pflanzenkrankheiten und Pflanzenschutz, Herrenhäuser Str. 2, D-30419 Hannover, Germany*

Number of participants: about 40

Introduction

This working group meets regularly every two years in different European countries. At these meetings, we evaluate current research activities, exchange new methods, data and ideas and discuss future research projects. The composition of the group has changed considerably during the last few years: Now, the majority of participants comes from Germany, France, Spain, Belgium, Italy and from eastern European countries like Hungary. About 20 permanent and a great number of "temporary" members participate in the meetings. Especially these temporary members, mainly young scientists, particularly graduated and post-graduated students presenting their latest research results, determine the innovative scientific orientation of the group.

Our main scientific aims are to enlarge the basic knowledge on:

- biology, ecology and damage potential of cereal pests and pathogens
- ecology of natural enemies in the cereal ecosystem
- interaction of pests and their natural enemies
- impact of pest and pathogen control strategies on non-target organisms and the environment
- improved strategies for environmentally-safe control measures.

In addition, we determine and initiate new research activities concerning the cereal ecosystem.

Main realisations

Meetings

- 1995 Meeting in Hanover, Germany (Local organiser Dr. H.-M. Poehling)
- 1997 Meeting Lleida, Spain (Local organiser Dr. X. Pons)

Publications and information about activities

Papers presented at the meetings are published in the IOBC-Bulletins. Meeting in Hannover 1996: Vol. 19 (3).The bulletin with papers from the Lleida-meeting is in preparation.

Information about the group is now available on the internet (http://www.ifgb.uni-hannover.de/extern/iobc/), the web-side is updated regularly, providing information on the activities of the group and abstracts of papers from the meetings.

Projects (Research areas in detail)

Past activities

The past activities of the group were nearly exclusively concentrated on the biology, ecology and control of cereal aphids, focusing on the following main topics:

- Population dynamics of cereal aphids
- Forecasting of cereal aphids, economic thresholds
- Selective application strategies of pesticides
- Effects of pesticides on the cereal ecosystem (side-effects on non-target organisms)
- Population dynamics of natural enemies
- Cereal aphids as vectors of BYDV, epidemiology of BYDV

Many important insights were gained by this activities (see Bulletins).

Present and future topics

Monitoring of cereal and maize pests and their natural enemies (long-term scale)

Long-term monitoring of cereal and maize pests (e.g. aphids, corn borers, gall midges, leaf beetles) and their natural enemies in different areas of Europe under changing climatic and agricultural conditions still provides new insights in pest population dynamics and pests-beneficials-interactions.

Temporal and spatial distribution of pests and their antagonists

The analyses of temporal and spatial distributions of cereal and maize pests and their key antagonists, including studies on a large scale (regions with different climatic conditions and landscape structures), using techniques like GIS and convenient statistical evaluation techniques (e.g. geostatistics), may elucidate relationships between climatic conditions and vegetation and landscape features. These studies will be combined with investigations on genetic diversity of pest species and selected natural enemies at different localities, using modern techniques of molecular genetics.

Population dynamics and efficacy of natural enemies in relation to the diversity of the cereal ecosystem

These studies will be based on data of the temporal and spatial distribution of natural enemies in relation to habitat diversity (crop system, field size, size and structure of field boundaries and ecotones, landscape structure in general). The impact of natural enemies on pest populations will be estimated using computer-based models of predator-prey or parasite-host interactions. For a realistic evaluation, multiple-species systems and multitrophic interactions (inter- and intraspecific competion, intra-guild predation) have to be considered. In addition, effects of habitat manipulation, including alternative agricultural techniques (low-input systems, reduced tillage systems, undersowing, mixed cropping etc.) will be studied.

Epidemiology of BYDV

Modelling BYDV-epidemiology and the development of reliable forecasting systems is still a current issue, and studies on the distribution and migration pattern of different vector species and clones are important research areas. Mechanisms of plant-pathogen-vector (aphid) interactions will be studied in more detail.

"New" control strategies

Studies on new control strategies will be based more on the use of resistant and tolerant plant material, including strategies of induced resistance and tolerance.

Pesticide side-effects

Regarding environmental impact, i.e. effects on beneficials, pesticide quality has improved considerably during the last few years. However, sublethal and long-term effects are often underestimated. The importance of such impacts has to be evaluated taking into consideration more functional aspects of communities of the cereal ecosystem.

The development of reliable risk-models may improve the forecasting of detrimental effects and help to establish more ecologically-sound application strategies for pesticides.

Current research topics as presented at the last meeting in Lleida, Spain, 1997

The following list of papers from the last meeting in Lleida (Spain) may give an overview about the main topics of the group and the present projects of group members:

Aphids as cereal pests

Niehoff, B. and Staeblein, J. (Göttingen, Germany): Comparative studies to determine the damage potential of the cereal aphids *Sitobion avenae* (F.) and *Metoplophium dirhodum* (Wlk.) in winter wheat.

Poehling, H.-M. and Galler, M. (Hannover, Germany): Induced tolerance and induced resistance against biotrophic pathogens and cereal aphids in wheat.

Lemke, A. and Poehling, H.-M. (Hannover, Germany): Effects of sown weed strips in winter wheat on the abundance of cereal aphids and spiders.

Aphids in relation to BYDV

Veenker, H., Meyer zu Brickwedde, W., Ulber, B. and Poehling, H.-M. (Göttingen, Germany): First flight activities and immigration of cereal aphids in spring 1994-1996 at Göttingen (Northern Germany).

Fiebig, M. and Poehling, H.-M. (Hannover, Germany): Host-plant selection and population dynamics of the grain aphid *Sitobion avenae* (F.) on wheat infected with Barley Yellow Dwarf Virus.

Johnson, D., Harrington, R., Taylor, M. and Burguess, A.J. (Rothamsted, UK): The influence of aphid natural enemies on the spread of Barley Yellow Dwarf Virus.

Aphids and natural enemies

Rappaport, V. (Kleinmachnow, Germany): Flexible control thresholds for aphids in winter wheat in dependence on naturally antagonists.

Kiss, J., Tóth, F., Kádár, F. and Barth, R. (Gödöllö, Hungary): Predatory arthropods in winter wheat in Northern Hungary.

Dinter, A. (Hannover, Germany): Interactions between predators and their cereal aphid prey.

Freier, B., Möwes, M., Triltsch, H. and Rappaport, V. (Kleinmachnow, Germany): Predator units – an approach to evaluate coccinellids within the aphid predator community in winter wheat.

Triltsch, H. and Freier, B. (Kleinmachnow, Germany): Investigations on differences between ladybird populations (Coleoptera, Coccinellidae) at three localities.

Poehling, H.-M. and Krause, U. (Hannover, Germany): Distribution of aphidophagous syrphids in different habitats including the cereal ecosystems.

Nienstedt, K.M. and Poehling, H.-M. (Hannover, Germany): Predatory efficiency of polyphagous predators of cereal aphids analysed by using the stable isotope ^{15}N as marker.
Ngamo, Tinkeu, L.S. (Louvain, Belgium): Phenology of parasitism and its influence on the predatory efficiency of larvae of *Episyrphus balteatus* (Diptera, Syrphidae).
Langer, A., Franck, B. and Hance, Th. (Louvain, Belgium): Egg laying behaviour of wheat aphid parasitoids at low temperatures.
Rohel, E., Couteaudier, Y., Papierok, B., Cavellier, N. and Dedryver, C.A (Rennes, France): Genetic variation in the entomopathogenic fungus *Erynia neoaphidis* and some related species.

Other cereal pests

del Moral, J. and Mejás, A. (Badajoz, Spain): Parasite specificity of *Mayetiola* spp. on winter cereals in Extremadura (Spain).

Maize pests and natural enemies

Hance, Th. and Hesbois, B. (Louvain, Belgium): Influence of maize varieties on the development of aphid püopulation.
Asín, L. and Pons, X. (Lleida, Spain): Aphid predators in maize fields.
Rigamonti, I.E. and Lozzia, G.C. (Milano, Italy): Effects of transgenic corn on non target species.
Eizaguirre, M., Sans, A. and Albajes, R. (Lleida, Spain): Application of *Trichogramma brassicae* against *Ostrinia nubilalis* in Catalonia, Northeast of Spain.

Working Group "Breeding for Resistance to Insects and Mites"

Activity Report 1993 – 1997

Convenor
P.R. Ellis, *Horticulture Research International, Department of Entomological Sciences, Wellesbourne, GB-Warwick CV35 9EF, United Kingdom*

The Working Group holds meetings every three years. The last meeting was organised by Chris Mollema from the Centre for Plant Breeding and Reproduction Research (CPRO-DLO) and held from 17-20 September 1995 at the Conference Centre "Alteveer", Arnhem, The Netherlands. The meeting was largely sponsored by IOBC with contributions from EUCARPIA (the European Association for Research on Plant Breeding) and Dutch seed companies. Grants were made available to scientists from Eastern Europe who were facing financial difficulties in attending the conference. A total of 55 participants from 9 countries attended the meeting. Most of these were scientists from research institutes and universities but it was most encouraging to record that representatives from nine seed companies were present and they made valuable contributions to the discussions and planning of future activities. There were both platform and poster sessions during the proceedings and time made available for more general discussions. More emphasis was placed on investigations of the basis of resistance and of interactions between host plant resistance and biological control. Several participants from other IOBC Working Groups were present and ensured that integrated pest management techniques were well represented. An excursion to the Centre for Biological Agriculture at Lelystad took place during the meeting. The proceedings of this seventh triennial meeting were published in an IOBC Bulletin and circulated to over 100 interested researchers in more than 12 countries.

Three Project Groups are active within the Working Group. The Project Group on Western Flower Thrips held a workshop at the Conference Centre "Alteveer", Arnhem, The Netherlands from 17 to 19 October 1994 which was attended by 10 active workers in the field of thrips research. The report on this meeting was submitted to the IOBC. This Project Group plans to continue the collaboration. The Project Group on Plant Surface Chemistry\Root Flies interactions has held several meetings and published research reports in refereed journals. This collaboration continues. The Project Group on EPG Studies (Electro Penetragraph) designed primarily to investigate aphid feeding behaviour organised a workshop in France and trains research workers in relevant techniques.

Apart from the Bulletin, the Working Group issues an Aphid Resistance Newsletter periodically. The participants specialising in aphid/plant relationships contribute news items to this Newsletter and it is circulated to interested scientists.

Future activities

From time to time discussions are held concerning the future activities of the Working Group. In Arnhem in 1995 it was decided to continue with the present format of meetings being held every three years, involving about 45-50 participants from many different countries and offering two full-days for scientific presentations. Participation by representatives from seed companies and from other IOBC Working Groups will be encouraged, and the proceedings will be published in a Bulletin. The Project Groups will continue and new Project Groups set up as areas for close collaboration are identified.

The next meeting of the Working Group will be held in Scotland in September 1998 and organised by Dr Nick Birch of the Scottish Crop Research Institute, Invergowrie, Dundee. Emphasis will be placed on molecular biology, genetic engineering and integration of host plant resistance with natural enemies and other approaches to pest control.

Working Group
"Use of Pheromones and other Semiochemicals in Integrated Control"

Convenor
Peter Witzgall, *Dept. of Plant Protection Sciences, Swedish University of Agricultural Sciences, 230 53 Alnarp, Sweden*

Number of participants: approximately 100 biologists and chemists from Europe and overseas.

Introduction

The Working Group develops the use of pheromones and semiochemicals for environmentally safe control of harmful insects. The Working Group has traditionally served as a liaison between basic research and practical application, with members drawn from academic and government research institutions, plant protection industry and extension services. Main realizations:

Insect control by mating disruption

Insects use sex pheromones to communicate for mating. Pheromones elicit strong behavioural reactions at minute amounts, they are species-specific and non-toxic. By permeating the atmosphere with synthetic pheromones, olfactory communication and mate-finding is prevented.

Mating disruption by dissemination of synthetic pheromones is increasingly used for insect management. In Europe, breakthroughs have been achieved with vineyard and orchard tortricids (*Eupoecilia ambiguella*, *Lobesia botrana* and *Cydia pomonella*). Mating disruption is applied on 15 000 ha of German and Swiss vineyards and on 5 000 ha Italian apple orchards.

Pheromone lures for detection and monitoring of insects

Traps baited with synthetic sex pheromones are an efficient, inexpensive and specific tool to detect the presence of insects and to monitor their flight period. Trap catch can be correlated with population densities to forecast damage levels. Pheromone traps are used worldwide in a wide variety of crops, they are available for virtually all economically important lepidopteran species.

The Working Group has driven the development of the mating disruption technique and of monitoring lures through chemical identification of natural sex pheromones, behavioural characterization of synthetic compounds, and the implementation of these techniques in insect management programmes.

Projects

Mating disruption

Providing scientific support to mating disruption will continue to be an important function of the Working Group. It has been demonstrated that the chemical industry is willing to develop the tools for this technique and carry through the procedures needed for their commercialisation, but few companies can afford to develop their own research in this area.

Therefore, the Working Group is an important mediator between the scientific world, the agricultural community and the chemical industry.

Pheromone lures for detection and monitoring
The formulation of reliable lures requires intimate knowledge of pheromone chemistry and biology. Initially, pheromone lures and traps were distributed by government research institutes, which had played an active role in their development. Today, pheromone lures are commercially available from a number of companies - these lures vary greatly in efficacy. This is due to a varying degree of purity of the starting materials as well as inadvertent changes in dispenser materials, lure composition and dose from one year to the other.

The Working Group Meetings in Avignon (1988) and Budapest (1997) were dedicated to insect lures. The following conclusions on the topic of quality control were reached in Budapest:

1 – In view of the variable performance of insect lures for insect monitoring and detection found on the market, it is suggested that commercial lures should carry information on the supplier, the batch of chemical (s) and support materials used.

2 – Chemical information should include the amounts and chemical purities of each component. An exception to this rule can be made for component (s) in case of proprietary information.

3 – Biological information on lures and batches should include field results with geographical location and history. Data should retain absolute captures of target an non-target species.

4 – The Working Group will establish procedures of experimental design and statistical evaluation of field tests. For the present time, the following rules are proposed: a) A distinction between an effective and an ineffective lure should be based on at least 3 replicates; b) quantitative differences between lures should be based on tests with at least 10 replicates; c) trap catches of less than 10 specimens per trap and season should generally be considered insufficient to claim efficacy.

5 – The Working Group will serve as a mediator to publish chemical and biological information on lures and chemicals on the Internet.

Use of other Semiochemicals
The practical use of semiochemicals is still largely restricted to lepidopteran sex pheromones. Compounds need to be made available to monitor and control economically important species belonging to other taxonomic groups. Methods based on compounds other than sex pheromones should be developed as a complement to the mating disruption technique. Plant volatile compounds guide insects to food sources, mating and oviposition sites. The potential of attractant or deterrent plant volatiles for insect control is hardly exploited at all, the knowledge of these compounds is fundamental also to plant breeding.

The upcoming Working Group Meeting on "Plant and Insect Semiochemicals from Orchard Environments" will address these topics.
Information on this meeting and other activities of the Working Group are continuously updated on the Internet at:

http://nysaes.cornell.edu/pheronet/iobc

Working Group "Integrated Control of Soil Pests"
"Lutte Intégrée contre les Ravageurs du Sol"

Activity Report for the 8th General Assembly of IOBC/WPRS (Vienna, 1997)

Convenor
Brian R. Kerry, *IACR-Rothamstedt, Entomology and Nematology Department, Harpenden, GB-Herts. AL5 3JQ, United Kingdom*

Number of participants: c. 100

Introduction
Members of the group target their research towards the integrated control of soil insects, slugs and plant parasitic nematodes. This research aims to develop strategies which maximise the effects of the natural enemies of pests and lead to reduced inputs of soil applied pesticides and thereby the minimisation of impacts on the environment. Research activities are co-ordinated through biennial meetings and, where appropriate, collaborative research projects within three main areas which form the subgroups:

- Integrated control of soil pests. (Co-ordinated by Dr David Glen)
- Pathology of nematodes. (Co-ordinated by Professor Richard Sikora)
- *Melolontha*. (Co-ordinated by Dr Siegfried Keller)

In the last four years, the Working Group has met in Bristol, UK (1994) and Wageningen, NL (1996) and the *Melolontha* subgroup had their first meeting in Freiburg, Germany in 1995.

General Activities
At the meeting in Wageningen, the membership strongly endorsed the current structure of the Working Group. However, separate, more specific meetings of the subgroups, possibly in association with other IOBC/WPRS working groups, could make better use of limited resources. Closer links with the "Insect Pathogens and Insect-Parasitic Nematodes" and "The Biological Control of Fungal and Bacterial Phytopathogens" Working Groups would be advantageous. Dr Jim Deacon, a leading scientist on the biological control of soil borne diseases and Dr Peter Smits, convenor of the insect pathogens working group attended our meetings in Bristol (1994) and Wageningen (1996), respectively. Common activities between these working groups include: (1) nematode biology and population dynamics, (b) quantification and visualisation of micro-organisms in the rhizosphere, (c) tritrophic interactions in the rhizosphere, (d) biodiversity in natural enemy communities and (e) impacts of agricultural practices on pest and natural enemy communities.

Topics of importance in the development of integrated pest control strategies which are generally not covered by our activities include: (a) the use of semiochemicals to enhance the performance of natural enemies, (b) integrated and biological control of weeds, (c) methods for monitoring microbial agents after their release, (d) the stability of microbial agents and their impacts on non-targets and (e) the impacts of organic wastes on pest and natural enemy communities.

The involvement of young scientists in the activities of the Working Group will remain a high priority; the exchange of students and postdoctoral workers between laboratories within the Working Group had proved very successful and would continue to be encouraged. The limited representation of colleagues from southern and eastern Europe was noted and efforts would be made to encourage their participation in future meetings. It was also felt that increased participation by representatives from industry would greatly benefit our discussions on the exploitation of biological control agents.

(a) Integrated Control of Soil Pests Subgroup.

The activities of this subgroup over the past four years have concentrated on four main topics: (i) Forecasting and sampling techniques; (ii) Biology, ecology and behaviour, (iii) Effects of husbandry practices and (iv) Integrated control strategies. Although the subgroup retains a general interest in insect pests and their natural enemies, the emphasis of research activities has shifted towards the management of slug pests on a wide range of crops. Slugs are likely to remain a strong interest of the subgroup for the foreseeable future, especially because of the increasing demand within Europe and the rest of the world for environmentally benign crop production systems. Often, such systems are favourable to the development of large slug populations and improved methods of control are needed. The subgroup meetings have also been host to the EC Concerted Action meetings on 'Integrated Management of Mollusc Pests in Less Intensive Systems' and an IOBC/WPRS Bulletin is being prepared on these activities.

Members of the subgroup have been involved in sampling and trapping methods to support basic studies on the population dynamics of slugs and the impacts of a forecasting scheme. The work on slug behaviour has led to the identification of new antifeedants and repellents which are currently being commercially evaluated. Most effort, however, has concentrated on the biological control of slugs. Although carabid beetles may be important predators in the field, most interest has concentrated on nematodes which parasitise slugs. These nematodes are produced commercially for use in gardens and their efficacy in horticulture and field crops is currently being evaluated.

The subgroup has several other interests which range from the population dynamics of predatory beetles and the impacts of farming practices on their activities and biodiversity to the spread of flatworm predators of earthworms within Europe.

(b) Pathology of Nematodes Subgroup

The subgroup activities have concentrated on: (a) The measurement of the antagonistic potential (nematode suppression) in soils and its dynamics, (b) The mode of action of selected agents, (c) Tri-trophic interactions in the rhizosphere and (d) The development of biomanagement strategies. Public pressure to reduce the use of nematicides, including methyl bromide which will be banned between 2001-2010 throughout the world, have not abated over the past four years. Nematicides include some of the most toxic compounds used in crop production and there is an urgent need to develop alternative strategies which do not rely on their widespread use.

Soils which contain nematode antagonists in sufficient numbers to affect the population dynamics of both sedentary (cyst and root-knot) and, more recently, migratory nematodes have been recognised in Europe and methods to quantify this antagonistic potential have been developed. Detailed studies on the dynamics of the decline of cereal cyst nematodes in the UK and beet cyst nematodes in Holland in monocultures of cereals and sugar beet, respectively have demonstrated that fungal antagonists can significantly reduce nematode populations but they are slow to build up in soil. At least four susceptible crops are required before the antagonists are effective, during which time much nematode damage has been incurred. Such biological control agents must therefore be integrated with other control methods.

Members of the subgroup have identified endophytic fungi and rhizobacteria as exciting potential biological control agents. Together with nematophagous fungi the activities of these organisms in the rhizosphere and/or root are much affected by the plant and the understanding of tri-trophic interactions between the nematode, antagonist and host plant has developed as a major topic of research. A biomanagement strategy which incorporates the use of the nematophagous fungus, *Verticillium chlamydosporium* to enhance the impact of poor hosts in reducing root knot nematode infestations on vegetable crops has proved effective in microplots and needs field testing.

(c) *Melolontha* Subgroup.

The field cockchafer is of increasing importance in several European countries especially as a pest in pasture and orchards. Research activities have concentrated on the use of *Beauvaria brogniartii* as a biological control agent. Applications of blastophores to swarming adults have provided good control in some situations but the incorporation, in soil, of cereal grains pre-colonised by the fungus has proved more reliable. Application rates of 30-50 kg ha^{-1} of such an inoculum have been registered in Switzerland as a plant protection agent and the fungus is now produced commercially. Other countries allow only experimental use.

Members of the subgroup are studying other potential biological control agents including nematodes (*Heterorhabditis* spp.) and bacteria such as *Bacillus popilliae* and *Serratia* spp. Trials with Neem-Azal® (seed extract from the neem tree *Azadirachta indica*) were done in Germany in 1994 and 1995. The treatment had no immediate lethal or repellent effect on the adults but altered their behaviour and physiology. Food consumption, flight activity and egg production were inhibited under both controlled and field conditions.

The use of different types of nets placed on the soil surface to prevent cockchafer females depositing eggs has been evaluated. Reductions in white grub populations of > 90% have been achieved but the nets are expensive and can only be used on high value crops such as orchards and vines. The activities of the subgroup were reported in the IOBC/WPRS Bulletin Vol. 19(2) 1996.

Future Projects

The Working Group will evaluate the need for a further subgroup to co-ordinate research on the impacts of the applications of organic wastes on pest and natural enemy communities. There has been increasing interest in this topic amongst the membership as more waste materials are being added to farmland.

Two EU funded projects have been awarded to members of the Working Group and will act as major foci for our activities over the next four years. The first is entitled 'Novel strategies for integrated control of slug damage in key horticultural crops' and will be co-ordinated by David Glen. The project includes studies on the biological control of slugs with nematodes, their population dynamics and the use of other methods of managing these pests including the use of soil amendments and semiochemicals.

The second programme will be co-ordinated by Brian Kerry and involves the development of a sustainable strategy for the biomanagement of root-knot nematodes in vegetable crops in southern Europe - an alternative to the use of methyl bromide. A strategy based on the nematophagous fungus, *V. chlamydosporium* will be compared with soil fumigation using methyl bromide and an integrated strategy using the fungus with reduced applications of granular nematicides. The project involves a risk analysis to assess the inpacts of the fungus on non-target organisms in the rhizosphere and the development of molecular methods to monitor and quantify the fungus in the soil and rhizosphere. This programme will bring several scientists from southern Europe to our meetings.

The Working Group is in the process of publishing three Bulletins which will be completed over the next 18 months. These Bulletins are entitled: (a) A Review of Working Group Activities, 1994-1997, (b) Integrated Management of Mollusc Pests in Less Intensive Agricultural Systems and (c) Priorities for the Exploitation of Biological Control Agents for Nematodes. The latter Bulletin will be a brief (50 pages) statement, with an executive summary on the priorities for research which can be used by policy makers and scientists in preparing and evaluating research projects. Although prepared by members of the Working Group, the document will be circulated widely amongst the scientific and commercial community before publication. It is proposed to have the Bulletin available for the International Congress of Plant Pathology (ICPP) meeting in Edinburgh, August 1998.

Meetings of the subgroups to co-ordinate our activities and identify topics for collaborative work will be held in Germany, 1998 (Pathology of Nematodes) and in Switzerland in the same year (other subgroups). Members of the Working Group will hold an evening discussion session at the ICPP on 'The Development of Biological Control Agents for Nematodes', under the auspices of the IOBC/WPRS. A proposed meeting is planned in 1999 on 'Tritrophic interactions in the rhizosphere' which hopefully will attract participation from members of other Working Groups.

The Integrated Control of Soil pests Working Group continues to attract an active membership and considerable research activity. Its membership continues to increase.

Working Group "Integrated Control in Oilseed Crops"

Activity Report 1995 - 1997

Convenor
V. H. Paul, *Universität-GH-Paderborn, Fachbereich Landbau, Labor für Biotechnologie und Qualitätssicherung, Lübecker Ring 2, D-59494 Soest, Germany*

X. Meeting of Working Group "Integrated Control in Oilseed Crops", 1995, Cambridge, UK

The main aspect of the Cambridge meeting was the numerous participation of delegates from the Eastern European countries. Thus at an informal meeting aside it was decided due to the special wishes of the Eastern European delegates to call in the XI. biannual meeting in Poznan, Poland.
It was also decided to take up the efforts to apply for EU-funded research programmes. The results are showing at the XI. biannual meeting in Poland.

XI. Meeting of Working Group "Integrated Control in Oilseed Crops", 1997, Poznan, Poland

For the first time since the existence of the working group on Integrated Control in Oilseed Crops the biannual workshop meeting took place in Central Europe. We met in the new Conference Centre of the Institute of Plant Protection in Poznan, Poland, from April 10 to 12, 1997.
On this 7th workshop 38 scientists from 8 countries attended. Pleasing was the numerous participation of 17 east European colleagues and from young scientists.
It is a very satisfying fact that our mutual efforts for financial support by the European Union finally seems to bear fruits. This can be seen in the fact that members of our working group are involved in three EU research projects. Those are

Biocontrol of Oilseed Rape Insect Pests (Boris)
Project co-ordinator: Dr. D. Alford, ADAS Cambridge, UK

A 3-year programme of work, funded by the European Commission that was begun in 1997 to minimise pesticide use and environmental impact by the development and promotion of bio-control strategies for oilseed rape (OSR) pests.
Co-operation between 8 countries (Austria, Denmark, Finland, France, Germany, Sweden, Switzerland and the UK)
Tasks:
- Establish a network amongst European scientists currently working on bio-control of OSR pests, by providing a forum for information exchange
- Through winter workshops and summer meetings focusing on technological exchange and to co-ordinate current and future research on natural enemies of OSR pests
- Reduce the environmental impact of pesticides on a major European Union (EU) crop by devising strategies for farmer to exploit natural enemies and thereby minimise and better rationalise pesticide use on OSR

- Make recommendations for the direction, harmonisation and prioritisation of future research efforts in the above-mentioned areas

Duration:
48 months (1 January 1997 - 1 January 2000)

Integrated Strategies for the Management of Stem Canker of Oilseed Rape in Europe (IMASCORE)
Project co-ordinator: Dr. M. H. Balesdent, INRA, Versailles, France

The objective is to propose integrated strategies to control stem canker (Leptosphaeria maculans, anamorph: Phoma lingam) the most damaging disease of oilseed rape and vegetable Brassica in Europe.
Co-operation between 5 countries (France, Germany, Poland, Portugal and the UK)
Tasks:
- Survey of European populations of Leptosphaeria maculans in comparison with a world-wide collection of isolates
- Screening for new sources of resistance
- Field efficiency for new or recently introduced resistance genes
- Genetics of the interactions between cruciferous plants and the pathogen
- Epidemiology and forecasting of stem canker pathogens

Duration:
48 months (1 January 1997 - 1 January 2001)

Alternative Oil-seed Crop Camelina sativa (CAMSA)
Project co-ordinator: Dr. J. Zubr, The Royal Veterinary and Agricultural University, Fredriksberg, Denmark

The project is intended to establish scientific and political basis for introduction of C. sativa (CS) as an alternative oil-seed crop in EU and OECD countries.
Co-operation between 3 countries (Canada, Denmark, Germany)
Tasks:
- Low input cultivation methods for CS under different climatic conditions
- Identification of suitable varieties for different climatic conditions
- Methods for control of weeds to eliminate application of herbicides
- Qualitative evaluation of the products from CS
- Exploitation of oil-cakes in fodder industries
- Exploitation of CS stalks in non-food industries
- Economic assessment for the crop and for the potential industrial products
- Dissemination of the results

Duration:
60 months (1 January 1995 - 1998)

XII. Meeting of Working Group "Integrated Control in Oilseed Crops" will be in the first half of 1999 in Pragne, Czech Republik

Publications

IOBC/WPRS Bulletin 18 (4) 1995, 133 pp.

Proceedings of the 9th International Rapeseed Congress of the CGIRC, Cambridge/UK, 1995, several papers of IOBC/WG members in Vol. 1-4, 1995

IOBC/WPRS Bulletin 21 (5) 1998, 239 pp.

Working Group "Fruit Flies of Economic Importance"

Activity Report

Convenor
M. Afellah, *I.N.R.A., Laboratoire de Zoologie, BP 578, Meknès, Maroc*

This Working Group was established in 1978 and had for first as convenors Dr E. Boller from Switzerland, followed by the Profs. R.Cavalloro and G. Delrio from Italy and in the last years Dr. J. Piedade-Guerreiro from Portugal.

The extreme economic importance of the damages caused by fruit flies requires a strict cooperation between specialists on this field of knowledge, thus justifying the existence of this working group, which has the following structure:

The Group involved the following areas: Biological control; Biotechnical methods; Autocidal control Microorganisms and Bioinsecticides.

The Group activities aim at the control of fruit flies of the Tephritidae family, mainly those belonging to the genera *Ceratitis, Dacus* and *Rhagoletis,* in its area of influence, that is the West Palaearctic Region.

- On this base the following actions have been developed:
- Mass rearing techniques of parasitic Hymenoptera of Tephritidae.
- Standardization of different types of traps which were all studied in the field.
- Transmission of fruit rots by Tephritidae.
- Study of both pathogenic and non-pathogenic viruses.
- Medfly (*Ceratitis capitata* Wied) as a rot vector in laboratory conditions.
- Establishment of pilot units for mass rearing of *Ceratitis capitata* which be used in autocidal control by the sterile insect technique.
- Studies of population dynamics of *Ceratitis capitata* in various regions of Portugal and Spain.

All active members of the Group are involved in the mentioned actions. Restrict meetings for the definition of strategies have been organized and a plenary Open Meeting took place in October 1993 in which 70 specialists of 13 countries were present

The « II International Open Meeting » took place in 22, 23 and 24 the September 1997, in Lisbon, with the participation of about 60 experts from 11 countries.

Future Strategy of the Working Group

We feel that it is of great interest to establish a closest cooperation with other W.G. with which affinities may exist, not only in what concerns fruit flies control, namely citrus groves, olive groves and other fruits infested by tephritidae, but also concerning other pest present in the entomofauna of those groves.

Keeping in sight the joint study of this problematic and the actions that later could be implemented, the Responsibles for the Working Groups should meet at least once a year.

In this way a further detailed information on the main pests and its problems in the West Palaearctic Region would be available.

In this context it would be important:

1 – To establish strategies coordinated by the working Groups responsables, aiming for the control of the most important pest of the Mediterranean Basin.
2 – To establish feasible agreements with institutions that by its vocation or nature (e.g. International Atomic Energy Agency) may efficaciously cooperate, namely in what concerns the autocidal control of *Ceratitis capitata*.
3 – To implement efficient methods of mass rearing of entomophagous and parasites present in the different ecological systems.
4 – Acclimatization and introduction of new species of usefull insects in areas in which due to it's ecological conditions this could be done.
5 – It would be of the outmost interest to establish the conditions for the realization of trainning periods for fruit flies workers and IPM specialists. For this purpose laboratories and experimental fields would be made available.
6 – Periodical realization of IPM Seminaries, with the cooperation of the E.U. and the African Regional Section, having in mind countries of the Tropical Regions, and namely those of Official Portuguese Expression.

We may conclude that all th's strategy has for objective the increase of the agriculture production, depending it of the damages caused by pests and other adverse causes and at the same time protecting the environment and human health.

Working Group "Integrated Control in Field Vegetable Crops"

Activity Report 1993-97

Convenor
S. Finch, *Horticultural Research International (H.R.I.), Wellesbourne,, Warwick CV35 9EF United Kingdom*

This Working Group holds meetings every two years. During the period of this report, meetings have been held at Einsiedeln, Switzerland from 1-3 November, 1993, Guitte, France from 6-8 November, 1995, and Chania, Crete from 6-8 October, 1997.

At about the time of the 1993 meeting, the general concensus of the 40-50 members of this Working Group was that our main emphasis should be to develop methods to reduce the amounts of insecticide applied for pest control in field vegetable crops, as classical systems of biological control have not yet been developed for any pest of field vegetable crops.

This emphasis on reducing the amounts of insecticide used was reflected well in the Einsiedeln meeting in which about 40% of the formal presentations were concerned with developing systems for monitoring pest activity and for using such information in the production of pest forecasts. A combination of the two could then be used to indicate whether there were sufficient insects within a crop to merit the application of insecticide. The culmination of such research is the development of Integrated Production systems. Although Ernst Boller and Christian Gysi gave lucid accounts in Einsiedeln of the way such systems were being introduced in Switzerland, most participants had doubts about whether such systems could ever be implemented satisfactorily in the major vegetable producing countries. The other three major topics discussed formally at Einsiedeln were host-plant resistance (3 presentations), insect predators and parasitoids of the cabbage root fly (*Delia radicum*) (7 presentations) and intercropping /undersowing (5 presentations). The latter subject, championed in particular by Jan Theunissen from The Netherlands, was shown to offer considerable promise in cabbage and leek production but there were still some problems in scheduling the undersown crop to be at the correct growth stage to have the desired effect in reducing pest insect infestations. Nevertheless, this subject was taken up by more group members than any other subject discussed since the first meeting of this group in 1969. The meeting in Switzerland was appreciated greatly by all participants and we thank Professor Ernst Boller and Dr Erich Stadler of Wadenswil for all they did with the local arrangements to make our visit so enjoyable.

Although pest control in field vegetable crops in all European countries is based currently almost entirely on the application of synthetic insecticides, only three presentations at the meeting in Guitte, France in 1995 dealt specifically with insecticides. However members recognize the importance of retaining considerable expertise on insecticides within the Group, as insecticidal control is the standard against which all alternative methods are judged. The three themes discussed at Guitte were 1) monitoring and forecasting pest insect attacks, 2) undersowing vegetable crops to reduce colonization by pest insects, and 3) the considerable interest now being shown, particularly in France, England and the Scandinavian countries in using the parasitoid rove beetle *Aleochara bilineata* to control the cabbage root fly.

Now that our pest monitoring and pest forecasting systems are being used as the basis for developing Integrated Production systems, some people believe we should become pro-active in producing "Guidelines" on how to grow vegetable crops with minimum environmental disturbance. At Guitte, as in Einsiedeln two years earlier, considerable doubts were expressed about the usefulness of Guidelines for field vegetable production. However, as several other Working Groups have had success with this approach, it seemed to be one subject that we should consider further. Therefore, members of the Group felt that there was a need to find someone willing to champion this cause and steer the Group into making firm recommendations about this subject at the 1997 meeting in Crete. As a group, we thank Dr Etienne Brunel and his colleagues from Le Rheu and Rennes for choosing an out-of-season Holiday Village as a superb venue for the meeting, for obtaining sponsorship for the excellent wines and seafood, and for all they did with the local arrangements to make our meeting in Guitte so enjoyable.

Directly following the General Assembly in Vienna (30 Sept – 1 Oct.), the Group held a meeting at Chania, Crete (6 – 8 October), hosted at the Mediterranean Agronomic Institute of Chania by Dr Stylianos Michelakis and organized by Dr Dionyssios Lykouressis from Athens. With such a splendid venue and hosts, the meeting was again highly memorable. It was also helped considerably by the inputs from two Americans, Professor Jeff Wyman from Madison, University of Wisconsin and Dr Brian Flood of the Del Monte Corporation, Delaware. For a considerable part of the meeting, we concentrated on replacing systems of "clean crop" cultivation by undersown crops. Although we have discussed such systems for the last 20 years, it is only in the last two years that systems acceptable to commercial growers have been developed. We also heard a presentation on "Guidelines" by Professor Peter Esbjerg, our new President, so we know that this subject with respect to field vegetable crops is at last in safe hands.

As a result of the directive from the General Assembly in Vienna, an election was held during the Chania meeting to choose the person to replace me as convener. It was decided that only people who had attended the Working Group for a period of 10 years, or six meetings, should be allowed to vote for my successor. Hence the seven people who voted were Etienne Brunel (France), Rosemary Collier (UK), Peter Esbjerg (Denmark), Stan Finch (UK), Martin Hommes (Germany), Jan Theunissen (The Netherlands) and Franz van de Steene (Belgium). The name of Dr Stefan Vidal (Germany) was sent to Council in the hope that Stefan will be ratified as the new convener. In the meantime, I agreed to be responsible for editing and preparing the Bulletin to be published from the Chania meeting. At this juncture, I would like to thank to Mrs S K Proctor and Mrs R Gez, Department of Entomological Sciences, Horticulture Research International, Wellesbourne, for the marvellous jobs they did in re-typing all of the manuscripts for the four Bulletins (1992-98) produced during my time as convener.

Future activities

Compared to undersowing which is likely to gain even greater impetus in future meetings, releasing parasitoids to control field populations of the cabbage root fly, is still in its infancy. However, this subject is also likely to expand greatly, as it is now receiving considerable interest from producers of natural enemies, who see it as a way of projecting their glasshouse expertise into field crops. Our uncompleted project is the Carrot Fly Bulletin, the data for which has been gathered fastidiously by Jost Freuler of Changins, Switzerland over the last 7 years. As four meetings have elapsed since the inception of this Project, it is imperative that it is completed and published prior to our meeting in Budapest in 1999. The ajor drawback to date has been the heterogeneity of the data, as some subjects have been researched in depth and others have been more or less totally neglected. At the meeting in Chania, it was agreed that instead of trying to produce a Bulletin that is all-embracing, we should include only data that reach the acceptable standard. This should highlight the neglected areas and indicate where further research is needed. Whatever happens, if the Carrot Fly Bulletin is to be accepted by scientists other than those within the Group, it must be of a high standard.

The next meeting of the Working group will be held in Budapest in November 1999 and will be organized by Dr Gabor Bujacki, Department of Plant Protection, 2105 Godolo, Hungary. The meeting will be open to all scientific, advisory and commercial members who wish to discuss openly the problems encountered in producing quality vegetable crops with less insecticide.

Groupe de Travail "Lutte Integrée en Cultures Protegées, Climat Méditerranéen"
Working Group "Integrated Control in Protected Crops, Mediterranean Climate"

Convenor
Ramon Albajes, *Universitat de Lleida, Centre UdL-IRTA, Lleida, Espagne*

Nombre de participants: 80

Introduction

Le Groupe de travail a été crée en 1984 avec l'objectif de promouvoir la recherche, le développement et l'application des systèmes de lutte integrée en culture protegée dans les régions soumises aux conditions méditerranéennes. À l'heure actuelle, les cultures protegées méditerranéennes surpassent largement les 100,00 ha, la plupart desquelles se font soit sous des tunnels hauts soit sous abri-serre. Le plastique y est le plus souvent utilisé et le verre ne couvre qu'un 7 % de la surface totale protegée. La variabilité du climat et des serres méditerranéens -qui évolue du climat doux de la Méditerrané septentrionale avec une prédominance de la serre en verre du Sud de la France ou le Nord de l'Italie jusqu'à le climat plus extrème de la Méditerranée méridionale et orientale où les abris plastiques y sont majoritaires- oblige à entreprendre des recherches visant à développer des systèmes de lutte integrée adaptés aux conditions locales. Malgré les specificitées de la culture protegée méditerranéenne et afin de profiter de l'expérience en lutte integrée des régions septentrionales de l'Europe, d'autant plus avantageuse dans la mésure où une grande partie de la production legumière méditerranénne se consomme aux centre et nord européens, le groupe maintient une étroite coopération avec le Groupe de travail de Cultures Protegées, Climat continental.

Parmis les **objectifs du groupe** on peut remarquer les suivants:

- Promouvoir la collaboration entre les membres appartenant à des régions, disciplines et institutions diverses,
- Stimuler l'acquisition de connaissances concernant l'écologie des ravageurs et pathogènes des cultures protegées qui devraient aboutir à une amélioration des techniques de lutte moyennant le développement et le transfert des résultats,
- Les études fondamentales et appliqués des antagonistes des ravageurs et pathogènes constituent un but essentiel de l'activite du groupe,
- Contribuer à la formation de scientifiques et techniciens en lutte biologique et integrée.

Principales Realisations

Réunions de travail

Au cours de la période 1993-97 le Groupe a tenu une réunion plenière à Lisbonne en septembre 1994 avec la participation de plus de 80 membres. On peut trouver la plupart des communications qui y ont été presentées au Bulletin OILB/SROP 17(5). Le volume contient 38 contributions. La prochaine réunion plenière du groupe tiendra lieu à Tenerife, Îles

Canaries, le prochain novembre. Le volume contenant les présentations orales est déjà disponible (Bulletin OILB/SROP 20(4) et reunit 43 contributions.

Principaux thèmes de travail et résultats:

1. Optimiser l'utilisation des espèces d'auxiliaires déjà disponibles. Définition des strategies d'utilisation en conditions méditerranéennes. À cet égard, les aleurodes (en particulier *Bemisia tabaci*) et *Frankliniella occidentalis* sont les principaux ravageurs visés. Une amélioration, trop timide probablement, dans l'utilisation des auxiliaires "traditionels" est constatable dans la Méditerranée septentrionale
2. Évaluation au laboratoire et sur le terrain de nouvelles espèces ou souches d'auxiliaires/ antagonistes. Compte tenu de la diversité faunistique de la Méditerranée, ce thème de travail occupe une grande partie de la recherche des membres du groupe et a abouti à la disponibilité commerciale de plusieurs espèces d'auxiliares. *B. tabaci*, *F. occidentalis* et les champignons du sòl sont les objectifs spécialment visés. On constate un plus grand interêt pour les prédateurs polyphages. La performance de souches méditerranéennes sous conditions extremes de température, humidité et photopériode est un des aspects qui est en train d'être testé.
3. Relations hôte-parasite pour mésurer la résistance des cultivars à l'action des ravageurs/ pathogènes, pour determiner des seuils d'intervention ou, finalement, pour mieux gérer la culture afin de diminuer les pertes de rendement.
4. Determination des effets nuisibles des pesticides vis-à-vis des auxiliaires avec la guidance du groupe de travail "Pesticides et Organismes Utiles".
5. Évaluation de l'efficacité des systèmes de lutte integrée en conditions commerciales. Cet aspect du travail -qui occupe une bonne partie des membres du groupe- tient compte des résultats des recherches concernant l'efficacité des agents de lutte biologique, l'identification des mésures culturales qui peuvent être corrigées pour freiner l'incidence des ravageurs et maladies ou pour encourager l'action des auxiliaires, la réponse differentielle des cultivars à l'attaque des ravageurs et pathogènes et profite du progrès eu dans le domaine de l'échantillonnage et suivie des populations. On constate que la disponibilité des systèmes de lutte integrée avance dans la Méditerranée; une plus rapide adoption de ces systèmes serait, cependant, désirable.
6. Formation. L'enseigment fait partir de l'activité quotidienne de plusieurs des membres du groupe, soit par leur enquadrement professionel à l'Université, Écoles Agronomiques ou Instituts inter-professionels, soit par leur participation à des cours specialisés comme celui qui a tenu lieu à Saragosse, organisé par le CIHEAM, avec la participation de 30 étudiants du Bassin Méditerranéen.

Relations avec d'autres groupes de travail.

Les relations permanentes avec le groupe de cultures protegées, climat continental a abouti à développer plusieurs projets conjoints de recherche, la réalisation de cours internationaux pour techniciens et scientifiques et la préparation de publications. À noter aussi la participation de quelques membres pathologistes aux activités du groupe de travail de lutte biologique contre les champignons et bactéries phytopathogènes. Le groupe de travail sur les pesticides et organismes utiles nous fournit des renseignments indispensables pour la mise en place de la lutte integrée en culture protegée. Parmis les directives pour l'évaluation de la qualité des auxiliaires produits en masse il y a plusieurs apports des membres du groupe.

Projets

Les projets du groupe se centrent à la consolidation des acquis et avancer dans la ligne de gagner la participation de membres des régions avec une superficie rapidement croissante de cultures protegées. La promotion d'activités de recherche conjointe entre le nord et le sud de la Méditerranée devra être un soucis principal du responsable et des membres du groupe. Approfondir la connaissance de l'écologie des ravageurs, pathogènes et leurs antagonistes à partir d'un approche global -qui devrait comprendre la serre et ses alentours- semble indispensable si on vise à augmenter la faisibilité de la lutte integrée en conditions méditerranéennes. La définition des strategies d'utilisation des auxiliaires -soit par le lâcher inoculatif soit par la gestion des populations naturelles- pourrait bénéficier du contrôle naturel qu'on constate souvent dans les serres méditerranéennes dès qu'on diminue les applications pesticides. On envisage éditer un directoire avec les membres du groupe et leurs thèmes de travail.

Working Group "Integrated Control in Glasshouses"
Groupe de Travail "Lutte Integrée en Cultures sous Verre"

Convenor Section North
Prof. Dr. J.C. van Lenteren, *Laboratory of Entomology, Wageningen Agricultural University, The Netherlands*

Number of working group members: 80

Introduction

The IOBC/WPRS working group « Integrated Control in Glasshouses » is one of the oldest in the IOBC history. Besides coordinating fundamental and applied ecological research for development of IPM programs, it has realized large scale practical use of biological control through intensive advisory and public relations work. At this moment, almost 40 years after commercial biological control was started in greenhouses, about 80 species of natural enemies are commercially available for control of more than 50 pest species. The greenhouse area on which biological control is used has increased from 400 hectares in 1970 to 15,000 hectares in 1996, which is about 50% of the current potential area for biological control.

Commercial producers of biocontrol agents have cooperated with the working group since its initiation. Most biological control is still applied in vegetable crops, but commercial application also takes place in floriculture. The working group has played an important role in stimulating development of biological and integrated control worldwide in countries with greenhouse production. The excellent commercial results with biological control of insect pests in greenhouses in Europe has shown to be a firm and reliable basis for research and application elsewhere in the world.

Aims of the Working Group

1. Design commercially applicable IPM programmes based on biological control of pests and diseases in combination with host-plant resistance and other non-chemical control methods
2. Initiate, coordinate and evaluate fundamental research elementary for development of biological and integrated control programmes
3. Initiate, coordinate and evaluate applied research for development of biological and integrated control programmes
4. Develop scientific criteria for selection of natural enemies
5. Assist in development of mass production methods for natural enemies
6. Devise quality control methods for natural enemies
7. Contribute to courses where IPM and biological control is taught

Main Activities Of The Working Group

During the first phase of the working group (the 1960s and the 1970s) coordination of experimentation and building up a cooperative research network in Europe was the first priority of the working group. In this way unnecessary overlap in research was prevented and results obtained with a new natural enemy in one country could be implemented in other countries.

As a second phase, fine tuned IPM programmes were realized for different cropping systems in a number of European countries in the 1980s. A growing number of natural enemy producers established and an important activity of the working group was to act as liaison between researchers, advisory workers, producers of natural enemies and growers. Coördination of research remained high on the agenda.

The third phase, during the 1990s, consisted of building a scientific background for the evaluation of natural enemies and to develop quality control criteria for the natural enemies which are commercially produced in order to be able to guarantee a certain basic quality of the marketed products.

During the past four years the working group has been very active. Cooperation within Europe with the southern section has been very good: members from each group attended the meetings of the other groups, and helped with organization and teaching of courses on IPM in greenhouses. Many working group members of the northern and southern greenhouse group are now writing chapters for a book on Integrated Management of Pests and Diseases in Protected Cultivation.

The cooperation with the IOBC global working group on quality control of mass produced arthropods was contined, and resulting in several joint meetings and development of guidelines for quality control of natural enemies. Relationships with the study group on Quantitative Approaches in IPM were strengthened and during the full meeting of this working group, a very successful section on modelling and expert systems was held. In order to coordinate activities, 4 issues of the working group's newsletter « Sting » were published.

Working group members contributed to training coursed in IPM in Protected Cultivation organized in Zaragoza (Spain) and Wageningen (The Netherlands). Working group members also collaborated in a number of EC funded research projects.

Working group priorities for the next four years are (a) to develop biological control of pests and diseases in ornementals, (b) to stimulate and integrate biological control of diseases in current IPM programmes, (c) to devise quality control methods for the most important natural enemies presently used in greenhouses, particular attention will be paid to flight-tests and performance tests of natural enemies in greenhouses, and (d) to continue and intensify cooperation with the study group on Quantitative Approaches in IPM.

The results of our work were discussed at the following meetings:

1. A meeting of the southern section of the working group, September 1994, Lissabon, Portugal.
2. The second EC/IOBC workshop on development of quality control criteria for natural enemies, September 1994, Evora, Portugal (report appeared)
3. A combined workshop with the IOBC global working group « Quality Control of Mass Reared Arthropods », October 1995, Santa Barbara, USA
4. The third EC/IOBC workshop on development of quality control criteria for natural enemies, February 1996, Antibes, France (report appeared)
5. The nineth full meeting of the working group, May 1996, Vienna, Austria (bulletin published)
6. The fourth EC/IOBC workshop on development of quality control criteria for natural enemies, February 1997, Barcelona, Spain (report in preparation)

The working group was represented at several international meetings, like the International Congress of Entomology in Florence, Italy (1996), the fifth Brasilian Congress on Biological Control, Foz d'Iguazu, Brazil (1996), and a symposium on biological control in greenhouss, Tokyo, Japan (1996).

Relationships with Other IOBC Groups
Official or ad hoc cooperation took place with the following working groups: « Integrated Control in Glasshouses, Southern Section », « Breeding for Resistance to Insects and Mites », « Pesticides and Beneficial Organisms », « Quantitative Approaches in IPM », IOBC/EPRS and IOBC/NRS working groups « Biological Control in Greenhouses », and IOBC-Global working goup « Quality Control of Mass-reared Arthropods ».

Projects
This working group has, with the exception of the EC funded project on quality control of natural enemies, never worked with projects aimed at joined experiments to compare situations in different European countries. Instead, most of the activities were geared towards stimulating and coordinating research, and preventing overlap in research. This attitude has resulted in a fast screening and development of a number of different natural enemies in different participating countries. After screening, the natural enemies became available for all participating countries.

In the next years we will concentrate our work on the topics mentioned under « aims ». Much attention needs to be paid to IPM in ornementals because of the very large pesticide load these crops receive. To realize IPM in ornementals we need, besides doing scientific research, also to develop activities in the area of advisory work, and intensive international cooperation is necessary to develop reasonable quality standards. Relaxation of the presently irrealistic zero-tolerance, leading to excessive use of pesticides, is the first priority.

Another area of priority is to develop stronger relationships with producers of natural enemies. Topics for research are here: setting up quality control systems, product diversification and specialization, production of natural enemies for secondary pests, and better cooperation to be able to serve the entire European market. The present commercial producers of natural enemies have largely benefitted from the work done by IOBC members. Four years ago, this working group started an EC funded programme entitled « Designing and implementing quality control of beneficial insects: towards more reliable biological pest control » in cooperation with the IOBC global working group on quality control. The reliability and visibility of biological control can be improved considerably when standards for acceptable quality would be used for all marketed natural enemies. Quality standards and efficacy data are also essential to obtain registration or certification of natural enemies in Europe. Scientists in Europe and North America have worked on quality control methods and natural enemy producers are now starting to apply these quality control methods on a regular basis to be able to check and guarantee the effectiveness of their natural enemies. More than 20 participants (researchers and biocontrol companies) from 10 EC and 3 non-EC countries cooperate in this project. At the latest meeting in Barcelona, Spain, 20 quality control guidelines have been accepted as standard, and members of the group hope to continue this very successful programme for other natural enemies.

Working Group "Insect Pathogens and Insect-parasitic Nematodes" Groupe de Travail "Pathogènes d'insectes et les Nématodes entomopathogènes"

Convenor
Dr Peter H. Smits, *DLO-Research Institute for Plant Protection (IPO-DLO), P.O.Box 9060, NL-6700 GW Wageningen, The Netherlands*

Number of participants: both the Poznan meeting in 1995 and the Copenhagen meeting in 1997 were attended by c. 100 persons

Introduction

The working group was founded in 1985, because it was felt there was a need for a forum for scientists in the field of insect pathology and microbial control in Europe. Many insect pathologists already participated and still participate in other working groups of IOBC/WPRS. A forum, in the form of bi-annual meetings and more specialised workshops, stimulates exchange of information, contacts and cooperation. The bi-annual meeting have c.100 attendants, in total 150-200 scientists regularly participate in the activities of the group. This covers the majority of people working in this field in Western Europe. More and more researchers from Eastern European countries attend the meetings as well. The 4-day bi-annual meetings are generally organised around a theme, but there is also room for contributed papers on other subjects. The meetings are a mixture of a conference and discussion meeting. During the meeting subgroup meetings are organised on entomopathogenic nematodes, fungi, bacteria and viruses. By limiting the number of papers and extending the time per paper and by putting additional focus on posters, that are all discussed by small groups, we have been able to create and maintain a very open and loose atmosphere that stimulates discussion and contacts between individual members.

Main Realisations

Activities carried out in the past 4 years

In 1995 a joined meeting with the East-Palearctic working group on insect pathogens was organised in Poznan, Poland. The meeting was attended by 50 scientists from WPRS and the same number from EPRS. The intention of the meeting was to stimulate contacts between scientists in both regions. For many this was the first time they met colleagues known only from literature in person. It was a historic meeting in many ways. The theme of the meeting was the use of insect pathogens in forestry.

In 1997 a meeting was organised in Copenhagen, Denmark. About 100 scientists from 25 countries attended the meeting. The theme this time was a discussion on the role of insect pathogens does and can play in sustainable agriculture.

Together with the European Cost Action 819 the working groups organised several specialised workshops on various aspect of the research on entomopathogenic nematodes.

Subjects

The focus of the meetings may change from forestry to sustainable agriculture but central subjects of all the meetings are the biology and practical use of the five main groups of insect pathogens: bacteria, viruses, fungi, protozoa and nematodes.

Aims

The aim of the working group is to provide a forum for the exchange of information in the field of microbial control of insect pests and to stimulate collaborative research between members of the working group. Our goal is to stimulate the registration, use and commercial development of microbial control agents.

Main scientific results and applications

The use of insect pathogens as microbial control agents is growing and more and more commercial products come to the market. But the total use is still marginal as compared to that of other chemical control agents. The worldwide sales of microbial insecticides has grown to 100 million $/year, but this only marginal compared to the 8 billion $/year sales of chemical insecticides. The main reasons for this are that most microbial insecticides are more expensive and less effective as compared to chemical insecticides. Furthermore the commercial development is hampered by the fact that the registration costs, though lower than those for chemicals, are relatively expensive compared to the annual turnover. Most products are so selective, a good trait in biological eyes, that also their markets are very limited, a very bad trait in marketing eyes. Without government changes in legislation or major changes in consumer attitude no big changes in the present balance will occur. Slowly microbial control will gain a slightly larger but always modest place in the field of insect control.

Relations with the other groups activities

Many of our members also participate in other more crop oriented working groups. Many members also participate regularly in the working group on soil pests.

Organisation of the group

The working group has tow formal subgroups. Ralf-Udo Ehlers is convenor of the subgroup Nematodes and Bernard Papierok is convenor of the subgroup Fungi.

Future Projects

The working group will continue its policy of joined bi-annual meetings but also wants to stimulate groups of members to organise specialised workshops. The working groups also want to continue the process of integration between scientist from EPRS and WPRS and therefore the next meeting of the working group is scheduled for 1999 in St. Petersburg, Russia.

Working Group "Management of arable farming systems for Integrated Control"
Groupe de Travail "Systèmes Intégrées des Grands Cultures"

Convenor
Peter Vereijken, *Research Institute for Agrobiology and Soil Fertility, P.O. Box 14, 6700 AA Wageningen, The Netherlands*

Participants: 25 research teams, each consisting of 1 - 5 scientists. On the annual workshop, each team is represented by the research leader, who should be actively involved in a farming systems project for 50% of his or her time, at least.

Introduction
The IAFS-working group is aimed at designing, testing and improving arable or mixed farming systems equally serving the major social values or interests involved in agriculture: food supply, employment/basic income, profit, environment, nature/landscape and well-being of man and animals. It implies the replacement of systems components only serving a part of this set of objectives (and harming another part) by components serving all objectives (or at least being compatible). An important example is the replacement of pesticide-based plant protection and fertiliser based plant nutrition by integrated plant protection and integrated nutrient management.

The general goal is to elaborate a methodical way of designing, testing, improving and disseminating prototypes of arable or mixed farming systems. These systems should predominantly (Integrated) or rather completely (Ecological) be based on a balanced set of non-chemical crop protection measures.

The Working group organises annual workshops to elaborate the subsequent steps of the prototyping method and discuss the progress in these steps of each project in its regional context. The results are laid down in annual progress reports since 1994. After the fourth report a manual for prototyping Integrated and Ecological Farming Systems will be published. These activities are being sponsored by the EU, as a concerted action.

Main achievements
Currently, 3 of the series of 4 reports have been published (freely available by sending a reprint request to the convenor). The members of the group have largely adopted the common method and experience increasing appreciation for it in their region. Most teams are still in the stage of testing and improving (on an experimental farm or pilot farms), though some teams are already disseminating the new farming methods within their region. Some other teams are still in the stage of designing prototypes behind the desk and preparing their lay-out for testing and improving in practise.

Projects
Crop protection against weeds, pests and diseases overall the farming system has maintained itself as our major theme. However, gradually our farming systems approach is getting more balanced and other themes get the attention they deserve. It concerns themes such as nutrient

management, soil cultivation and crop rotation, which are also major factors in maintaining soil fertility in physical, chemical and biological terms and thereby long term productivity and profitability of the farming systems.

Increasingly, the group is paying attention to the overall manageability of advanced and highly knowledge-intensive farming systems. The sophistication of systems will find a natural boundary in the capacity of farmers to learn, adapt and apply. This awareness compels us system designers to develop farmer-friendly systems, by adapting and improving the prototypes in pilot farms, in interaction with the farmers. Besides, dissemination of the prototype systems is being envisaged.

Relations are to be developed in various directions: first of all within the group to maintain a good balance between interests of individuals, sub-groups with common projects and the group itself. Secondly, relations could be strengthened with other IOBC-groups, to help them in inserting the components they have developed into advanced integrated or ecological farming systems and to get their support in solving detailed problems. Thirdly, relations with farming systems researchers in Mediterranean and East-European countries need to be developed.

Joint publications

Vereijken, P., 1994 (ed.). Designing prototypes. Progress report 1 of the research network on Integrated and Ecological Arable Farming Systems for EU and associated countries, 90 pp., AB-DLO, Wageningen (The Netherlands).

Vereijken, P., 1995 (ed.). Designing and testing prototypes. Progress report 2 of the research network on Integrated and Ecological Arable Farming Systems for EU and associated countries, 90 pp., AB-DLO, Wageningen (The Netherlands).

Vereijken, P., 1996 (ed.). Testing and improving prototypes. Progress report 3 of the research network on Integrated and Ecological Arable Farming Systems for EU and associated countries, 69 pp., AB-DLO, Wageningen (The Netherlands).

Working Group "Biological Control of Fungal and Bacterial Plant Pathogens"

Convenor
Dr. N.J. Fokkema, *IPO-DLO, Research Institute for Plant Protection, P.O. Box 9060, NL-6700 GW Wageningen, The Netherlands*

Founded in 1990
Number of participants: c. 200

Introduction

The aim of the working group is to create a scientific platform for scientists involved in biological control of fungal and bacterial plant pathogens and to promote the implementation of biological control in agricultural practice.

The subject area of the working group comprises disease suppression by naturally occurring antagonists in soil as well as on the plant surface and disease control by introduction of antagonists via application to the soil, artificial substrate, seeds, seedlings, aerial plant parts, harvested products or crop debris. These subjects include the ecology of the antagonists, population dynamics of antagonists and target organisms, mechanisms of interaction, mass production of the antagonists, formulation and registration.

Organisation

Workshops related to the subject area will be organized in association with the Working Group on Biological Control of the European Foundation for Plant Pathology (EFPP). Therefore, a joint management committee has been established consisting for the IOBC/WPRS of C. Alabouvette (France), Y. Elad (Israel) and N.J. Fokkema (the Netherlands) and for the EFPP of G. D,fago (Switzerland), J. Hockenhull (Denmark) and J. Whipps (U.K.).

Activities from 1993 onwards

IOBC/EFPP Workshop "Biolgical control of sclerotium-forming pathogens", 12-14 December, 1994, Wellesbourne. Local organizer: J.M. Whipps. 30 participants from 10 European countries. IOBC/wprs Bulletin 18(3) 1995.

IOBC/EFPP Workshop "Biological and Integrated Control of Root Diseases in Soilless Cultures", 18-21 September 1995, Dijon. Local organizer: C. Alabouvette. 36 participants from 7 European countries. IOBC/wprs Bulletin 19(6) 1996.

Participation in the XIth International Botrytis Symposium, 23-27 June, 1996, Wageningen. Organizing and sponsoring the sessions: Biological Control and Integrated Pest Management.

Organization of the symposium "Biological Control of Plant Diseases: Strategies and Implementation" at the International IOBC Conference "Technology Transfer in Biological Control: from Research to Practice", 9-11 September 1996, Montpellier. IOBC/wprs Bulletin 19(8) 1966.

IOBC/EFPP Workshop "Molecular Approaches in Biological Control", 15-19 september 1997, Delemont, Switzerland. Local organizer: G.Defago. 75 participants from 15 different countries. IOBC/wprs Bulletin in preparation.

Future Activities Planned

1998
Participation in the 7th International Congress of Plant Pathology (ICPP98), 9-16 September with:

- a joint symposium: "Ecological Basis of Biological Control"
- an evening discussion session: "Implementation of biocontrol of diseases"

Participation in the OECD-Workshop "Strategies of Microbial Inoculation for a Sustainable Agriculture", 17-20 August, Dijon. Local organizer: C. Alabouvette. IOBC/wprs Bulletin planned.

1999
IOBC/EFPP Workshop "Biological Control of Plant Pathogens by Management of Crop Residues", May, Wageningen. Local organizer: N.J.Fokkema. IOBC/wprs Bulletin planned.

Working Group "Integrated Protection of Stored Products"
Groupe de Travail "Protection Intégrée des Denrées Stockées"

Convenor
Cornel Adler, *BBA, Institut für Vorratsschutz, Königin-Luise-Str. 19, D-14191 Berlin, Germany*

Number of participants: 33

Introduction

The group studies the biology of stored product pests and environmentally friendly methods to avoid, detect and control infestations in all processes between harvest (production) and consumption. The main focus of interest is on insects and mites that damage durable commodities like grain, pulses, nuts, herbs, teas, dried fruits or tobacco ($a_w < 0.7$).

Main realizations

a) Among the research findings presented, biological control of arthropod pests with parasitoids, predators and microorganisms played a major role. Other important topics were the biology of pests or antagonists as well as trapping and pheromones.. Traditional storage methods were studied to assess losses or to improve local techniques. However, as in the case of hermetic storage or the use of phytochemicals, traditional techniques may have also some potential for the future. Further presentations covered the control of pests with attracticides (mass trapping), controlled atmospheres, inert dusts, physical or chemical methods.

So far, there are no strong relations with other groups, but some group members attended the meetings of the working groups on pheromones and on *Trichogramma.*

It was agreed that Integrated Stored Product Protection should stress on methods to prevent the manifestation of pests like cold storage, low moisture contents, hygiene, low moisture contents and a good structural design. Methods for early pest detection like trapping, the measurement of temperature, movement or CO_2-levels could help to localise infested goods before damages occur or spread. For control, the most appropriate physical, biological or chemical method should be chosen.

b) The study group was founded by Prof. Dr. Giorgio Domenichini on 23.9.1992 in Piacenza during the „5° Simposio sulla difesa antiparassitaria nelle industrie alimentari e sulla protezione degli alimenti" (5th Symposium on pest control in the food producing industry and on the protection of food products") under the name „Integrated protection of stored foodstuffs and other commodities" (15 participants). Meetings were held May 13-14, 1993, in Milano, Italy (27 participants), and September 29-30, 1994, in Prague, Czech Republic (12 participants, proceedings in: Notiziario sulla protezione delle piante, Proceedings of the IOBC wprs study group, No. 2, 68 pp. and No. 4, 93 pp).

In a technical meeting during the XX. International Congress of Entomology, August 27, 1996 in Florenz (25 participants), Prof. Domenichini resigned from his position and the present convenor was elected. The most recent meeting took place in Zurich, August 31-September 2, 1997 (33 participants). There, the new study group name was decided, a definition of Integrated Stored Product Protection was discussed and a food industry company using an integrated approach of pest management was visited. Proceedings will be released as IOBC/wprs Bulletin 21 (3), 1998.

The next meeting is planned for fall 1999 in Berlin, Germany.

Study Group „Integrated Protection in *Quercus* sp. Forests“

Convenor
Claire Villemant, *Museum National d'Histoire Naturelle, 45 rue Buffon, F-75005 Paris, France*

Number: The working group comprises actually 17 active members

Introduction

The general goal of the study group « Integrated protection in *Quercus* sp. forests » is to promote and co-ordinate the research concerning the adverse factors, principally pests and pathogenous fungi, involved in the decay of the oak stands (primarily of cork-oak stands) around the Mediterranean region; this in order to define adequate strategies for their exploitation, conservation and integrated protection.

The formation of this group was approved by the IOBC/WPRS council in early 1993. First of all, it focused on cork-oak forests which are one of the most fragile Mediterranean ecosystems, largely due to their high anthropisation. Cork-oak area extends on about 2.2 million hectares, 1.3 million of which being present in European countries. About 3 million quintals of cork are produced every year. In all countries where the cork-oak grows, a gradual reduction of covered area was observed. During the last 20 years, 300,000 ha of cork-oak stands were lost and the fall of cork production attained 400,000 quintals per year. Cork-oak decay however does not differ from that observed in other *Quercus* species. This phenomenon named « oak decline » is a complex syndrome whose etiology is difficult to define because of the variety of the involved biotic and abiotic factors. The interaction of these factors may predispose the trees to a progressive deterioration and death. Only the collaboration of scientists working on various biological and environmental disciplines could lead to successful management of complex diseases syndromes as in the case of cork-oak decline.

Activities

A first meeting entitled « Integrated Protection in Cork-Oak forests » was held in the cork-oak experimental station in Tempio Pausania, in Sardinia, from 15 to 17th September 1994. The participants shared their findings and tried to harmonise their research concerning study of cork-oak pests and pathogenous fungi, forest management and integrated protection. The research reports, the conclusions and recommendations of the group are reported in the proceedings of the meeting edited by Pr. Pietro Luciano in the IOBC/WPRS Bulletin in 1995).

The studies presented during the meeting were carried out in Sardinia, Corsica, north-eastern Spain, Portugal and Morocco, in cork-oak stands with different climatic, edafic and physiological conditions as well as different forms of forest management and health statuses. The efficiency of the control techniques adopted was evaluated. It appeared necessary to better analyse the complex relationships existing between the various factors involved in forest decline and particularly between fungous diseases and insect pest attack.

Fungi are the most common and harmful pathogenous agents. In Sardinia, Portugal and Morocco, more than 10 species are considered as cork-oak pathogens, inducing leaf diseases and occasionally total defoliation, or producing drying-up and cankers on trunk and branches or ruts on roots and collar. Interesting research were carried out in Portugal and Sardinia concerning the bark fungi which development certainly influences the quality of the cork. The host-pathogens relations and the role played by biotic and abiotic factors which predispose the trees to fungi attack should become subject of intense study.

Among the phytophagous pests, the lepidopterous defoliators (especially the gypsy moth *Lymantria dispar*) are generally the most harmful. Defoliation induced by their outbreaks limits the productivity and the regeneration of the cork-oak. Excellent results however, have been recently obtained in the control of the gypsy moth infestations in Sardinia and Morocco by application of various preparations of *Bacillus thuringiensis*. It would be advisable to test the efficiency of the release of entomophagous insects: those known for their action in limited environments (as for example egg predators in Morocco) as well as parasitoids multiplied on artificial diets (such as *Exorista larvarum* and *Brachymeria intermedia* in Italy).

In wide areas in Portugal and Morocco, serious damage may also be induced on declining stands by bark insects (beetles such as *Coraebus florentinus* and *Coraebus undatus* or the cork-ant *Crematogaster scutellaris*) and by xylophagous insects such as the beetles *Platypus cylindrus* and *Cerambyx cerdo*. Interesting studies should be carried on the population dynamics of these xylophagous pests and on their interactions with fungi, for example : beetles as fungi vectors or fungi as agents of beetle development.

Further group projects concern the continuation of this research by integrating more scientific and technical competency from all the Mediterranean countries where oak forest areas gradually reduced. In order to avoid conditions of plant stress, greater attention should be paid to the forest management of the cork oak-areas concentrating particularly on the density of trees and undergrowth and on the quality of the cork removal. It is necessary moreover, to forgo the cork removal in the driest years or in case of strong attack by pests or pathogenous agents. The rationalisation of grazing and agricultural exploitation is essential to allow natural regeneration of the forest and to maintain the soil adequately fertile.

It is also strongly necessary to make both the authorities and the public of related countries aware about the serious and widespread decline of the cork-oak forests. It is urgent to ensure effective and efficient integrated protection in order to preserve this precious natural resource for the future generations.

Possible common work by pathologists and entomologists would notably concern :

- the drawing up of a list of scientists working on cork oak forest protection ;
- the creation of a service for identification of the cork-oak pathogenous fungi ;
- the improvement of common sampling methods aiming at elaborating models for surveillance and forecasting of the pest infestations ;
- the use of European surveillance grid of the forest phytosanitary conditions and its extension to the Maghreb countries.

At first, it may be advisable to increase collaboration with colleagues from the Maghreb countries, where a large part of the cork manufactured in Europe is produced.

In order to verify the work progress, it is proposed to hold a new meeting in Morocco. Funds were previously allocated by the IOBC council to this second session planned in 1997, but their transfer to the next year is asked owing to the recent change in convenorship and to the reduced available organisation period remaining in 1997. The second meeting would take place in spring 1998. The about thirty scientists working on cork-oak forest protection that have been already listed would be advised accordingly and invited to join to this study group.

Study Group "Critical Assessment of Modeling Approaches in IPM"

Convening committee
Walter A.H. Rossing and Wopke van der Werf, *Department of Theoretical Production Ecology, Wageningen Agricultural University*; Bo J.M. Secher, *Danish Institute of Plant and Soil Science, Lyngby, Denmark*

Number of participants: depending on session

Introduction
By request of the Council of the International Organization for Biological Control in 1995 a new Study Group has been established on the theme of quantitative approaches in IPM. Its mission is twofold:

i. to investigate and overcome reasons for low adoption rates of research- and model-based IPM decision support systems in growers' practice;
ii. to critically evaluate the scientific contents of research models on pest dynamics, damage and management, and their usefulness in applied research.

These objectives require a mode of operation that cuts across current commodity-oriented Working Groups. Therefore, organization of joint meetings are aimed at.

Main achievements:
The period May 1995 – August 1997 has been dedicated to assessment of the relevance of a study group on quantitative methods in IPM. Aims and approach of the Study Group have been established in consultation with the President of IOBC/WPRS, and a core convening committee has been founded. Links have been established with selected Working Groups with the purpose of organizing joint activities.

In May 1996, a joint session was organized during the plenary meeting of the Working Group IPM in greenhouses in Vienna (convenor prof. J.C. Van Lenteren). The first topic of the session focused on 'Decision support tools & learning processes'. Recent sociological research results on use (or non-use) of decision support systems (DSS) by growers were presented which indicate that DSS are used in practice if they support *farmer learning*. Characteristics of learning processes were then used to evaluate two practical decision support systems in terms of usefulness and compliance with grower needs. The second topic of the session addressed 'Factors stimulating and hampering the application of models in applied biocontrol'. After a summarizing presentation of submitted papers, a discussion followed on why the audience (mostly consisting of researchers on applied biological control) *did* or *did not* use models or modeling in their work. The discussion pinpointed a need for adaptable, general pest - natural enemy models at applied research sites and in biocontrol companies. Such model should represent a tool for 'decision support' and 'learning' by applied researchers and biocontrol product / strategy developers. An extended summary is presented in Sting (1996). The approach in the session was received very favourably.

The foundation of the IOBC working group stimulated an enquiry into the scientific basis and practical spinoff of simulation models of pest-enemy systems. A discussion on this topic was held at the Third International Symposium on Population Dynamics of Plant-Inhabiting Mites, June 1995, in Gilleleje, Denmark. An inventory was put together and has been dispatched to a significant number of researchers involved in mite modelling. The purpose is to publish a critical evaluation of the scientific basis and usefulness of simulation modelling for mite management.

A poster on the objectives and approach of the new IOBC study group was presented at the Meeting on Forecasting in Plant Protection, organized by the European Plant Protection Organization in Potsdam, 21-24 November 1995.

Conclusion after 2 years

In the first meeting, the added value of the Study Group's theme and the appropriateness of the approach was evident from response of convenor and participants. At the same time, the approach requires the Study Group to cut across disciplinary and commodity oriented borders, and requires relatively much preparation by the convening committee.

Future projects

Using the experience of the first meeting, the Study Group will organize a session at the Fifth International Symposium on Computer Modeling in Fruit Research and Orchard Management, in Wageningen, the Netherlands, in July 1998. New links to Working Groups will be established, and possibilities for joint sessions explored. The inventory of mite pest-enemy models will be pursued by actively involving model authors in a review. Possibilities for projects in which the gap is bridged between research models and needs of applied researchers, such as identified during the Vienna workshop, will be explored with a view on financing.

Publications

Rossing, W.A.H., Van der Werf, W. and Secher, B.J.M., 1996. Critical evaluation of quantitative approaches in IPM: a new study group of the IOBC. Poster presented at the EPPO Conference on Forecasting in Plant Protection, Potsdam (DE), 1995-11-21/24.

Rossing, W.A.H. and Van der Werf, W., 1996. Contributions of modeling to IPM.. Report of the Workshop. In: J.C. van Lenteren (ed.). Sting. Newsletter on Biological Control in Greenhouses. Dept. Entomology, Wageningen Agricultural University. Vol. 16: 9-12.

Various contributions in: J.C. van Lenteren (ed.) Integrated control in glasshouses. Bulletin IOBC/WPRS 19 (1), 135-138.

Working Group „Integrated Control in Viticulture“

Convenor
Dr. B. Dubos, *INRA – CRA Bordeaux, Pathologie Végétale, 71 Ave. Edouard Bourleaux, F-33883 Villenave d'Ornon Cedex, France*

Working Group „Integrated Control in Citrus Fruit Crops“

Convenor
Dr. C. Vacante, *Università della Tuscia, Dipartimento di Protezione delle Piante, Via S. Camillo de Lellis, I-01100 Viterbo, Italy*

From both Working Groups activity reports have not been delivered for publication in this Bulletin.

IOBC WPRS International Organisation for Biological and Integrated Control of Noxious Animals and Plants: West Palaearctic Regional Section
OILB SROP Organisation Internationale de Lutte Biologique et Integrée contre les Animaux et les Plantes Nuisibles: Section Régionale Ouest Paléarctique

IOBC / WPRS - General Assembly Recommendations

a) Recommendations regarding Working Groups

1. Ameliorate the interaction/collaboration between Working Groups: e.g. start sending the first announcement of workshop to all convenors. Have an accessible plan of all WG-meetings and activity. During the general assembly time should be made available for a formal meeting of convenors, to discuss plans of the next four years and discuss joint meetings.

2. Organise a meeting (one every 4 years) in which the convenors give a presentation of the state of art in their field of research in ca. 30 minutes. Combine these presentations into a IOBC/WPRS bulletin or special issue of BIOCONTROL to produce an up to date of the state of the art in biocontrol and IPM every 4 years. To combine these meetings with the general assembly to make this more attractive and interesting for the convenors and delegates and other interested attendants.

3. Produce a guide-(help) for the convenors, describing what is expected from them (reports, timetables, money matters, publications, addresses), where they can find information, assistance, ...

4. In order to help the treasurer to plan his budget, and to enhance the spread of information on events, the convenor should try to forward a 4 year planning frame on the activities within the working groups.

5. Initiate discussion on elaboration of a position (a view) on genetically modified organisms in relation to guidelines, which influence crop protection practices.

6. A topic on mycotoxins should be included where appropriate.

b) Specific Working Group / Commission concerning recommendations

1. Links should be made with organisations on weed control outside IOBC.

2. Assist the WG on integrated control in cereals to collaborate with other WGs in particular in regard to pathology. Review the scope, activities, structure and collaboration of the WG Fruits flies and WG Management of farming systems for integrated control.

3. Reconsider the mandate of the commission of guidelines.

4. The costs related to the registration of microbial pesticides and pheromones hampers their introduction. This is an old but still persistent problem, which should be brought to the attention to the relevant bodies by IOBC-WPRS. It is a waste of all the money spent in

research if implementation cannot be realised because financial reasons. The mostly small enterprises planning to develop microbial pesticides should therefore get financial support from the EC. Consider setting up a commission.

c) Recommendations regarding publication, presence to the outside

1. Communicate with the rest of the scientific community by an active presence on WWW. Should go electronic as soon as possible.
2. Revise guidelines in consultation with convenors on the desired (minimal) standard of the Bulletin, including timetable.
3. Define policy in regard to WWW and papers from workshops.

d) Recommendations regarding memberships and council administration

1. Explore possibility to involve industrial partner active in integrated control.
2. Intensify acquisition of individual and institutional memberships.
3. Study the possibility to introduce flexible memberships-dues with appropriate criteria to guarantee representation of all regions of WPRS.
4. Publish the summary of minutes (protocols) of executive and council meetings in Profile.

e) Recommendations regarding collaboration with other associations

1. Further develop co-operation with different organisms (FAO, OCDE, EPPO, ... and especially the EU) in those fields that overlap with the activities of IOBC/WPRS; especially towards guidelines. Establish common area with IOBC-Global.
2. The possibility to resume EC-IOBC courses should be investigated.
3. Collaboration between WPRS and EPRS should be continued and stimulated.
4. Technical-/information assistance out of non-WPRS regions requests should be handled by the Executive council and clear procedures should be formulated. Eventual mandate to WPRS-commissions should be formulated.

Commissions, Working Groups, Study Groups
Names of Convenors and Liaison Officers

Commissions	Convenor	Liaison
Publications	Bathon	
Determination and **identification** of entomophagous insects	Baur	
Promotion and extension of WPRS activities	Freuler	
Guidelines in integrated production	Boller	

Working groups

Integrated plant protection in **orchards**	Polesny	Gessler
Integrated plant protection in **stone fruit**	Cravedi	Kozar
Pesticides and **benefical organisms**	Vogt	Bigler
Integrated control in **cereals**	Poehling	Albajes
Breeding for **plant resistance** to insects and mites	Ellis	Tirry
Pheromones and other semio-chemicals in integrated control	Witzgall	Bathon
Integrated control of **soil pests**	Sikora	Kerry
Integrated control in **viticulture**	Dubos	Gessler
Integrated control in **oilseed rape**	Paul	Baayen
Fruit flies of economical importance	Afellah	Afellah
Integrated control in field **vegetables**	Vidal	Esbjerg
Integrated control in **glasshouses continental** climate	Van Lenteren	Blümel
Integrated control in **glasshouses mediterranean** climate	Albajes	Blümel
Integrated control in **citrus** fruit crops	Vacante	Afellah
Insect pathogens and entomoparasitic nematods	Smits	Huber
Management of **farming systems** for integrated production	Vereijken	Esbjerg
Biological control of **plant pathogens**	Fokkema	Alabouvette
Integrated control in **stored products**	Adler	Lavadinho

Study groups

Integrated control in **olives**	Delrio	Afellah
Integrated protection in **oak forest**	Villemant	Lavadinho
Quantitative approaches in IPM (**modelling**)	Rossing	Gessler

Comité exécutif / Executive committee

Dr Esbjerg P.
Université Royale Vétérinaire et Agricole
Departement de Zoologie
Bulowsvej 13
DK-1870 FREDERIKSBERG C.
Danemark

Dr Alabouvette C.
I.N.R.A.
Laboratoire de Recherches sur la Flore Pathogène
17, rue Sully - BP 1540
FR-21034 DIJON Cedex
France

Dr Huber J.
BBA
Inst. for Biological Control
Heinrichstr. 243
DE-64287 DARMSTADT
Allemagne

Dr Gessler C.
Ecole Polytechnique Fédérale de Zurich
Phytomedizin-Pathologie
ETH Zentrum/LFW
Universitätstr. 2
CH-8092 ZURICH
Suisse

Dr Lavadinho A.M.P.
Instituto de Protecçao da Produçao Agro-alimentar
Centro Nacional de Protecçao da Produçao agricola
Quinta do Marquês
PT-2780 OEIRAS
Portugal

Conseil / Council

Dr Afellah H.
I.N.R.A.
Laboratoire de Zoologie
BP578
MEKNES
Maroc

Dr Baayen R.P.
Research Institute for Plant Protection (IPO-DLO)
Binnenhaven 5
P.O. Box 9060
NL-6700 GW WAGENINGEN
Pays Bas

Pr Albajes R.
Universitat de Lleida
Centre Udl-IRTA
Rovira Roure, 177
ES-25006 LLEIDA
Espagne

Dr Bathon H.
BBA
Institute for Biological Control
Heinrichstr. 243
DE-64287 DARMSTADT
Allemagne

Dr Bigler F.
Swiss Federal Research Station for Agronomy
Reckenholzstrasse 191
CH-8046 ZÜRICH
Suisse

Dr Bluemel S.
BFL
Spargelgfeldstr. 191
AT-1126 WIEN
Autriche

Dr Buchelos C.T.
Agricultural University of Athens
Lab. of Agricultural Zoology & Entomology
Lera Odos 75
VOTANIKOS, GR-118 55 ATHENS
Grèce

Dr Kerry B.
IACR-Rothamdted
Entomology & Nematology Department
Harpenden
GB-HERTS AL5 2JQ
Grande Bretagne

Dr Malavolta C.
Servizio Sviluppo Sistema Agroalimentare
Viale Silvani, 6
IT-40122 BOLOGNA
Italie

Dr Kozar F.
Hungarian Academy of Sciences
Plant Protection Institute
Hermann O. u. 15
P.O.Box 102
BUDAPEST, HU-1525
Hongrie

Dr Pettersson J.
Swedish University of Agricultural Sciences
Institute for Entomology
P.O.Box 7044
SE-75007 UPPSALA
Suède

Dr Rossler Y.
Citrus Marketing Board
Israel Cohen.Inst.J.Biol. Control
B.o.Box 80
50250 BET DAGAN
Israel

Prof Tirry L.
University of Gent
Lab. of Agrozoology - Dept. of Crop Protection
Coupure Links 653
BE-9000 GENT
Belgique

Comité de Gestion / Management Committee

Dr Royle D.J.
University of Bristol
AFRC Inst. of Arable Crops Research -
Long Ashton Research Station
LONG ASHTON, BRISTOL BS18
9AF
Grande Bretagne

Dr Castanera P.
C.S.I.C.
Centro de Investigaciones Biologicas
Velasquez, 144
ES-28006 MADRID
Espagne

Dr Frazao A.
IPPA
Centro Nacional de Proteccao da
Produçao Agricola
Quinta do Marquês
PT-2780 OEIRAS
Portugal

Dr Freuler J.
Station Fédérale de Recherches en
Production Végétale de Changins
Route de Duillier
CH-1260 NYON
Suisse

Dr Poitout S.H.
I.N.R.A. Unité de Zoologie
Domaine Saint Paul
Site Agroparc
FR-84914 AVIGNON Cedex 9
France

Commissions

Dr Bathon H.
BBA
Institute for Biological Control
Heinrichstr. 243
DE-64287 DARMSTADT
Allemagne

Dr Freuler J.A.
Station Fédérale de Recherches en
Production Végétale de Changins
Route de Duillier
CH-1260 NYON
Suisse

Dr Boller E.F.
Eidg. Forschungsanstalt Obst-., Wein &
Gartenbau
CH-8820 WAEDENSWIL
Suisse

Dr Baur H.
Department of Invertebrates
Natural History Museum
Bernastrasse 15
CH- 3005 BERN

Groupes de travail / Working Groups

Dr Adler C.
BBA
Institut für Vorratsschutz
Königin-Luise-Str. 19
DE-14195 BERLIN
Allemagne

Dr Afellah H.
I.N.R.A.
Laboratoire de Zoologie
BP578
MEKNES
Maroc

Pr Albajes R.
Universitat de Lleida
Centre Udl-IRTA
Rovira Roure, 177
ES-25006 LLEIDA
Espagne

Dr Cravedi P.
Univ. Cattolica del Sacro Cuore
Inst. di Entolologia e Patologia vegetale
Via Emilia Parmense 84
IT-29100 PIACENZA
Italie

Dr Dubos B.
I.N.R.A., Pathologie Végétale
71, Ave. Edouard Bourleaux
B.P. 81
FR-33883 VILLENAVE d'ORNON
Cedex
France

Dr Ellis P.R.
Horticulture Research International
Dept. Entomol. Sciences
Wellesbourne,
GB-WARWICK CV35 9EF
Grande Bretagne

Dr Fokkema N.J.
IPO-DLO, Res. Inst. for Plant Protection
P.O. Box 9060
NL-6700 GW WAGENINGEN
Pays Bas

Dr Kerry B.
IACR-Rothamdted
Entomology & Nematology Department
Harpenden
GB-HERTS AL5 2JQ
Grande Bretagne

Dr van Lenteren J.C.
Wageningen Agricultural University
Dept. of Entomology
P.O. Box 8031
NL-6700 EH WAGENINGEN
Pays Bas

Dr Paul V.H.
Universität - GH Paderborn
Fachbereich Agrarwirtschaft
Lübecker Ring 2
DE-59494 SOEST
Allemagne

Dr Poehling H.M.
Universität Hannover
Inst. für Pflanzenkranheiten &
Pflanzenschutz
Herrenhäuserstr. 2
DE-30419 HANNOVER
Allemagne

Dr Polesny F.
BFL,
Fed. Office & Res. Centre of Agriculture
Inst. of Phytomedicine
Spargelfeldstrasse 191
AT-1220 VIENNE
Autriche
Dr Sikora

Dr Sikora
Universität Bonn
Institut für Pflanzenkrankheiten
Nussallee 9
DE-53115 BONN
Allemagne

Dr Smits P.H.
DLO Res. Inst. for Plant Protection (IPO-DLO)
P.O. Box 9060
NL- 6700 GW WAGENINGEN
Pays Bas

Dr Vacante V.
Universita della Tuscia
Dipt. di Protezione delle Piante
Via S. Camillo de Lellis
IT-01100 VITERBO
Italie

Dr Vereijken P.
DLO Res. Institute for Agrobiology and Soil Fertility
P.O. Box 14
NL-6700 AA WAGENINGEN
Pays Bas

Dr Vidal S.
Justus-Liebig-Universität
Institut für Phytopathologie
und angewandte Zoologie
Alter Steinbacher Weg 44
DE-35394 GIESSEN
Allemagne

Dr Vogt H.
BBA
Inst. für Pflanzenschutz im Obstbau
Schwabenheimerstrasse 101
DE-69221 DOSSENHEIM
Allemagne

Dr Witzgall P.
Swedish Univ. of Agricultural Sciences
Dept. Plant Protection Sciences
Box 44
SE-230 53 ALNARP
Suède

Dr Adler C.
BBA
Institut für Vorratsschutz
Königin-Luise-Str. 19
DE-14195 BERLIN
Allemagne

Groupes d'étude / Study Groups

Dr Delrio G.
Universita degli Studi
Istituto di Entomologia Agraria
Via Enrico de Nicola
IT-07100 SASSARI
Italie

Dr Rossing W.A.H.
Wageningen Agricultural University
Dept. of Theoretical Production Ecology
P.O. Box 430
NL-6700 AK WAGENINGEN
Pays Bas

Dr Villemant C.
Museum National d'Histoire Naturelle
Laboratoire d'Entomologie
45 rue Buffon
FR-75005 Paris
France

List of the Participants

Abad, Pierre	INRA, Centre de Recherches d'Antibes Laboratoire de Biologie des Invertébrés 123, Boulevard Francis Meilland 6606 Antibes Cedex, FRANCE
Adler, Cornel	Federal Biological Research Centre for Agriculture & Forestry Königin Louise-Straße 19 14195 Berlin, GERMANY
Aeschlimann, Jean-Paul	Agropolis 66, allée Mac Laren 34394 Montpellier, FRANCE
Afellah, Mohamed	INRA, Laboratoire de Zoologie B.P. 578 Meknès, MAROC
Alabouvette, Claude	INRA, Flore Pathogène 17, rue Sully BV 1540 21034 Dijon Cedex, FRANCE
Albajes, Ramon	IRTA, (Institut de Recerca i Tecnologia Agroalimentaries) Av. Rovira Roure 177 25006 Lleida, SPAIN
Amaro, Pedro	Instituto Superior de Agronomia Tapada de Ajuda 1399 Lisboa, PORTUGAL
Baayen, Robert	DLO, Research Institute for Plant Protection P.O. Box 9060 6700 GW Wageningen, The NETHERLANDS
Bathon, Horst	Institute for Biological Control Heinrichstr. 243 64287 Darmstadt, GERMANY
Berger, Harald K.	BFL Spargelfeldstr. 191 1226 Wien, AUSTRIA
Blümel, Sylvia	BFL Spargelfeldstr. 191 1226 Wien, AUSTRIA

Boller, Ernst	Swiss Federal Research Station for Fruit Growing, Viticulture and Horticulture 8820 Wädenswil, SWITZERLAND
Castanera, Pedro	CSIC-CIB Velazquez 144 28006 Madrid, SPAIN
Cravedi, Piero	Instituto di Entomologia e Patologia Vegetale Via Emilia Parmense 84 29100 Piacenza, ITALY
Degheele, Chretienne	Laboratory of Agrozoologoy, University of Ghent Coupure links 653 9000 Gent, BELGIUM
Dubos, Bernadette	INRA-CRA de Bordeaux, Station de Pathologie Végétale 71, avenue Edouard Bourleaux 33883 Villenave d'Ornon cedex, FRANCE
Ellis, Bob	Horticulture Research International Wellesbourne Warwick CV35 9EF Warwick, UK
Esbjerg, Peter	Zoology Section, Royal Veterinary and Agricultural University Thorvaldsensvej 40 1871 Frederiksberg C, DENMARK
Finch, Stan	Horticulture Research International Wellesbourne Warwick CV35 9EF Warwick, UK
Fokkema, Nyckle	IPO-DLO P.O.Box 9060 6700 GW Wageningen, The NETHERLANDS
Foletto, Bruno	Servizio Fitosanitario Regionale OSS: Manl. Piante Regione Veneto Lungadige Capuleti 11 37122 Verona, ITALY
Frazao, Amélia	Direccao-Geral de Proteccao das Culturas Quinta do Marques 2780 Oeiras, PORTUGAL
Freuler, Jost	Station Fédérale de Recherches en Production Végétale de Changins 1260 Nyon, SWITZERLAND

Gessler, Cesare	Inst. Plant Sciences, Phytomedicine / Pathology ETH Zentrum / LFW Universitätstraße 2 8092 Zürich, SWITZERLAND
Goncalves, Mario	Direccao-Geral de Proteccao das Culturas Tapada de Ajuda 1300 Lisboa, PORTUGAL
Hassan, Sherif	Institute for Biological Control Heinrichstraße 243 64287 Darmstadt, GERMANY
Höbaus, Erhard	BM für Land- und Forstwirtschaft, Abt. IIA2 Stubenring 1 1010 Wien, AUSTRIA
Hron, Reiner	BFL Spargelfeldstr. 191 1226 Wien, AUSTRIA
Huber, Juerg	Institute for Biological Control Heinrichstraße 243 64287 Darmstadt, GERMANY
Jourdain, Jean Marc	CTIFL 22, Rue Bergère 75009 Paris, FRANCE
Kerry, Brian R.	IACR- Rothamsted Harpenden Hertfordshire AL5 2JQ Hertfordshire, Harpenden, UK
Köchl, Arnold	BFL Spargelfeldstr. 191 1226 Wien, AUSTRIA
Koschier, Elisabeth	Universität für Bodenkultur, Institut für Pflanzenschutz Peter Jordanstr. 82 1190 Wien, AUSTRIA
Kozar, F.	Plant Protection Institute Hermann O. u. 15 1022 Budapest, HUNGARY
Luh, Brigitte	BFL Spargelfeldstr. 191 1226 Wien, AUSTRIA

Masutti, Luigi	Instituto di Entomologia Agraria – Università di Padova Via Romea 16 35020 Legnaro PD, ITALY
Minks, Albert K.	IPO-DLO, Research Institute for Plant Protection P.O. Box 9060 6700 GW Wageningen, The NETHERLANDS
Montes de Oca, Mireille	Secretariat Permanent OILB Av. Agropolis 34394 Montpellier Cedex 5, FRANCE
O'Gara, Fergal	Microbiology Department, University College Cork, IRELAND
Oukil, Salah	I.N.P.V. Av. Des Frères Ouadek Hacénes Badi Echarra El Harrach, ALGERIA
Paul, Volker H.	Universität GH Paderborn Lübecker Ring 2 59494 Soest, GERMANY
Pöhling H.M.	Universität Hannover Institut für Pflanzenkrankheiten und Pflanzenschutz Herrenhäuserstr. 2 30419 Hannover, GERMANY
Poitout, Henri S.	Institut National de la Recherche Agronomique Site Agroparc, Domaine St. Paul 84914 Avignon, FRANCE
Polesny, Friedrich	BFL Spargelfeldstr. 191 1226 Wien, AUSTRIA
Rabasse, Jean Michel	INRA, Laboratoire de Biologie des Invertébrés 37, Boulevard du Cap 06600 Antibes, FRANCE
Reisenzein, Helga	BFL Spargelfeldstr. 191 1226 Wien, AUSTRIA
Royle, David J.	University of Bristol, Long Ashton Research Station Long Ashton BS18 9AF Bristol, UK

Ruiu, Pino Angelo	Stazione Sperimentale del Sughero Via Limbara 3 7029, Tempio Pausania SS, ITALY
Smetnik	RUSSIA
Smits, Peter	IPO-DLO, Research Institute for Plant Protection P.O. Box 9060 6700 GW Wageningen, The NETHERLANDS
Szith, Richard	Landwirtschaftskammer für Steiermark Hamerlinggasse 3 8020 Graz, AUSTRIA
Tirry, Luc	Dept. of Crop Protection, University of Ghent Coupure links 653 9000 Gent, BELGIUM
Vidal, Stefan	Institut für Pflanzenkrankheiten und Pflanzenschutz Herrenhäuserstr. 2 30419 Hannover, GERMANY
Villemant, Claire	Museum National d'Histoire Naturelle, Lab. d'Entomologie 45, rue Buffon 75005 Paris, FRANCE
Waage, Jeff	International Institute of Biological Control Silwood Park, Buckhurst Rd. Ascot, Berkshire SL5 7TA, UK
Wegensteiner, Rudolf	Univ. für Bodenkultur Wien, Inst. für Forstentomologie Hasenauerstr. 38 1190 Wien, AUSTRIA
Witzgall, Peter	Swedish University of Agrocultural Sciences, Department of Plant Protection SLU Box 44 23053 Alnarp, SWEDEN
Yamvrias, Christos	Agricultural University of Athens 75, Iera Odos 11855 Athens, GREECE
Zwatz, Bruno	BFL Spargelfeldstr. 191 1226 Wien, AUSTRIA