ORGANISATION INTERNATIONALE DE LUTTE BIOLOGIQUE
CONTRE LES ANIMAUX ET LES PLANTES NUISIBLES

INTERNATIONAL ORGANIZATION FOR BIOLOGICAL
CONTROL OF NOXIOUS ANIMALS AND PLANTS

RAPPORT D'ACTIVITE

1975

ACTIVITY REPORT

BULLETIN SROP
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INTRODUCTION

Après un délai d'un an, pendant lequel est paru le Bulletin OILB/SROP n° 1975/1 intitulé "Progrès en lutte biologique et intégrée", qui est un recueil de l'ensemble des contributions soumises à l'Assemblée Générale tenue en Espagne du 7 au 11 octobre 1974, le Rapport d'activité pour l'année 1975 se présente encore une fois sous la forme des années précédentes. Vous trouverez donc réunie dans le présent rapport une collection plus ou moins hétérogène de courtes sélections, y compris les rapports d'áctivité des divers Commissions et Groupes de travail de l'OILB/SROP, ainsi que des comptes-rendus des réunions qui ont eu lieu pendant l'année 1975.

Malgré le fait qu'il y ait des lignes générales qui permettent le fonctionnement de ces groupes, il est évident que d'importantes différences dans l'organisation s'avèrent cependant, d'un groupe à l'autre. Les rapports qui font partie du présent document reflètent cet état d'affaires et donnent au lecteur une impression juste de la variété des activités entreprises par notre organisation pendant l'année 1975. Ces rapports montrent l'importance de l'expansion de la mise au point et de l'application de la lutte biologique et intégrée contre les ravageurs dans notre région. On est actuellement en train d'étudier un nombre important de cultures et la mise en route "au niveau de l'agriculteur" a vu une augmentation rapide. L'important rôle joué par l'OILB/SROP dans la réalisation de ces projets a été rendu possible seulement grâce à l'effort considérable fait par les responsables et les membres des Groupes de travail et des Commissions.

L. BRADER
Secrétaire Général

INTRODUCTION

In 1975 we return to the Activity Report form of previous years after departing from it in 1974 to publish IOBC/WPRS Bulletin 1975/1, "Progress in Biological and Integrated Control", which was a compilation of all contributions to the General Assembly held in Spain 7 - 11 October 1974. You will therefore find in this Activity Report a rather heterogeneous collection of short contributions including individual activity reports from the Commissions and Working Groups of our Section as well as reports of the various meetings held in 1975.

Although general guidelines are set out to enable the functioning of these groups, it is evident that important differences in organization do nonetheless occur from group to group. The reports included in this publication reflect this state of affairs, and as such allow the reader a realistic view of the diverse activities undertaken by the Organization in 1975. These reports bear evidence of expanded development and application of biological and integrated pest control in our region. A large number of crop situations is currently under study, and application at the grower level is increasing rapidly. The important role played by IOBC/WPRS in these accomplishments has been made possible only through the support of our growing membership and especially the great effort put forth by convenors and members alike of our Commissions and Working Groups.

L. Brader
Secretary General

1. RAPPORTS D'ACTIVITE / ACTIVITY REPORTS

1.1 COMMISSIONS

1.1.1 COMMISSION DES PUBLICATIONS
COMMISSION ON PUBLICATIONS AND INFORMATION

Responsables : A. DUNN, R.J. DYSART, B. HURPIN, G. REMAUDIERE

Adresse / Address : B. HURPIN, Station de Recherches de Lutte Biologique et de Biocoenotique, 78 - La Minière par Versailles, France.

Pour répondre au souhait de plusieurs membres du Conseil de la SROP et de l'OILB globale, le format, la présentation et la typographie de ENTOMOPHAGA ont été modifiés à partir du tome 20 (1975). Une couverture et des caractères typographiques plus modernes ont été adoptés, après accord des participants à l'Assemblée Générale de Madrid. Les réactions dont nous avons eu connaissance sont toutes favorables.

Par contre, à cause de la situation socio-économique des imprimeries françaises, un retard regrettable est enregistré dans la parution des fascicules, en dépit de réclamations renouvelées près de l'Imprimerie Nouvelle et près de la librairie Le François. Le fascicule 1 a été diffusé en juin et le fascicule 2 en fin septembre. Les premières épreuves des fascicules 3 et 4 dont les manuscrits ont été envoyés à l'impression respectivement les 3 mai et 13 août, sont attendues début novembre, de sorte que la parution de ces deux fascicules se trouvera reportée à 1976. Il est promis par l'imprimeur que cette situation fâcheuse ne se renouvellera pas l'an prochain. La table des matières du tome 20 compte 48 articles, représentant approximativement 400 pages dont environ 36 payées par les auteurs à raison de 100 francs suisses par page.

Afin de réduire les charges de la SROP, tous les échanges avec des revues étrangères ont été supprimés à partir de 1976 : les services éditeurs de ces revues ont été avertis au mois d'août. Dans ces conditions

et en fonction des nouveaux membres à la SROP, qui reçoivent chacun désormais 6 exemplaires de ENTOMOPHAGA selon la règle établie antérieurement, le budget de la SROP aura à prendre en charge en 1976, 210 exemplaires pour distribution aux Institutions membres, ce nombre sera majoré s'il y a de nouvelles adhésions.

Du fait de l'augmentation constante du prix de revient de la revue, la librairie Le François a porté à 150 Francs français le tarif de l'abonnement à partir de 1976. Malgré ses charges financières croissantes, l'éditeur d'ENTOMOPHAGA accepte de faire bénéficier les membres individuels de l'OILB globale ainsi que la SROP d'un tarif préférentiel de 57,50 francs suisses pyaés en 1974 et 1975 alors que le prix de l'abonnement est majoré de 25%(1).

Fin octobre 1975 la revue est diffusée à 859 exemplaires : 421 abonnés, 241 au compte de la SROP et 197 membres individuels, alors qu'en 1974 le total des envois d'ENTOMOPHAGA était de 996. La différence est donc essentiellement due à la diminution considérable des membres individuels américains : 100 cette année au lieu de 257 l'an passé.

1.1.2 COMMISSION DE PATHOLOGIE DES INSECTES ET DE LUTTE MICROBIOLOGIQUE
COMMISSION ON INSECT PATHOLOGY AND MICROBIAL CONTROL

Responsables : W.A.L. DAVID, P. FERRON et C. VAGO

Adresse / Address : P. FERRON, Station de Recherches de Lutte Biologique
78 - La Minière par Versailles, France

Suite aux décisions prises lors de l'Assemblée Générale de Madrid (octobre 1974) donnant comme activités prioritaires à la Commission de Pathologie des Insectes et de Lutte Microbiologique la création de Groupe de réflexion puis de Groupes de travail sur la technologie de la production des préparations microbiologiques entomopathogènes et sur

(1) A noter que les tarifs de Journal of Economic Entomology et Environmental Entomology ont augmenté de 36% de 1974 à 1976, les Annales de Zoologie Ecologie Animale de l'INRA de 40% pendant la même période, par exemple.

l'innocuité des microorganismes concernés pour les vertébrés, des contacts ont été pris principalement avec le Groupe de travail Lutte microbiologique contre Lymantria dispar. En effet la réorientation des activités de ce Groupe de travail a été définie compte tenu du fait que les secteurs multiplication du virus de Lymantria susceptible d'être utilisé comme moyen de lutte biologique, et innocuité de ce virus pour les vertébrés, seraient pris en charge en priorité par les futurs groupes de travail à créer dans ce but.

En raison de la convergence des programmes de travail entre le Laboratoire de lutte biologique de Demun (Yougoslavie) (J.L. VASILJEVIC et M. INJAC) et la Station de Recherches de lutte biologique INRA de La Minière (B. HURPIN et A. BURGERJON) sur ce même problème de la virose de Lymantria dispar, il a été convenu lors de la réunion de Paris (12 mars 1975) de demander :

- d'une part à B. HURPIN et A. BURGERJON un rapport sur les possibilités d'emploi de la centrifugation zonale de type industriel pour la purification du virus;
- d'autre part à M. INJAC un rapport sur les méthodes et techniques utilisées aux USA pour assurer la multiplication et la purification de ce même virus.

Ces démarches n'ayant pas encore abouti, la réunion en Angleterre des trois coresponsables de la Commission, prévue au cours de l'année 1975 n'a pas eu lieu. Il est envisagé pour 1976 une réunion d'experts de la technologie de la multiplication des microorganismes (et donc des virus en priorité) et de l'innocuité de ces mêmes germes pour les Vertébrés (les recherches conduites actuellement en France sur l'innocuité du Rhabdionvirus d'Oryctes pouvant servir de base de discussion). Il est souhaité que cette réunion d'experts qui pourrait avoir lieu à Paris aux environs du 15 octobre 1976 soit informelle et limitée à un faible nombre de participants. Elle aura pour but de définir les orientations et la composition des Groupes de travail à créer.

Enfin, bien qu'il ne s'agisse pas à proprement parler d'une activité spécifique de la Commission, signalons qu'une revue bibliographique des recherches effectuées au cours des dix dernières années sur les champignons entomopathogènes a été présentée par P. FERRON dans le Bulletin OILB/SROP, 1975/3.

1.2 GROUPES DE TRAVAIL / WORKING GROUPS

1.2.1 LUTTE INTEGREE EN VERGERS / INTEGRATED CONTROL IN ORCHARDS

Responsable : H. STEINER

Adresse / Address : H. STEINER, Landesanstalt für Pflanzenschutz, Reinburgstrasse 107, 7 Stuttgart W., D.B.R.

Sitzungen

a. Integrierte Bekämpfung im Hopfenanbau, Linz (Österreich), 16.-18. Juli 1975 15 Teilnehmer aus 7 Staaten. Leitung: I. Hrdý / H. Steiner.

Es wurde über den heutigen Pflanzenschutz in den wichtigsten europäischen Hopfenanbaugebieten berichtet und über die damit Zusammenhängenden Probleme: Zunehmende Resistenz der Hopfenblattlaus (Phorodon humuli) und der Gemeinen Spinnmilbe (Tetranychus urticae), Zunahme des Echten Mehltaus als Folge der Bekämpfung des Falschen Mehltaus und steigende Bekämpfungskosten.

Diskutiert wurde über die Möglichkeiten des Resistenzgrads vor allem der Hopfenblattlaus, über die natürlichen Feinde der Hopfenschädlinge, über Möglichkeiten integrierter Bekämpfungsprogramme, über die Verminderung der Peronospora-Spritzungen und über die künftige Zusammenarbeit. Die Teilnehmer kamen überein daran mitzuarbeiten, die derzeitige präventive Bekämpfung durch eine den ökologischen Gegebenheiten angepasste zu ersetzen und legten dafür ein Arbeitsprogramm fest.

b. Integrierte Bekämpfung in Birnenanlagen, Manosque (Frankreich); 16.-18. Sept. 75 30 Teilnehmer aus 9 Staaten. Leitung: H. Milaire / Bassino.

Berichtet wurde über den aktuellen Pflanzenschutz in den europäischen Birnenanlagen, ebenso über die Tätigkeit und über die bisherigen Versuchsergebnisse der französischen Kollegen, die auf diesem Gebiet arbeiten. Schliesslich wurde über die Möglichkeiten einer integrierten Bekämpfung der wichtigsten Schädlinge und Krankheiten in Birnenanlagen diskutiert.

Es zeigte sich, dass die Prognose und die Bekämpfung des Birnblattsaugers (Psylla piri) und der Schalenwickler (Adoxophes reticulana, Pandemis

heparana und ribeana und anderer) noch erhebliche Schwierigkeiten bereiten.

c. OILB/SROP - Richtlinien für integrierten Pflanzenschutz, vorgesehen für 9. oder 10. Dezember in Heilbronn (BRD).

Bei dieser Sitzung sollen von Vertretern der EPPO, der OILB/SROP, der Nahrungsmittelindustrie, des Handels und der Verbraucher die Möglichkeiten diskutiert werden, im Bereich der OILB/SROP einheitliche Richtlinien für den integrierten Pflanzenschutz für verschiedene Kulturpflanzen festzulegen und zu benützen.

Kleinere Sitzungen

Aktivität der Arbeitsgruppe:

Stuttgart, 29.4.1975 (L. Brader, H. Steiner)

Montfavet, 15.9.1975 (M. Baggiolini, P. Gruys, H. Milaire, H. Steiner)

Herausgabe der Broschüren für integrierten Pflanzenschutz im Obstbau

München, 29.1.1975 (E. Naton, H. Steiner)

Stuttgart, 24.4.1975 (E. Naton, H. Steiner)

Lienden/Wageningen, 9.9.1975 (L. Brader, P. Gruys, H. Steiner, PUDOC)

Broschüren "Anleitung zum Integrierten Pflanzenschutz"

Im Laufe des Jahres erschienen:

- Anleitung für den integrierten Pflanzenschutz - visuelle Kontrollen im Apfelanbau- , 2.Auflage (deutsch), Wageningen 1975, 71 S.
- Introduzione alla lotta integrata - Guida per i rilievi periodici dei nemici del mele-, Prima edizione (italienisch), Verona 1975, 80 p.
- Integrated Control in Orchards. 5th Symposium Bolzano 1974, Wageningen 1975, 369 pp. (Redaktion L. Brader)
- Anleitung für den integrierten Pflanzenschutz - Die Klopfmethode -, Wageningen 1975, 145 S. (voraussichtlich Nov. 1975) 1.Aufl. (deutsch)
- Anleitung für den integrierten Pflanzenschutz - Die Nutzorganismen in Apfelanlagen-, 1.Auflage (deutsch), Wageningen 1975, 242 S. (vorauss. Dez.1975)

1.2.2 LUTTE BIOLOGIQUE CONTRE LES COCHENILLES ET LES ALEURODES DES AGRUMES / BIOLOGICAL CONTROL OF CITRUS COCCIDS AND ALEURODIDS

Responsable : C. BENASSY

Adresse / Address : C. BENASSY, INRA Station de Zoologie et de Lutte Biologique, 37 Bd du Cap, Antibes, France

La dernière réunion du groupe, la 3ème tenue à Palerme du 24 au 26 septembre 1974, permettait au cours de l'autonne dernier d'apporter d'utiles précisions au niveau de chacun des quatre thèmes regroupant l'activité du groupe depuis le début de son fonctionnement.

Ainsi, dans le domaine de l'écologie des ravageurs et de leurs parasites, comme de l'application pratique de la lutte biologique, un certain nombre de résultats reproductibles devaient être mentionnés, la majorité des participants ayant fait leur la recommandation antérieure visant à établir des méthodes communes d'évaluation des populations.

C'est pourquoi, à côté de l'action poursuivie dans le domaine fondamental, le groupe a-t-il essayé de développer la lutte biologique dans les divers pays méditerranéens non encore officiellement gagnés à cette technique de lutte (Algérie, Espagne, Sardaigne).

Sur le plan fondamental les travaux poursuivis sur Citrus cette année ont porté suite à l'orientation des études exposées à Palerme, sur les Aleurodes, les Diaspines et les Pseudococcines avant tout, car S. oleae figurant parmi les trois principaux ravageurs de l'olivier, fait l'objet à ce titre d'un programme spécial de la part de la F.A.O.

Le groupe suit néanmoins avec une grande attention les divers progrès susceptibles d'intervenir dans la manipulation de tout nouvel entomophage, en vue de son utilisation pratique contre S. oleae au niveau des Citrus, tandis qu'il fonde beaucoup d'espoir pour le futur sur l'étude de systématique entreprise à l'échelle du Bassin méditerranéen par l'un de ses membres, sur le plan développement, des missions variées en vue soit d'établir et de coordonner les programmes dans le cadre d'accords bilatéraux de coopération technique (Aleurodes, Cochenilles : Espagne), soit de proposer des orientations pratiques sur des problèmes précis (Pou de Californie,

P. citri : Sardaigne) et la participation active de divers membres du groupe au séminaire d'Alger (24-28 mars 1975) sur les ravageurs des agrumes, mobilisèrent une partie non négligeable de l'activité de beaucoup au cours de cette année.

Cette dernière peut schématiquement se résumer ainsi :

Aleurodes : Les études menées sur les deux espèces d'Aleurodes inféodés aux Citrus, Aleurothrixus floccosus et Dialeurodes citri ont été poursuivies à la fois en Corse et sur la Côte d'Azur pour une analyse plus finie des interactions entre la plante-hôte et le phytophage susceptibles d'expliquer les différences fondamentales observées dans la dynamique des populations des deux ravageurs dans le même biotope et pour un ravageur déterminé, en l'occurrence D. citri, dans des biotopes différents (Italie, Corse, Côte d'Azur).

Parallèlement l'efficacité et le pouvoir de dispersion et de dissémination de °Cales noacki, parasite spécifique d'Aleurothrixus floccosus ont été suivis simultanément en Corse et au Maroc et confirment les résultats exceptionnels enregistrés sur la Côte d'Azur. Il semble que les modalités d'un équilibre durable entre C. noacki et son hôte puissent être précisées dès 1976.

D'autre part, le souci d'introduire et de libérer un parasite spécifique de Dialeurodes citri, ravageur dangereux en pleine extension en Corse, Italie et Algérie a conduit au développement, en France, d'essais de maintien constant de l'élevage du ravageur en conditions contrôlées, propres à assurer dans l'avenir une production suivie de l'auxiliaire utilisé.

Diaspines : Les études menées sur les différentes espèces citricoles A. aurantii, L. beckii et P. pergandei notamment ont été poursuivies pour une analyse plus précise des différents facteurs intervenant sur la dynamique des populations.

C'est ainsi que l'évolution et l'efficacité d'Aphytis lepidosaphes ont été précisées en Corse et sur la Côte d'Azur, tandis que l'efficacité pratique confirmée d'A. melinus vis-à-vis d'Aurantii au Maroc permettait à ce dernier pays d'exporter les premiers lots de fruits indemnes de toute intervention chimique.

Dans le domaine de l'élevage, un effort particulier a été réalisé en France en vue de l'introduction, de la mise en souche et des premiers tests d'efficacité vis-à-vis d'Unaspis yanonensis d'une espèce nouvelle, indiscernable morphologiquement d'A. lingnanensis, mais évoluant sur Unaspis citri en Floride.

En outre, dans le secteur de l'aménagement des programmes phytosanitaires, l'expérimentation conduite en Sicile sur Aspidiotus hederae et sa faune associée a conduit à la mise en route de tests de laboratoire comme moyen de sélection.

Pseudococcines : C'est la préoccupation principale également dans le domaine de P. citri en Italie où les recherches sur l'association insecticides - entomophages sont conduites à l'extérieur comme en laboratoire avec des méthodes voisines de celles adoptées par le groupe OILB "Insecticides et arthropodes utiles".

Lécanines : Quant aux recherches sur S. oleae, si l'on excepte l'étude actuellement en cours de morphologie comparée des divers individus récoltés dans les différents pays riverains du Bassin méditerranéen et celle de longue haleine, relative à la dynamique des populations de S. oleae par l'établissement des tables de sruvie, elles concernent avant tout l'aspect pratique de la lutte biologique. En Grèce, notamment, la diversification préconisée des méthodes d'élevage de S. oleae (sur pommes de terre, sur Nerium oleander, sur olivier et sur citrus) comme l'essai de plantes hôtes variées pour la multiplication aisée de S. coffeae et la recherche de nouveaux hôtes de substitution pour la production de parasites importés ne concourent qu'à un seul et même but : tester le plus grand nombre de parasites possible au fur et à mesure de leur obtention.

1.2.3 LUTTE GENETIQUE CONTRE CARPOCAPSA ET ADOXOPHYES
GENETIC CONTROL OF CODLING MOTH AND ADOXOPHYES

Responsable : TH. WILDBOLZ

Adresse / Address : TH. Wildbolz, Eidg. Forschungsanstalt für Obst-, Wein- und Gartenbau, Abt. Entomologie, 8820 Wädenswil Suisse

The field of activity of the group originally centred on the genetic control of codling moth and Adoxophyes has been broadened. It will include integrated control and all alternatives to chemical control. Activities of the group will however be restricted to fields of active research.

Contacts with the working group of the International Atomic Energy Agency on the sterile insect release method of codling moth have been intensified. A joint meeting of the two groups, originally scheduled for Kiev, will be held in Vienna, November 17-21, 1975. By combining the meetings of the two groups an exchange of results will be possible with specialists from North America and Eastern Europe.

A review of current research and research programmes on the sterile insect release technique of codling moth and related fields will be made during the Vienna meeting. This review as well as recommendations for future action will be summarised at the end of the meeting.

The agenda of the meeting and the papers submitted reflect the fields where research is most active:

- Population dynamics of wild populations
- Population assessment (larval counts, band traps, pheromone traps)
- Mass rearing, quality control of reared, sterile moths
- Sexual behaviour and dispersion
- Release programmes (requirements for releases, release of sterile and semi-sterile insects)
- Integration of Sterile Insect Release Technique with other control methods

1.2.4 LUTTE GENETIQUE CONTRE RHAGOLETIS CERASI
GENETIC CONTROL OF RHAGOLETIS CERASI

Responsable : E.F. BOLLER

Adresse / Address : E.F. BOLLER, Eidg. Forschungsanstalt für Obst-, Wein- und Gartenbau, 8820 Wädenswil, Suisse

The group held its fifth meeting September 16-19, 1975 at Wädenswil, Switzerland with 15 scientists representing 7 nations and 2 international

organizations participating. A complete set of abstracts on the scientific papers presented will be sent to the Secretary General.

The Group reviewed the coordinated research programme for 1974/75 and reached the following conclusions:

- The present structure of the Group with limited full memberships and scientists on temporary assignment seems to be the optimal form of internal organization and should be maintained.
- The Group has made considerable progress with respect to the classical Sterile Insect Technique (SIT) and is now terminating phase I (research). This conclusion was based on a hearing carried out during the fifth meeting. It was decided to pool all available resources in order to carry out a joint international SIT field project of phase II (development).
- The recent discovery of two incompatible races has led to further investigations aiming at a potential utilisation of this interesting phenomenon for practical control purposes. Although second priority research on the mechanisms of this incompatibility remains to be done, it was agreed that knowledge on the performance of the two races was sufficient to initiate a second joint international field project using the Incompatible Insect Technique (IIT). Sexing techniques (mechanical) that allow immediate production of pure male populations have been developed by members of the group to be used in a joint IIT programme.
- The Group thoroughly reviewed recent progress made in important aspects of research having auxiliary function for SIT programmes. Promising results in mass-rearing on liquid diets (Switzerland), prevention of diapause in pupae (Slovakia), new marking systems (Switzerland) and improved trapping systems (Hungary, Switzerland) were discussed and joint investigations recommended for the new activity programme in 1976/77.
- The Group once again realised the lack of a comprehensive bibliography on R. cerasi but learned with satisfaction that the preparation of such a document by A. Haisch, Munich, has reached an advanced stage and should be terminated by early spring 1976.
- The Group observed increasing interest in Rhagoletis in other European countries (especially Italy, Hungary and France) as well as in North America, where a U.S./Canadian working group on Rhagoletis was estab-

lished in spring 1974. Our Group has excellent personal contacts with that Group.

Working Programme 1976/77

The Group has decided to carry out common research activities under three titles: Joint Internationalized Field Programmes
Minimal Programmes (to be carried out by all members)
Recommended Programmes (without obligation)

Joint International Field Programmes

The Group has decided to proposed to the Council that two field programmes be internationalized. Whether these programmes will become official international IOBC programmes or internationalized programmes based on bilateral agreements between interested national laboratoires awaits corresponding decisions to be taken by the Council.

International SIT Programme

Headquarters: Wädenswil, Switzerland (E. Boller), surface of ca. 2.5 km^2 containing 1400 cherry trees and isolated by forest and man-made buffer-zones from adjacent cherry production areas not treated with SIT.
Objectives:

- Eradication of the pest in two steps until 1980
- Testing of representative conditions (topography, isolation) with respect to the feasibility of SIT in a larger programme
- Production of a realistic cost-benefit analysis for future recommendations.

Preparations were initiated in summer 1975 and the first releases of sterile flies will begin in 1976. Termination of releases in sub-areas South and Centre in 1979 (releases 1976, 1977, 1978) and in sub-area North in 1981 (releases in 1978, 1979, 1980).

Over 90% of total costs will be covered by Switzerland. The coverage of the remaining costs of S.Fr. 18,000 annually (salary for one labourer) by international and national sources is under negotiation.

International IIT Programme

Headquarters: Vienna, Austria (K. Russ), field-cage tests will be carried out in 1976 and small scale field release projects started in 1977 with non-leaking strains provided by the Rhagoletis pool of the Group.

Major supporting countries are Slovakia and Switzerland (provision of male material, development of genetic sexing techniques). No special funding is required during the period 1976/77.

Special investigations and services

A. Haisch, Germany, is asked to carry out phase I field tests (SIT) to test overflooding ratios (sterile: wild flies) between 20:1 and 50:1 in repeated isolated cherry orchards and to prepare recommendations in due course.

He is also asked to complete the bibliography of R. cerasi in the shortest time possible and to submit it to an appropriate publisher. The Council is asked whether it intends to publish this bibliography through IOBC channels (special issue of Entomophaga or brochure), which would be highly appreciated by the Group.

Minimal Programme (to be carried out by all members and candidates for future membership)

- Comparing 4 trapping systems (coordinated by Remund, Switzerland)
- Definition of incompatibility lines (collections in the Far East coordinated by K. Russ, in South Europe by E. Boller)
- Density-response in larval rearing on artificial diets
- Definition of developmental threshold of diapausing pupae from various geographic origins (coordinated by C. Bakker, England)

Recommended research activities of interest to the Group

- Measuring Ecdyson titre in pupae (Haisch)
- Investigation of intra-population incompatibility (coordinated by Bush)
- Investigation on genetic background of incompatibility (coordinated by Laven)
- Bioacustics (K. Russ)
- Collection of Rhagoletis spp. for genetic analysis (Bush, Boller)

Sixth meeting

The meeting will take place in the fall of 1977. Location, dates and participants have not yet been specified. A coordinated effort with the IOBC Working Group on Ceratitis (L. Mellado) seems to be desirable.

1.2.5 LUTTE MICROBIOLOGIQUE CONTRE LYMANTRIA DISPAR
MICROBIOLOGICAL CONTROL OF LYMANTRIA DISPAR

Responsable : L. VASILJEVIC

Adresse / ADDRESS : L. Vasiljevic, Institut de la Protection des Plantes, T. Drajzera 7, Beograd - Topcider, Yougoslavie

Propositions présentées au Conseil

Pendant le VIIIe Congrès International pour la Protection des Plantes qui a eu lieu à Moscou du 21 au 28 septembre 1975, il s'est tenue une réunion informelle des chercheurs intéressés par les problèmes de la lutte biologique contre Lymantria dispar, à la demande des responsables du groupe de travail de l'OILB/SROP, Messieurs VASILJEVIC et GRISON.

L'Assemblée Générale de l'OILB/SROP avait proposé de dissocier les activités poursuivies depuis 1968 par le groupe et orientées essentiellement sur la lutte microbiologique entre deux principales orientations explicitées par les conclusions de la réunion restreinte de Paris du 12 mars 1975 :

1 - sur les problèmes se rapportant à la technologie s.l. et à la toxicologie s.l. des virus d'insectes, dont ceux de Lymantria dispar, seraient confiés à la diligence de la Commission de la Pathologie des Insectes et de lutte microbiologique de l'OILB/SROP.
2 - les problèmes se rapportant à l'acquisition des données écologiques de base en vue d'une utilisation pratique des germes entomopathogènes feraient l'objet d'une nouvelle orientation du groupe Lymantria dispar.

A la réunion informelle de Moscou du 23 août 1975, à laquelle participaient des spécialistes de différents autres pays, Messieurs BILIOTTI, VASILJEVIC et GRISON ont exposé à leurs collègues les motivitations de l'OILB/SROP concernant ces deux orientations essentielles.

Des informations ont été présentées :

- d'une part sur l'activité antérieure du groupe en priant les participants intéressés de se reporter au numéro spécial n° 124 - 125 de "Zachtita Bilja" consacré à la publication des rapports du colloque

de Belgrade du 9 - 12 septembre 1971;

- d'autre part sur l'activité de certains instituts des Pays de l'Est européen se rapportant à l'utilisation des virus en lutte microbiologique contre Lymantria dispar.

Ensuite, une discussion a porté sur les propositions suivantes pour définir les nouvelles orientations du groupe de travail qui s'intitulerait : "Regulation des populations de Lymantria dispar". Les principaux objectifs scientifiques de ce groupe seraient :

1 - d'une manière prioritaire, la définition d'une méthodologie standardisée pour évaluer les critères qualitatifs et quantitatifs des gradations de Lymantria dispar dans les différents écosystèmes forestiers (en peuplements monospécifiques plus ou moins anthropisés comme en peuplements mixtes);
2 - l'étude des composantes des biocoenoses pour caractériser la nature des relations entre Lymantria dispar et les autres organismes des milieux forestiers (vertébrés, arthropodes et microorganismes entomopathogènes) sans omettre les effets secondaires des interventions phytosanitaires, des modes d'exploitation sylvicole et des problèmes liés à l'environnement;
3 - la prise en considération des perspectives d'utilisation des agents biologiques dans la lutte contre Lymantria dispar.

Par ailleurs, il a été confirmé la nécessité d'organiser un symposium en automne 1978 au cours duquel seraient débattus et définis les différents points relatifs aux problèmes précédemment mentionnés. Ce symposium pourrait se tenir en Roumanie et être élargi aux représentants de la nouvelle section Est Européenne en voie de constitution.

Une proposition financière sera faite dans ce but au Conseil de l'OILB/SROP et il paraît indispensable que Monsieur VASILJEVIC puisse débattre en même temps à Paris des détails pratiques d'organisation du Colloque.

1.2.6 MANIPULATIONS GENETIQUES DANS LA LUTTE CONTRE LES ANIMAUX NUISIBLES / GENETICAL METHODS OF PEST CONTROL

Responsable : R.J. WOOD

Adresse / Address : R.J. WOOD, Department of Zoology, University of Manchester, Manchester M13 9PL, England.

The Group assembled in September at the Cadarache Nuclear Centre, near Aix-en-Provence. This meeting was the best attended ever, attracting 25 participants representing nine countries and two international bodies (WHO and EURATOM). For the first time, we welcomed colleagues from the United States who brought the latest information on the screw-worm sterile-male release programme, creating great interest.

At the final session we debated the value of the Group. The members were asked to consider whether it had now served its purpose and should be wound up. But this idea was vigorously opposed, and it was the unanimous opinion that we should meet again within the next year. It is evident that the group still fulfills a very real need, being the only body at which workers in the agricultural, veterinary and medical fields can meet together regularly, and exchange views on common problems on the application of genetical techniques of pest control.

Two areas of investigation have aroused particular interest in the past year, and will surely increase in importance in the future. The first is genetic sexing techniques - the development of means to produce one-sex lines in order to remove the need for sexing procedures in mass-rearing programmes, which can be expensive and not always completely accurate. A good deal is known about the production of one-sex lines in some species (e.g. houseflies and silk-worm moths) but we need to draw up some general guidelines.

The second area of genetic interest is quality control of mass reared insects. Many failures of genetic control techniques have been attributed to lack of quality control. A questionnaire on the subject, in which opinions on various topics connected with quality control were solicited, was circulated prior to the last meeting. A good response was received

and an initial analysis of the answers was made. This was considered by the group participants, and it was also the subject of a further meeting held in Wädenswil later in the month, at which a small committee (Boller, Bush, Cook, Robinson, Wood) met to formulate the basis of a final analysis. This is now being prepared and will be circulated.

1.2.7 LUTTE INTEGREE EN CULTURES DE CEREALES
INTEGRATED CONTROL IN CEREAL GROWING

Responsable : F. SCHÜTTE

Adresse / Address : F. SCHÜTTE, Biologische Bundesanstalt für Land- une Forstwirtschaft, Institut für Getreide-, Ölfrucht und Futterpflanzenkrankheiten, Schlosskoppelweg 8, 2305 - Kiel-Kitzeberg, DBR.

Participants of the last meeting, held at Copenhagen 11-13 December 1974 were : R. de Clercq and G. Latteur, Belgium; W. Nijveldt, Netherlands; H. Suter, Switzerland; F. Schütte, Th. Basedow and A. Sagenmüller, GFR; K.S. George and S.E. Wratten, England; Barbro Nedstam, K. Andersson and G. Videgård, Sweden; J. Reitzel, Denmark; Marit Austreng, Norway; C.A. Edwards, England; J.P. Moreau, France; A.M.P. Lavadinho, Portugal.

Two reports, by K.S. George and Th. Basedow, about the main discussions are given below. The experiments considered important for 1975 have been performed by many of the members, and will be discussed during the next meeting. Two publications of the Working Group are in press (one on the occurrence of epigean predators in cereal fields, and the other on the influence of insecticides on them).

Working programme for 1976

The next meeting will be held in Gembloux, Belgium, 10-12 December 1975. Results obtained in 1975 will be discussed, and plans for future work will be decided.

In addition to the project "economic threshold of cereal aphids", it seems necessary to get more information on the population dynamics of the different aphid species living on cereals. Spring development, influence

of climatic conditions and health status of the populations could be integrated in a projected control system. A study of the different antagonists could explain the different development of the cereal aphid populations at different localities and will need special attention.

Dr. Suter (Zürich), who has great experience in studying population dynamics of aphids, will be pleased to coordinate the new project "cereal aphid ecology". During the next meeting of the Working Group, the setting up of an international research programme on cereal aphid ecology will be discussed with the main points being recognition of the aims of the new project, standardisation of methods of investigation and exchange of results.

Moreover, it is planned to establish two new subgroups on "integrated control of weeds" and "integrated control of diseases". It will be the main aim of these projects to develop systems of forecasting. The coordinators of these two projects have not yet been named, as the projects are not yet completely finalised.

1.2.8 LUTTE INTEGREE EN VITICULTURE
INTEGRATED CONTROL IN VINEYARDS

Responsable : M. BAILLOD

Adresse / Address : M. BAILLOD, Station fédérale de recherches agronomiques de Lausanne, Château de Changins, CH-1260, Suisse

a. Administration du groupe

L'administration du groupe s'est surtout concentrée sur les besoins les plus immédiats à savoir d'une part, concrétiser un état mieux défini du nombre des sous-groupes et des participants actifs dans chaque sous-groupe, et d'autre part, de faire démarrer le premier sous-groupe de travail. Après consultation des principaux chercheurs intéressés, le nombre des sous-groupes a été arrêté à 4, soit :

- Tordeuses de la grappe (vers de la grappe), resp. R. Roehrich
- Maladies fongiques, resp. Dr. Gärtel

- Effets secondaires, resp. J. Touzeau
- Acariens phytophages, resp. M. Baillod.

Afin de rationalisation, ou par manque de disponibilité actuelle de la part de quelques chercheurs, le sous-groupe Lutte autocide a été rattaché pour l'instant au sous-groupe Tordeuses de la grappe. Pour le même genre de raisons, le sous-groupe Pyrale n'a pas été constitué provisoirement.

La mise à jour des participants de chaque sous-groupe se réalise automatiquement à la première réunion de travail, par l'engagement personnel de chaque chercheur dans la réalisation d'un programme d'expérimentation minimum défini par le sous-groupe lui-même.

L'essentiel des crédits consentis par l'OILB a été consacré en 1975 au démarrage du sous-groupe de travail Tordeuses de la grappe, qui a réalisé cette année un premier programme d'expérimentation.

Signalons une prise de contact avec l'OIV afin d'établir des liaisons en vue d'une future coordination entre ces organismes dans des domaines à préciser en 1976. Les problèmes financiers que posent les réunions sont aigus dans la mesure où chaque sous-groupe doit se réunir chaque année dans les perspectives de travail d'une première tranche de cinq ans.

b. Réunion tenue

Le sous-groupe Tordeuses de la grappe s'est réuni les 18 et 19 février 1975 à Montfavet (Avignon), France.

c. Rapport de travail

Le Compte rendu de la réunion d'Avignon, sous-groupe Tordeuses de la grappe a été publié et précise les objectifs de travail de ce sous-groupe (rapporteurs : G. Maurin et R. Roehrich).

d) Activités des sous-groupes

Les objectifs que le sous-groupe Tordeuses de la grappe s'est fixé pour 1975 ont été les suivants :

- prévision négative du risque Tordeuses de la grappe (zones de faibles populations) et prévision positive du risque (zones de populations moyennes à fortes);
- seuil de nuisibilité des Tordeuses de la grappe et influence des

Tordeuses sur le développement du Botrytis;

- lutte biologique : amélioration de l'action de Bacillus thuringiensis par l'étude d'attractifs et d'adjuvants;
- influence de la température et détermination d'un seuil de température pour le développement en postdiapause des chrysalides de Lobesia botrana;
- détermination des sommes de température pour la prognose des vols de Lobesia et Clysia;
- inventaire de l'importance des auxiliaires.

Les autres sous-groupes ont défini des travaux préparatoires pour les réunions prévues de 1976 :

Sous-groupe acariens : Observations préliminaires (basées sur les travaux antérieurs des chercheurs français) sur la prévision du risque, les seuils de tolérance (printemps et été) et la recherche de prédateurs pour P. olmi, E. carpini et T. urticae.

Sous-groupe effets secondaires : Etablissement d'une liste récapitulative des principaux effets secondaires en viticulture. Dans l'immédiat, ce sous-groupe concentrera ses efforts sur la connaissance des effets secondaires sur les auxiliaires.

Sous-groupe maladies fongiques : Contacts préliminaires en cours; ce sous-groupe portera probablement ses efforts sur le problème du Botrytis.

e. Activités en cours

Les démarches sont en cours afin de réaliser une réunion des quatre sous-groupes en février 1976 (voir programme de travail). Les résultats d'expérimentations sont actuellement en préparation pour le sous-group Tordeuses de la grappe.

f. Conclusions

L'année 1975 a vu le départ de l'expérimentation dans le but de réaliser tôt ou tard, une lutte mieux intégrée en viticulture. Dans les autres cas, des enquêtes, observations, voire travaux préliminaires ont eu lieu afin de préparer, et valoriser les réunions de 1976. Enfin, l'intérêt porté au groupe en général a dépassé le cadre proprement dit de la pathologie de la vigne et, de même, l'intérêt de chercheurs d'autres pays s'est manifesté en cours d'année.

Programme de travail 1976

a. Poursuite et développement de l'activité des premiers sous-groupes déjà en fonction en 1975 : "Ver de la grappe", "Effets secondaires" et "Acariens phytophages". Les responsables respectifs : MM. Roehrich, Touzeau et Baillod assurent l'animation et la coordination des recherches et de l'expérimentation prévues pour leur sous-groupe durant les rencontres du Groupe de travail de Lausanne (1974) et de Changins (1976).

b. Réunion des membres intéressés de tous les sous-groupes actifs, pour la préparation du programme 1976. Cette réunion pourrait avoir lieu durant le mois de février 1976 à la Station fédérale de Changins à Nyon (Suisse).

En vue de permettre à certains membres polyvalents de participer aux travaux des différents sous-groupes, tout en évitant à l'un ou à l'autre spécialiste, aux mycologues par exemple, un trop long séjour à Changins, le programme des réunions des différents sous-groupes, travaillant séparément, pourrait être le suivant :

mardi	mercredi	jeudi
Sous-groupe Ver de la grappe	Sous-groupe Effets secondaires	Réunion
ou	ou	
Sous-groupe Acariens phytophages	Sous-groupe Maladies fongiques (éventuellement)	plénière

Le nombre de participants à cette réunion devrait être réduit au minimum, dans le but d'assurer l'efficacité des rencontres et de contenir les frais, à la charge de l'OILB, dans les limites supportables.

1.2.9 LUTTE INTEGREE DANS LE SOL
INTEGRATED CONTROL OF SOIL PESTS

Responsable : C.A. EDWARDS

Adresse / Address : C.A. EDWARDS, Rothamsted Experimental Station
Harpenden Herts, England

A meeting was held at Zeist, in the Netherlands from 17 - 21 March 1975. There were 56 participants from 14 countries including entomologists, soil zoologists, nematologists, microbiologists and plant pathologists. A collaborative project on the role of soil organisms in seedling establishment was proposed and details worked out. Final details were decided when the Convenor attended a meeting of the Pest Group of IIRB at Louvain, Belgium 23-25 June 1975. Many likely participants attended this meeting.

Plan of Action for 1976

The proposed project will begin in spring 1976 with 16 full participants and four other contributors from six countries. It is proposed that results be discussed at a meeting in September 1976. This will be arranged at Göttingen, West Germany to run consecutively with a meeting of the Pest Group of IIRB. At this meeting other participants will also attend with the aim of setting up one or more additional projects. These were discussed at the 1975 meeting.

1.2.10 PESTICIDES ET ARTHROPODES UTILES
PESTICIDES AND BENEFICIAL ARTHROPODS

Responsable : J.M. FRANZ

Adresse / Address : J.M. FRANZ, Institut für Biologische Schädlingsbekämpfung der B.B.A., 61 - DARMSTADT, D.B.R.

The second meeting of the Working Group was held at the Station de Zoologie (INRA), Colmar, France on March 2-4 1975. Twenty-seven research workers, nine of them guests, reported on their activities during the past year and agreed on the programme for the future.

As a special report on this meeting has already been submitted, the following key points on this meeting should suffice. The aims of the Working Group were again defined in detail. Reports on the development of guidelines were given by several members. General contributions to the principles of standardized tests were discussed, including problems of terminology. Agreement was reached on suggestions for registration procedures for pesticides with selective qualities, more or less harmless to beneficial arthropods. The discussion of test methods for new substances for biotechnical control and proposals on standardization made some progress. A programme for the preparation of guidelines was established listing the names of 24 workers prepared to study 31 species of beneficial arthropods and determined to submit draft guidelines to a special approval committee.

A technical meeting comprising three external plus two Darmstadt members of the Working Group will be held on September 30. Its purpose will be to finalise two or three guidelines for standardized laboratory tests of Chrysopa carnea, Encarsia formosa, Coccinelle septempunctata. This meeting has been approved by the Council.

Summing up of the activities of this year, it was possible to agree on a general scheme for the guidelines to be developed for several important beneficial arthropods by specialised members. In some cases, several members are working jointly in order to secure agreement from the beginning (e.g. guidelines on Phytoseiulus persimilis, to be developed by three members and one guest member from Rumania).

Working programme for 1976

The programme for the next year was developed at this meeting. Efforts will henceforth be concentrated on the development of further guidelines dealing with more beneficial arthropods including their critical review by the group and final admission. For this purpose, a second technical meeting will be planned, probably early in April 1976, again for a very limited number of workers who are in the process of finishing their guidelines.

As membership of the group in the future will depend on active cooperation in the setting up of a guideline, it is hoped that the next full meeting

will be possible in late autumn 1976, in Darmstadt, as suggested by the Group. The appropriate date will probably be November 1976; however, the final decision on whether or not to have this meeting will depend on the number of guidelines worked out by September. If the number of guidelines is insufficient, it is suggested that the full meeting be postponed from autumn 1976 to spring 1977 and to try, meanwhile, to assist those who struggle with the last technical difficulties by a second technical meeting in the autumn of 1976. Thus, the decision on whether to have a full meeting or only a very limited technical meeting will be taken in autumn 1976 and depends on the reaction of the group and the general activity of its members.

It should be noted that, following a suggestion of our group, the Biologische Bundesanstalt has officially accepted the type of "Zulassungsprüfung" (registration tests) dealing with the side-effects of pesticides on beneficial arthropods, as suggested by our group (as a voluntary additional test). The BBA will also accept results of corresponding tests carried out in other member countries of WPRS and it expects reciprocal recommendations abroad. It would be helpful if the Council would explain this problem of mutual acceptance of results of this type of specially developed and standardized tests on beneficial arthropods to administrators reponsible for registration (admission) of pesticides in countries where WPRS member institutions are located.

2. COMPTES RENDUS DES REUNIONS / REPORTS OF THE MEETINGS

2.1 INTEGRATED CONTROL IN CEREAL GROWING

(Copenhagen, Denmark, 11 - 13 December 1974)

Participants :

R. de CLERCQ, G. LATTEUR (Belgium); J. REITZEL (Denmark); C.A. EDWARDS, K.S. GEORGE, S.D. WRATTEN (England); J.P. MOREAU (France); TH. BASEDOW, A. SAGENMÜLLER, F. SCHÜTTE (German Federal Republic); W. NIJVELDT (The Netherlands); MARIT AUSTRENG (Norway); A.M.P. LAVADINHO (Portugal); K. ANDERSSON, V. NEDSTAM, G. VIDEGÅRD (Sweden); H. SUTER (Switzerland).

Report on sessions concerning the cereal aphids project

A summary of the results of Experiment 1 was circulated. Most of the experiments were done in the U.K. and the Netherlands. The results of these experiments indicated that significant increases in yield had been obtained on those crops where more than five aphids were present on the ears at growth stage 10.5.1. A further feature of the overall results was that the mean yield from combined treated and untreated plants was much lower on those crops where aphids had increased to above five per ear, compared with those where aphid colonies failed to establish. This suggests the possibility that aphid increase is favoured more on those plants which are already under stress from some other factor.

A summary of the work done in Belgium (Latteur) revealed that the aphid level at which losses were to be expected was 15 rather than five, but that counts were made later, i.e. at growth stage 10.5.4. In discussion it was suggested that the two views of critical numbers were not dissimilar, as it was always understood that when five aphids were present on the ear, at G.S. 10.5.1., this should be the starting point for a sub-

sequent increase.

In reply to a question about the influence of other pathogens such as BYDV and Thysanoptera, it was suggested that this point had been checked by those doing experiments and pointed out that Aphox was said to be a specific aphicide.

In Denmark Reitzel carried on with experiments in cages. Aphids were introduced into the crop at different growth stages and dates. In general, there was more damage the earlier the aphids were introduced and more effect on spring wheat than on spring barley. There was an effect on the top-sized fraction when yield samples were sieved. It was concluded that on spring barley, aphids introduced after flowering do less harm than those introduced before, as far as grain quality is concerned.

On spring wheat the quality of the grain at harvest was better the earlier the aphids were killed. The one thousand grain weight was influenced at flowering but the effect diminished progressively thereafter.

Wratten described the aims of his work which was based on field experiments in large cages, and growth room experiments, on both winter and spring wheat. In all cases, plants were grown to maturity. Investigations were made into the nature of damage, the mechanism of damage (how does reduction occur?), the relative importance of avenae and dirhodum and the relating of numbers to damage. The cages used were two metres square and two metres tall. The variety was Cappelle, sown in November, and cages with no aphids, with avenae only and with dirhodum only were replicated three times. Sixty nymphs were placed in each cage two weeks before ear emergence and the plants were sampled weekly. Numbers of aphids were counted and senescence of the leaves was measured. At harvest, each ear was divided into three regions and the three grains in each spikelet were examined separately. The peak numbers of aphids found were 111 avenae and 69 dirhodum per tiller, although at growth stage 10.5.1., there were only four avenae per ear and one dirhodum per ear. The peaks occurred in early July. Avenae fed on the ear and the dirhodum feeding sites reflected senescence of leaves; they moved up the leaves so that there were many on the flag leaf at the ear-filling stage. Both species caused the flag leaf to senesce more rapidly than on uninfes-

ted plants. The ear analyses related mainly to a post flowering population, and there was no reduction in the number of grains, although there was a highly significant reduction in grain weight in all regions of the ear. It was least in the basal area. When there is a nutrient drain, the basal part of the ear receives most nutrient and one would expect less aphid influence on this part than on the terminal parts of the ear. The effect of the aphids was similar to that in leaf-removing experiments where assimilates were removed from the ear. It was suggested that the weight reduction in the grain comes from removing leaf assimilates and by speeding up senescence in the flag leaf. Protein analyses were made, and both species reduced protein content by 1%. There were no significant effects on germination, straw weight or chaff weight. It was noticed that there was some stimulant of the plant by aphids at low numbers and this could be due to plant growth stimulants in the saliva of aphids. This is known in nematodes.

Reporting on his experiments in Sweden, Andersson said the weather was very bad in 1974, so there was little attack by aphids. His results had been circulated and showed that spraying was done, not at the correct stages, but at interesting stages of development. One remarkable factor was that padi developed at such a late stage; usually it occurred before or at the time of heading. There were significant losses of yield in his experiments.

Suter in Switzerland described his work on four sites, two of which were on heavy soil and two on light. His significant increases in yield despite very small aphid populations indicated that the drought of three to four weeks after flowering had had a marked effect on those plants which had been infested with aphids. He described another study in Switzerland in which he attempted to relate the incidence of heavy attacks by different aphids on different crops from year to year, and discussed the importance of predicting 'bad' years if possible.

The development of pea aphid populations relative to parasites, predators and fungus, and the spread of these antagonists onto other crops as the aphids declined was described. It was possible to predict the development of aphids on summer crops relative to pea aphids on alfalfa and this work

was to continue. However, Suter emphasized that he had not been able to determine any relationship between the onset of aphid attack and subsequent build-up. Other workers agreed with these findings. Suter completed his talk by showing the theoretical basis on which he assessed the relative influence of the various antagonists.

Videgard presented a paper of his work on resistance to padi in spring-grown cereals and George agreed that small experiments in glasshouses were unsatisfactory, as plants could easily be overwhelmed by aphid numbers.

This completed the talks on aphid work and there followed descriptions of experiments which had been done on Carabids. Basedow has agreed to summarise these talks.

Proposals for work in 1975 were considered, and the following points were agreed upon with respect to Experiment I: 1) there should be six replications; 2) no water sprays would be used; 3) insecticides to be used should be Pirimicarb or Menazon; 4) counts of aphids should be done weekly; 5) BYDV and other pests should be noted; 6) each collaborator should do at least three experiments.

Experiment II would be done as before, but collaborators should feel free to add treatments which seemed suitable under their own conditions.

It was agreed that aphids should be washed off and counted if possible, but also that collaborators whould attempt to compare other methods of estimating aphid numbers. Basedow's method of measuring infestations and relating centimetres of infestation to aphid numbers should be investigated and he agreed to circulate a note about the method.

Suter agreed to send around a summary of his study on aphid antagonists.

Report on the sessions concerning the project on "epigean predaceous arthropods" (Basedow)

Basedow gave a report on the results obtained in the first two years of investigation, concerning the number of predaceous arthropods in cereal fields and the effect of commonly used insecticides upon them (Fenitrothion, Parathion and Methoxychlor). Methoxychlor was the only insecticide harmless to some, but not all species. C.A. Edwards

(Rothamsted) gave a report on his trials with insecticides performed with other methods (on small plats with barriers), which cover a larger number of insecticides.

In the separate session on the predator project the following points were decided:

1) Results obtained so far shall be published soon;
2) Some further tests with insecticides shall be conducted using the same methods and pitfall traps. Tests take place in Bavaria, Northern Germany and Sweden.
3) The investigations about the occurrence of predators on cereal fields shall be restricted on comparing areas where no chemioals are used with neighbouring ones having the same crop rotation, but treated with chamicals. A new type of trap constructed and distributed by W. Nijveldt, Wageningen is to be used for these investigations. Investigations will take place in Holland, Belgium, Northern Germany and perhaps England. The trapping period shall be from 1 April to harvest.

2.2 LUTTE INTEGREE EN VITICULTURE
Sous-groupe : "TORDEUSES DE LA GRAPPE"
Responsable : R. ROEHRICH

(Avignon, France, les 18 et 19 février 1975)

Participants :

M. SAMPAYO (Espagne); M. BASSINO, Mme GUENNELON, M. LAURENT, M. MAURIN, M. MILAIRE, M. ROEHRICH, M. TOUZEAU (France); M. VALLI (Italie); M. BAILLOD, M. BOLLER, M. SCHMID (Suisse).

Protocoles d'expériences arrêtés en commun lors de la réunion du sous-group à Avignon les 18 et 19 février 1975 :

Nous vous rappelons que les protocoles TG 1 et TG 2 sont des programmes minimals à prévoir dans toutes les régions concernées.

Le protocole TG 3 n'intéresse que deux laboratoires : Nyon et Bordeaux, et le protocole TG 4, trois seulement : Wädenswil, Avignon et Bordeaux, étant étendu pour ce dernier que chacun doit envoyer des insectes pour

cet essai.

Enfin, les protocoles TG 5 et TG 6 attirent l'attention sur les notations à faire et les récoltes de parasites à effectuer chaque fois que l'on en a la possibilité.

Protocole N° 1 - Code : TG 1

1 - Objectifs

A partir du piégeage à l'aide de phéromone sexuelle, l'objectif de ce protocole d'observations est double :

- Etablir une prévision négative du risque dans les zones où les populations de vers de la grappe sont faibles ou nulles;
- Etablir une prévision du risque pour la culture dans les zones où les populations de vers de la grappe ont une importance moyenne à forte.

2 - Conditions générales

- Capsule retenue : C E V A M1 (ACETOXY 1 DODECADIENE 7 E 9 Z à 100 µ par capsule)
- Piège : Phérotrap 1 C,
- Un poste de piégeage équivaut à un piège,
- Le piège est placé au niveau des grappes,
- Changement de la capsule tous les 2 mois, dans les zones à faible population, tous les mois dans les zones à population moyenne,
- Changement de la glue tous les mois.

3 - Notations et observations à effectuer

- Zones où les populations de vers de la grappe sont faibles à nulles :
  - Relevé des captures hebdomadaire (une fois par semaine)
  - Notations des dégâts par contrôle visuel sur 500 grappes à raison de 5 grappes prises sur 100 ceps répartis au hasard dans l'hectare entourant le piège en fin de chaque génération :
    - pour la première génération on notera le nombre de glomérules. Les résultats seront exprimés en glomérules pour 500 grappes.
    - pour la deuxième génération on notera le nombre de pénétrations (ou de chenilles).
    - pour la troisième génération on notera le nombre de pénétrations ou à défaut le nombre de chenilles à la vendange.

Les résultats seront exprimés en nombre de pénétrations (ou de chenilles) pour 500 grappes.

- Zone à population de vers de la grappe moyenne : Le travail est à faire sur des parcelles non traitées.
  - . Relevé des captures : quotidiennement (tous les matins si possible à la même heure).
  - . Relevé des conditions météorologiques :
    - . Température maximum
    - . Température minimum
    - . Température moyenne = $\frac{\text{Maxi + Mini}}{2}$
    - . Température crépusculaire prise au moment où le soleil a disparu derrière l'horizon(1)
    - . Humidité relative minimum
    - . Humidité relative au crépuscule (au moment où le soleil a disparu derrière l'horizon).
  - . Notations et observations dans l'hectare entourant le piège :
    - . Des pontes (si possible) par observation de 100 grappes :
      - à raison d'une grappe prise parmi les plus développées sur 100 ceps,
      - deux fois par semaine après le premier sondage positif.
    - . Des glomérules au cours de la période de risque de dégâts de première génération : deux fois par semaine sur 100 grappes prises par hasard sur 100 ceps. Résultats en glomérules pour 100 grappes et en pourcentage de grappes attaquées.
    - . Des pénétrations au cours des périodes de risques de dégâts, pour la deuxième et la troisième générations, sur 100 grappes prises au hasard sur 100 ceps. Si l'on ne peut pas noter les pénetrations pour la troisième génération, on notera le nombre de chenilles sur 100 grappes à la vendange et le pourcentage de grappes

(1) Repérer l'heure du coucher du soleil tous les dix jours.

attaquées à cette époque.
Résultats en nombre de pénétrations pour 100 grappes et en pourcentage de grappes attaquées.

Protocole N° 2 - Code : TG 2

1 - Objectifs

. Etude du seuil de nuisibilité des Tordeuses de la grappe.

. Etude de l'influence des tordeuses de la grappe sur le développement du Botrytis.

. Une bibliographie et une synthèse de résultats déjà existantes sur le sujet sera faite par Monsieur ROERICH - INRA, Bordeaux, France.

2 - Conditions générales

. Opérer dans des conditions où les populations de tordeuses de la grappe sont moyennement élevées.

3 - Dispositif expérimental

. Bloc 5 ou 6 répétitions

. Parcelle élémentaire = 10 ceps (ou minimum 100 grappes par parcelle élémentaire)

. Traitements :

0 = Témoin non traité

1 = Traitement facultatif sur la première génération

2 = Traitement sur la deuxième génération

3 = Traitement sur la troisième génération

2 + 3 = Traitement sur la deuxième et la troisième générations. Dans les régions où il n'y a que deux générations et dans celles où la deuxième et la troisième générations se chevauchent, les traitements seront faits de la façon suivante :

- avant véraison pour le n° 3
- après véraison pour le n° 2

. Produit à employer : parathion méthyl

4 - Notations

Les comptages seront faits sur 100 grappes successives par parcelle élémentaire prises à partir d'un cep repéré. On observera toutes

les grappes à partir de ce cep jusqu'à obtenir 100 grappes.

- Sur les vers de la grappe :
  - Première génération : on notera le nombre de glomérules.
    Résultats en nombre de glomérules pour 100 grappes.
  - Deuxième génération : on notera le nombre de pénétrations sur 100 grappes.
    Résultats en nombre de pénétrations pour 100 grappes et en pourcentage de grappes attaquées.
  - Troisième génération : à la vendange, on disséquera les 100 grappes et on comptera le nombre de chenilles. On notera également dans la mesure du possible, le nombre de pénétrations.
    Résultats en nombre de chenilles (ou de pénétrations) pour 100 grappes et en pourcentage de grappes attaquées.
- Sur la pourriture grise :
  On notera :
  - le pourcentage de grappes atteintes avant l'apparition de la deuxième génération;
  - le pourcentage de grappes atteintes à la deuxième génération;
  - le pourcentage de grappes atteintes et l'indice d'attaque à la vendange selon l'échelle 0, 10%, 25%, 50%, 75%, et 100%;
  - le poids de vendange pour chaque parcelle élémentaire;
  - l'indice mustimétrique.

Protocole N° 3 - Code : TG 3

1 - Objectifs
  - Amélioration de l'action de Bacillus thuringiensis employé contre l'Eudémis au moyen d'attractifs présumés des larves;
  - tester l'action de ces adjuvants sur la durée d'action.

2 - Dispositif expérimental
  - traitement en place des vignes : avec Dipel à 0,1%, Dipel à 0,1% + 1% de sucre, Dipel à 0,1% + 2% de sucre, Dipel à 0,1% + lait écrémé en poudre;
  - prélèvement de 10 grappes par produit + 10 grappes témoins aux jours : 0 - 3 - 9 - 16. Utiliser des grappes dans lesquelles les baies sont en contact les unes avec les autres.

- infestation de ces grappes par 10 chenilles nouvelles-nées;
- mise en élevage pendant 2 semaines à 25° C.

3 - Notations

- dénombrement des pénétrations et des larves vivantes;
- notation de la durée d'ensoleillement, de la quantité de pluie en mm et de sa durée en heures pendant la période comprise entre la date du traitement et le prélèvement des grappes.

(N. B. Ce protocole est confié aux stations de Nyon et de Bordeaux.)

Protocole N° 4 - Code TG 4

1 - Objectifs

- Détermination de l'influence de la température sur le développement en post-diapause des chrysalides de Lobesia botrana et Clysia ambiguella.
- détermination du seuil de température;
- recherche de l'existence éventuelle de différences pour ce caractère entre les insectes des différentes provenances.

2 - Dispositif expérimental

- Ramassage de lots d'environ 200 chenilles diapausantes; conservation à l'extérieur jusqu'à l'envoi dans un des laboratoires suivants avant le 1er novembre :
  a. M. BÖLLER - Eidg Versuchanstalt für Obst, Wein und Gartenbau, 8820 - Wädenswil, Suisse
  b. Mme GUENNELON - Station de Zoologie INRA, Domaine Saint Paul, 84148 - Montfavet, France
  c. M. ROEHRICH - Station de Zoologie INRA, La Grande Ferrade, 33140 - Pont de la Maye, France.
- De plus, chacun de ces trois laboratoires enverra des lots provenant de sa région aux deux autres;
- Conservation des cocons à 7° C et 70% humidité relative à l'obscurité pendant quatre mois;
- Exposition des cocons aux températures d'expérimentation (10) - 15, 20, 25° C jusqu'à l'émergence. Photopériode : 16 h de jour.

3 - Notations

. Relevé des sorties d'adultes tous les jours, et deux fois par jour à 25° C. Calcul du seuil de développement théorique à partir de ces données.

Protocole N° 5 - Code TG 5

1 - Objectif

. Détermination directe des sommes de température nécessaires pour la prognose des apparitions d'adultes de Lobesia et de Clysia.

2 - Notations

. Il ne s'agit pas d'expérimentation particulière, mais de notations à effectuer lors d'autres expérimentations ou lors de l'établissement d'avertissements agricoles.

. Si des données relatives aux années passées sont disponibles, elles seront également utilisées.

. Chaque fois qu'un poste de piégeage est placé assez tôt pour capturer les premiers papillons, la température maximale doit être relevée journellement depuis le 1er janvier à partir d'un poste météorologique situé dans le vignoble ou à défaut dans la même petite région, et ces données jointes aux relevés de captures seront envoyées à M. BOLLER à Wädenswil.

. Si les données thermiques ne sont disponibles au'à partir de la première capture, elles pourront également être utilisées pour calculer les constants thermiques correspondant aux points caractéristiques de la courbe de vol.

Protocole N° 6 - Code TG 6

1 - Objectif

. Inventaire d'importance des auxiliaires, particulièrement des parasites des chenilles de Lobesia et de Clysia.

2 - Marche à suivre

A l'occasion de l'élevage de chenilles provenant de vignobles

. noter à chaque relevé le nombre de parasites ainsi que celui des émergences de papillons;

. calculer le pourcentage de parasitisme pour le lot récolté;

- envoyer les parasites à M. SCHMID, Station Fédérale de Recherches Agronomiques, 1260 - NYON, Suisse, dans des petits tubes avec l'indication de la provenance, de l'insecte parasité, de la date du prélèvement en vignoble, du pourcentage de parasitisme dû à cette espèce, d'un numéro d'ordre.
  Les insectes ainsi réunis seront envoyés aux spécialistes de chacun des groupes systématiques en vue d'identification.

2.3 PESTICIDES AND BENEFICIAL ARTHROPODS

(Colmar, France, 2 - 4 March 1975)

Participants:
K. RUSS (Austria); G. VANWETSWINKEL (Belgium); J. ZELENÝ (Czechoslovakia); E. KIRKNEL (Denmark); C. BENASSY, P. BLAISINGER, J. COULON, R. DELORME, G. IPERTI, P.Ch. ROBERT, M. STENGEL (France); H. BOGEN-SCHUTZ, E. DICKLER, J.M. FRANZ, S.A. HASSAN, W. HERFS, Th. KOCK, H. STEINER (German Federal Republic); J.C. FELTON, J.H. STEVENSON (Great Britain); G. MINEO, G. VIGGIANI (Italy); J.A. JOBSEN (Netherlands); P. FELS, M. FRISCHKNECHT, A. SCHMID, H. SUTER (Switzerland).

The second meeting of the Working Group was held at the Station de Zoologie (INRA), Colmar, France, on 2 - 4 March 1975. Twenty-seven research workers, nine of them guests, reported on their activity during the past year and agreed on a programme for the future.

The aims of the Working Group were defined in detail. The Group is now in phase I: development of an agreement on test methods for important entomophagous arthropods based on standardized principles. The next steps will be to carry out such tests and evaluate them properly; to organize an efficient exchange of information; to get the results accepted by the

responsible national and international administrations as contributions to the normal protocol for registration of pesticides.

The aims of the work of the Group will be confined to measuring the susceptibility for pesticides of certain beneficial arthropods. THese data are not directly relevant to all ecological implications of pesticide use; they will be, however, useful contributions to the development of pest management systems by the Working Groups for various crops.

Agreement on the principles of test methods will allow the setting up of guidelines, leading to the performance of tests and finally to the desired results.

Report on the development of guidelines concerned field and laboratory tests. In the field, testing in three levels (trees, medium, soil surface) were considered to suffice at present. An aspirator method for alfalfa and fallow land (medium level) as well as suggestions for improving the well established funnel methods for trees and to cover work in citrus trees were discussed. For the laboratory the best developed drafts for tests were for Aleochara and Chrysopa. Other reports concerned carabids, Encarsia, Diaeretiella and predatory mites. Transition models for tests under semi-field conditions, developed for Trichogramma, will be needed to bridge the gap between laboratory and field tests.

General contributions to the principles of standardized tests stemmed partially from past experiences, partially from theoretical considerations. For the classification of results of tests indicating initial toxicity as well as persistence of a pesticide proposals were made and statistical and terminological problems ("half-effective-time") discussed. A comparative study of all aspects of pesticides in their effect on beneficial arthropods was offered by our guest speaker from Prague. The principles, advantages, and limitations of standardized tests appeared clearly after a special debate on this subject. The use of articicial weathering conditions was demonstrated as a useful approach to reproducible tests on the persistence of pesticidal activities.

Registration procedures for pesticides with selective qualities to beneficial arthropods were discussed by the competent representative from the Federal Republic of Germany. Standard tests on some important ento-

mophagous arthropods will become part of the normal testing and approval procedure for pesticides in 1975. Details on this testing system were reported and compared with conditions in other countries. For the future development of international cooperation, it was important to realize the present parallel trend for harmonization of this and other aspects of registration procedures for pesticides, as in EPPO for instance.

The discussion of test methods for new substances for biotechnical control and proposals on standardization centred on juvenile hormone analogues. The difference in action of these substances as compared with conventional insecticides requires different types of standard tests, as demonstrated by four speakers. The sub-group devoted to this field redefined their goals and formulated the first concrete suggestions.

The programme for the preparation of guidelines lists the names of 24 workers prepared to study 31 species of beneficial arthropods and determined to submit the drafts for guidelines to a special approval committee. Active membership in the Working Group will depend, in the future, on such a contribution. The procedures for official approval were agreed upon. The results will be made available (1) to other members of the Group, (2) later on also to the WPRS Working Groups on Integrated Control in various crops, by a planned information Centre at the Station de Zoologie (INRA - Mr. Blaisinger in charge), Colmar. Conditions for delivery and retrieval of information were carefully considered.

The Group noted with interest that a special symposium will be held at the 15th International Congress of Entomology in Washington, D.C. during August 1976, devoted to the subject of "Pesticides and Beneficial Arthropods". Possible contributions were discussed.

The next full meeting of the Working Group is scheduled for autumn 1976 at Darmstadt. It will be preceded by two technical meetings, restricted to those members who are in the process of completing their guideline, provisionally fixed for the end of September 1975 and for early March 1976.

Report on Technical Meeting, September 30 1975

The following guidelines, of which preliminary drafts were available, were discussed with the authors and dealt with by the group:

1) Pales pavida (Tachinidae), Dr. HUANG of the Niedersächs. Forstl. Versuchsanstalt, Abt. B - Waldschutz, Göttingen, GFR;
2) Aleochara bilineata (Staphylinidae), Dr. E. KIRKNEL, State Plant Pathology Institute, Lyngby, Denmark;
3) Chrysopa carnea (Chrysopidae), Ing. H. SUTER, Eidg. Forschungsanstalt für landwirtschaftl. Pflanzenbau, Zürich-Reckenholz;
4) Coccinella septempunctata (Coccinellidae), Dr. W. PINSDORF, Institut für Pflanzenschutz, Saatgutuntersuchung und Bienenkunde, Münster/ Westf., GFR.

The discussion was necessarily very detailed and resulted in several concrete suggestions for improvements. The topic of the desirable general expression for both fertility and prey intake of predators, was discussed, along with suggestions for an exchange of results as soon as the respective guidelines are accepted.

The group was interested to learn of the announcement of the Abteilung für Pflanzenschutzmittel und -geräte, Biologische Bundesanstalt für Land- und Forstwirtschaft concerning the incorporation of official tests on side-effects of pesticides on beneficial arthropods into the protocol for registration in the Federal Republic of Germany (Nachrichtenbl. Deutsch. Pflanzenschutzd. (Braunschweig), 27, p. 142-143, 1975). This note may facilitate steps of active members in the same direction, in coordination with their national services for registration.

It is hoped that the drafts for guide-lines which were discussed at Darmstädt will start circulation to the committee for approval before the end of this year. New drafts, developed according to the standard principles as repeated in the check-list, will be welcomed for the next meeting in March, 1976.

2.4 LUTTE MICROBIOLOGIQUE CONTRE LYMANTRIA DISPAR

(Réunion restreinte - Paris, France, le 12 mars 1975)

Participants :
pour le Comité exécitif :
MM. BILIOTTI, BRADER, MATHYS
pour le Groupe de travail "Lymantria dispar" :
MM. GRISON, INJAC, VASILJEVIC
pour la Commission de Pathologie des insectes et de Lutte microbiologique :
M. FERRON; M. VAGO s'étant excusé
pour les liaisons Recherches-Industrie :
MM. HURPIN, METIVIER

Il est convenu d'inscrire à l'ordre du jour de cette réunion, la discussion de la résolution n° VI de l'Assemblée Générale de l'OILB de Madrid des 7-11 octobre 1974.

Résolution N° VI

Consciente des difficultés techniques et législatives qui freinent gravement les nouveaux développements de l'utilisation d'agents pathogènes, l'Assemblée Générale recommande la recherche des voies les plus appropriées pour :

- étudier les aspects technologiques de la production des organismes auxiliaires utilisables,
- étudier et démontrer l'innocuité de ces agents pathogènes, tant vis-à-vis de l'homme et des animaux domestiques, que vis-à-vis des biocoenoses appelées à recevoir les applications.

La discussion de cette résolution N° VI portait sur les Virus de Lymantria dispar en considérant, d'une part les difficultés rencontrées du point de vue technologique dans l'application du programme établi par le groupe de travail à Belgrade en 1971, et d'autre part, le fait qu'en Europe, les Virus de la Polyédrose intranucléaire de Lymantria dispar représentent le microorganisme entomopathogène dont l'étude est la plus approfondie en vue des applications pratiques en lutte microbiologique. Il a donc été convenu de retenir ce germe entomopathogène comme "modèle"

permettant de définir les orientations d'un groupe de réflexion spécifique sur les aspects technologiques et toxicologiques précédant les applications pratiques et relevant par conséquent de la Commission de Pathologie des insectes et de Lutte microbiologique.

Quelques points de discussion ont porté notamment sur : les problèmes posés par la purification du stock de Virus recueilli par les collègues yougoslaves à partir de collectes de cadavres, dans la nature, de cette matière première présentée sous forme de poudre : il était nécessaire de procéder à l'élimination de contaminants bactériens.

Il a alors été mentionné les différentes méthodes de purification. Monsieur INJAC a rendu compte des techniques utilisées au Canada concernant le Poxvirus de Chonistoneura et surtout celle qu'il a vu pratiquer aux USA à la fois sur les Virus d'Heliothis et précisément sur les Virus nucléaires de Lymantria dispar. Le principe de cette méthode repose sur la séparation des particules suivant un gradient de densité (centrifugation zonale) impliquant la préparation du matériel de base sous la forme de suspension aqueuse.

M. INJAC est chargé d'établir un rapport détaillé sur les techniques américaines et de le transmettre à la Commission de Pathologie.

M. HURPIN se propose d'établir un rapport sur les performances de l'ultracentrifugeuse zonale après avoir consulté le Dr. LAVERGNE de l'Institut Pasteur de Paris qui dispose du seul exemplaire de cette centrifugeuse existant en France.

M. METIVIER a évoqué l'importance, du point de vue technique industrielle, de disposer de méthodes fiables d'identification et de titrage indépendamment des techniques classiques de titrage sur rameaux pratiqué dans les Laboratoires de Zemmm, de La Minière et de Tempio Pausania.

Il a été mentionné les propositions faites par M. VAGO : réaliser des tests rapides sur culture de tissu. M. VAGO fournira des détails complémentaires à ce sujet.

Un autre point de discussion a porté sur les méthodes de multiplication des Virus qui ont d'ailleurs été évoquées précedemment au cours des réunions de la Commission de Pathologie :

- sur cultures de cellules,
- en élevages en chambre climatisée,
- et par collecte dans la nature;

malgré les inconvénients présentés par cette dernière méthode, celle-ci a été retenue provisoirement pour assurer la constitution d'un nouveau stock de matière active, sous réserve, de bénéficier d'une épizootie naturelle en période de progradation, de procéder à la récolte des insectes malades ante mortem et de les congeler immédiatement; de procéder à la caractérisation du ou des Virus ainsi récoltés avant toute manipulation technologique (critères virologiques et sérologiques).

En conclusion, il est recommandé aux Groupes Forestiers de disjoindre les problèmes liés à la technologie et à la toxicologie des germes entomopathogènes de leur programme spécifique de recherches écologiques.

MM. FERRON et INJAC sont chargés de faire une proposition au Conseil de l'OILB/SROP lors de sa prochaine session d'automne en vue de constituer au sein de la Commission de Pathologie des insectes et de Lutte microbiologique un groupe de réflexion sur les problèmes définis à la Résolution N° VI de l'Assemblée Générale. Il est entendu que les Virus de Lymantria dispar ne représentent qu'un exemple parmi les germes entomopathogènes relevant des préoccupations de la Commission de Pathologie.

Par ailleurs, MM. GRISON et VASILJEVIC ont été chargés de redéfinir les orientations des activités du groupe de travail de "Lutte biologique contre Lymantria dispar".

2ème partie : Orientation du groupe de travail de "Lutte biologique contre Lymantria dispar"

Faisant suite aux recommandations de la réunion restreinte, tenue à Paris le 12 mars 1975 et au cours de laquelle, MM. FERRON et INJAC ont été chargés de présenter au Conseil de l'OILB/SROP, un projet de constitution d'un groupe de réflexion sur la technologie et la toxicologie des germes entomopathogènes en utilisant comme "modèle" les Virus de Lymantria dispar, il a été envisagé de reconsidérer l'orientation du groupe de travail forestier concernant Lymantria dispar.

M. VASILJEVIC continuera à assurer l'animation de ce groupe dans le cadre d'une coordination, par M. GRISON, des problèmes relatifs à l'écologie et à la lutte biologique des ravageurs forestiers.

L'orientation des activités des groupes forestiers doit nécessairement se situer dans une optique d'études de l'impact des insectes défoliateurs sur les écosystèmes forestiers. Les objectifs du groupe "Lymantria dispar" devraient donc être analogues en ce qui concerne les Chênaies sempervirentes et caducifoliées à ceux que poursuit le groupe de "Lutte intégrée en Pinèdes méditerranéennes".

Le Secrétaire Général de l'OILB/SROP, M. BRADER, a recommandé que ces nouvelles orientations soient définies par les membres du Groupe à l'initiative de M. VASILJEVIC et M. GRISON, à l'occasion du VIIIe Congrès International de Protection des Plantes de Moscou, 21-38 août 1975.

L'ordre du jour pourrait être le suivant :

1°) Position du Groupe de travail "Lymantria dispar" dans les activités forestières de l'OILB et liaison avec le Programme MAB, rapporteur P. GRISON;

2°) Rapport de synthèse sur les travaux effectués dans le cadre du Groupe de "Lutte microbiologique contre Lymantria dispar", par M. VASILJEVIC;

3°) Rapport sur les travaux conduits dans chaque pays, dans le domaine de la Lutte biologique contre Lymantria dispar par un représentant de chacun des pays ou Instituts, membres de l'OILB;

4°) Définition des nouvelles orientations du groupe et établissement d'un programme d'actions à soumettre au Conseil de l'OILB/SROP;

5°) Proposition du lieu et de la date de la prochaine réunion plénière du groupe.

D'ores et déjà, il est suggéré de demander aux Collègues de Roumanie d'organiser cette réunion plénière en automne 1976, dans la région forestière de Roumanie subissant les gradations de Lymantria dispar. Les discussions pourraient porter sur les points suivants :

- caractérisation bioécologique des populations de Lymantria dispar et méthode d'évaluations numériques de celles-ci;
- influence des facteurs climatiques sur les gradations;
- facteurs biotiques de régulation des populations : entomophages et

entomopathogènes;
- autres facteurs de régulation susceptibles d'être utilisés en milieu forestier : phéromones, contrôles génétiques, etc ...

2.5 INTEGRATED CONTROL OF SOIL PESTS

(Zeist, The Netherlands, 17-21 March 1975)

Participants:
J. RIDSDILL SMITH (Australia); R. de CLERG, C. GREGOIRE-WIBO, A. HEUNGENS, E. TILEMANS (Belgium); J.T. MILLS, A. TOMLIN (Canada); N. HAARLØV (Denmark); D.A. ALLISON, J.B. CARTER, T.H. COAKER, R.A. DUNNING, C.A. EDWARDS, A.A.F. EVANS, J.C. FELTON, J.R. LOFTY, P.L. SHERLOCK, M.R. SPEIGHT, C.J. STAFFORD, A.R. THOMPSON, W. WILKINSON (England); J.C. CAYROL, C. da FONSECA, B. HURPIN, A. KRETZSCHMAR, C. LAUMOND, M. RITTER (France); L. KAMPFE (German Democratic Republic); J. BAUCHHENSS, J. MULLER, L. STEUDEL, W. WOHANKA (German Federal Republic); G.K. VEERESH (India); M.F. RYAN (Ireland); G. MARCUZZI (Italy); L. BRADER, C. van der BUND, J. BUNT, H. EYSACKERS, W. HEIJBROEK, H. HOESTRA, P.W. MAAS, C.A.A. MAENHOUT, H. den OUDEN, J.A. van RHEE, B. SCHIPPERS, H. TOXOPEUS, G. WESTSTEIJN (The Netherlands); N. BALICKA, M. GORNY, M. KAMIONEK, T. WITKOWSKI (Poland); G.N. FOSTER (Scotland); J. KLINGER, V. DELUCCHI (Switzerland)

Introduction

This was the fourth meeting of the Group. There was no meeting in 1974, so that sufficient funds would be available in 1975 to enable a large meeting to be held and at least one working project to be defined.

There were 56 participants from 14 different countries, and they included entomologists, soil zoologists, nematologists, microbiologists and plant pathologists.

Plenary Sessions

The meeting was opened with an introduction by Dr. L. Brader, the Secretary General of WPRS. There were four main papers on the first morning. They were:

- The possibilities for integrated control of soil pests (C.A. Edwards);
- Effects of pesticides on the soil fauna (C.F. v.d. Bund);
- The consequences of agricultural practices on soil organisms (M. Ritter);
- Interrelationships between microorganisms, nematodes, insects and other invertebrates affecting their roles as pests (J.T. Mills);

On the second morning, there were five plenary addresses:

- Interrelationships between microorganisms and nematodes (J. Müller);
- Interrelationships between microorganisms and arthropods (B. Hurpin);
- Influence of nematodes on arthropods (C. Laumond);
- Influence of arthropods and nematodes on nematodes (A.A.F. Evans);
- Interrelationships between microorganisms (B. Schippers).

It is intended that these papers will be published as a separate IOBC Bulletin.

Discussion Groups

On the afternoons of the first two days, the meeting divided into three Discussion Groups, in which participants briefly reported and discussed their current research relevant to the theme of the Working Group. The groups were:

1) Effects of pesticides on the soil fauna (23 participants - Chairman, J.C. Felton);
2) The influence of fauna management, crop rotation, cultivation and fertilizers on soil organisms (15 participants - Chairman, V. Delucchi);
3) Interrelationships between microorganisms, nematodes, insects and other invertebrates affecting their roles as pests (18 participants - Chairman, H. Hoestra).

On the third day, the Chairmen of the Discussion Groups reported on the discussions in the Groups.

Group 1 had discussed a wide range of topics. The discussion covered both direct effects of pesticide treatments and indirect or accidental effects. The effects of pesticides on nematodes, the microfauna, macro-arthropods and earthworms were all discussed. Most workers agreed that selectivity of pesticides tended to be the rule rather than the exception, and many instances of differential responses of closely related species were given. Methodology and the desirability of standardized

techniques were discussed. Problems relating to both single and repeated pesticide applications and combinations of pesticides, were emphasised. The sub-Group agreed that a project on sugar beet would be one that linked the interests of many of its members.

Group 2 had discussed the influence of rotations on arthropod populations and concluded that they were not of major importance. They considered how various cultivations (including non-ploughing) affected soil animals and pest problems. The influence of fertilizers was discussed, but there was not much evidence of their effect. The possible effects of different plant populations and of weeds and trap crops were discussed.

Possible manipulation of environmental factors without changing cultural practices was discussed. It was emphasised that all the agricultural practices and climatic and environmental factors interact in their influence on soil organisms.

Group 3 discussed interactions between earthworms and plant pathogens, the possible use of mathematical models in interpreting interactions between soil organisms, practical applications of interactions between soil organisms, antagonoism between soil organisms, the possibilities for biological control of nematodes.

The group emphasised the great need for better knowledge of interactions between the various groups of soil organisms.

Study Groups

After these reports the plenary session of the meeting divided into three Study Groups, charged with discussing and formulating International Collaborative Projects under the aegis of the Soil Pests Working Group. The groups were as follows:

1) The role of soil organisms on seedling establishment (Chairman, C.A. Edwards);
2) The role of organic matter on pest and disease problems in arable soils (Chairman, J. Klingler);
3) Biological control of plant parasitic nematodes (Chairman, H. Hoestra).

The Chairman emphasised that the Working Group as a whole could sponsor one or more projects, that projects should preferably be multi-disciplinary, should involve a better understanding of the soil system, be applicable to

international cooperative work, would preferably be of economic importance and should be designed as far as possible to use standardized methods.

The Study Groups met for several hours and their Chairmen reported their recommendations and conclusions to a final plenary session.

Group 1 decided that it would be feasible to establish an International Collaborative Working Project investigating the role of soil organisms on the seedling establishment of sugar beet. Details of the proposed project are given in the appendix.

Group 2 decided that they had much to discuss of interest but they did not feel that it was the right time to formulate a project. They decided that instead they would like to continue as a Study Group and have further discussions at the next meeting of the main working group. There was considerable interest in the effects of green manuring, sewage application and direct drilling on pest problems and soil organisms, particularly springtails, nematodes (phytoparasitic and saprozoic), mites and soil insects. Several workers were interested in the beneficial activities of earthworms, including the dissemination of pathogens of pests.

Group 3 also decided that they would not begin a Working Project but would remain a Study Group for the next meeting of the Working Group. They thought that three areas where they could make useful contributions were to study sugar beet nematode populations in continuous sugar beet cropping, to study nematode problems in protected environments and to collect and distribute information.

In particular, they strongly recommended that a Study Group on "Entomophilic nematodes" be formed, and this may ultimately be a Working Group separate from the Soil Pests Working Group.

Conclusions

The meeting was unusual in that it included workers with such a wide range of disciplines and interests. For this reason the consensus of opinion was that any cooperative work should be based on a crop or crops rather than on a particular pest or disease. The wide range of interests in the Working Group as it stands at present is both its strength and its weakness. If suitable projects can be chosen and initiated, the Working

Group provides a unique opportunity for interdisciplinary cooperation. The Working Group is also the only one that provides for the interests of nematologists, of whom 16 attended the meeting.

The pattern of formal talks in the morning followed by Discussion Groups in the afternoon seemed to be very successful and the residential nature of the meeting ensured very considerable discussion amongst the participants. The main aim of the meeting to initiate at least one Working Project was achieved, and it is hoped that at the next meeting further projects may be begun. It was hoped that the next meeting would be in 1976, but no date was fixed; the organization of this meeting was left to the Chairman.

Contributions

BALICKA, N. Some aspects of integrated control of soil pests.

BAUCHHENSS, J. Untersuchungen zur Collembolenfauna auf drei Zucker-Überschlägen in Bayern.

BOUCHE, M.B., KRETZSCHMAR, A & ROUELLE, J., Utilisation des lombriciens pour la dispersion des germes employés en lutte biologique : cas de Beauveria tenella (Delarr.) Siemaszko (Fungi imperfecti, Moniliales).

BUND, C.F. van de, BUNT, J.A. & ENNIK, G.C. The predator-prey relationship between Rhodacarellus silensiacus Willmann and the population of nematodes and springtails under influence of certain nematicides.

CARTER, J.B., Parasites of pasture Tipulidae.

CAYROL, J.C., Inter-relations entre le Nematode libre Coerorhabditis elegans et sa flore Bacterienne Associée.

COAKER, T.H., The distribution of carrot fly (Psila rosea) in relationship to field boundaries.

CRAM, W.T., Some observations of possibilities for biological interference with root weevils attacking soft fruit.

DELUCCHI, V, New trends in biological control methods.

DOANE, J.F. & KLINGER, J., Some observations on parasitism of wireworms by a nematode on a trap crop effects on wireworm damage to strawberry plants.

DUNNING, R.A. & BAKER, A.N., Effects of sugar beet seed spacing on pest aggregation in the seedling root zone.

ENNIK, G.C., BUNT, J.A. & BUND, C.F. van de, Effect of Oxamy and Phenamiphos on the yield of Lolium perenne L.

EIJACKERS, H., Side-effects of herbicides on some representatives of the soil fauna.

FELTON, J.C., Environmental factors in the selection of candidate soil insecticides.

GORNY, M., Ecological aspects of the harmfulness of forest soil organisms.

GREGOIRE-WIBO, C., LEBRUN, Ph & BOURLACO, F., Effects of pesticides on the soil fauna.

HEIJBROEK, W., Investigations into different possibilities for integrated control of Onychiurus armatus in sugar beet.

HEUNGENS, A., Effects of pesticides on the soil fauna.

HURPIN, B., Interrelations entre arthropodes et microorganismes.

JEANSON, C., A study in experimental pedozoology : morphology of an artificial soil structured by earthworms.

KAMIONEK, M., The effects of pesticides on nematodes parasitizing insects and on entomogenous fungi.

MARCUZZI, G., Observations on the soil fauna of an annual crop near Perugia (Central Italy).

VAN RHEE, J.A., Effects of pesticides on earthworms.

ROBERTS, R.J., RIDSDILL SMITH, T.J. & GEORGE, J.M., An analysis of grassland insect and weed problems in relation to grazing management.

SHERLOCK, P.L., Virus and protozoan diseases of cutworms.

SPEIGHT, M., Invertebrate predator complexes in central fields.

THOMPSON, A.R. & FINCH, S., Investigation on the need to control cabbage root fly.

TILEMANS, E., La pollution du sol par les insecticides.

TOMLIN, A.D., Toxicity of insecticides to springtails and carabids in laboratory tests.

WITKOWSKI, T., The reaction of the saprobiotic nematodes on the herbicide - Dikotesc.

YAROWAYA, N., Preliminary data concerning interrelationships between Atomaria linearis and black leg fungi attacking sugar beet seedling.

In addition, unscripted contributions were made by:

ALLISON, D.A., Pesticides and the soil fauna.

EVANS, A.A.F., Nematodes.

DAN FONSECA, C., Orabatid mites and the soil fauna.

HAARLØV, N., Soil biology.

KAMPFE, L., Ecology and control of nematodes.

LOFTY, J.R., The effects of pesticides and agricultural practice on earthworms.

SIENHORST, H., Plant parasitic nematodes.

STAFFORD, C.J., The effects of molluscicides on soil organisms.

STEUDEL, L., Influence of crop rotation and nematicides on cyst nematodes.

TILEMANS, E., Residues and registration.

WILKINSON, C.R., Methods for establishing the effects of pesticides in the environment.

Collaborative Project on the Role of Soil Organisms in Seedling Establishment

At the Working Group meeting at Zeist, the Netherlands (March 17-21, 1975), it was decided that a suitable working project which is very relevant to the main theme of the Group, and of considerable economic importance, would be to attempt to assess how important are seedling pests, especially marginal pests, and to determine which factors influence their importance. As a first project, it was decided to investigate the extent and importance of seedling pests of sugar beet (with particular emphasis on the Collembola). The evolution of springtails as seedling pests could be due to the build-up of springtail populations when their predators are killed by pesticides, to the increased use of herbicides which removes alternative sources of food, or to precision drilling (the loss of a seedling being an irrevocable loss). The latter two factors also affect millipedes, symphylids, Atomoria, slugs and other arthropods as pests.

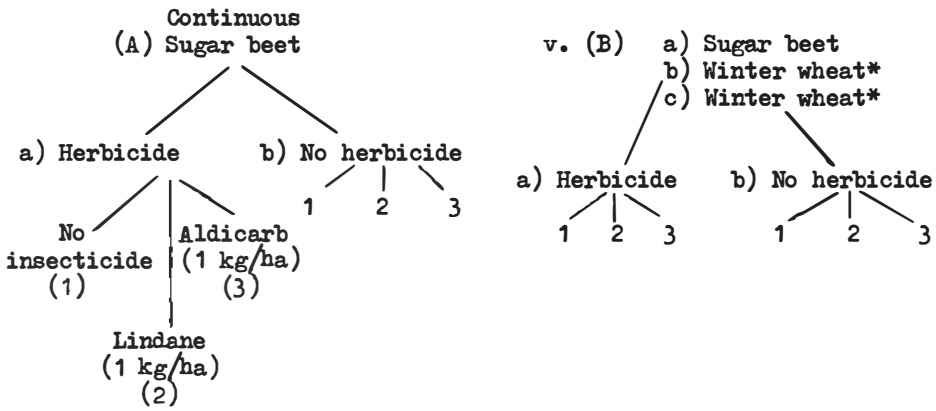
At the meeting to decide on the details of the project, it was decided to design a complex experiment, but if collaborators found this to be too time consuming, they could participate by reducing the number of variables in the experiment. The experiment will begin in spring 1975 but it is preferable to find a site in 1974.

Collaborators

C. Gregoire-Wibo, L. Van Steyvoort (Belgium); R.A. Dunning, C.A. Edwards (England); G. Lemaire (France); J. Bauchenss, F. Kock, W.R. Schaufele, W. Steudel (German Fed. Rep.); A.M. Feeney, M.F. Ryan (Ireland); C.F. van der Bund, W. Heijbroek (Netherlands); V. Delucchi and 2 students (Switzerland).

Layout and treatments

Treatments (Modified after I.I.R.B. Louvain meeting 23-25 June 1975)



This is 12 treatments if implemented in full. It can be decreased to six treatments by omitting the rotation, if the full experiment is too large for implementation.

Replication

At least two replicates. Complete random block design.

Size of plot

6m x 15m or as close to this size as is convenient with available equipment.

Cropping

1. In first year sugar beet and winter wheat. Second year both sugar beet. (Other cereals can be substituted for wheat if necessary. Spring barley would be a preferred alternative.)
2. No insecticide seed dressings on either cereal or sugar beet.
3. Cereals cut high and straw incorporated.
4. A suitable herbicide shoud be used on all cereal plots.
5. Sugar beet sown as early as possible with Megamono pelletted (3.75 -

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* or spring barley

4.75 mm), monogerm seed treated with T.M.T.D., at 6 - 8 cm (3 inch) spacing. (Seed will be supplied from a central source - notify C.A. Edwards of your requirements.)

6. Whole experiment can be sprayed with pirimcarb to control aphids as and when necessary.

Pretreatments

1. Take soil samples to ensure Onychiurus spp. (and if possible millipedes, and Atomaria) are present. (C.F. van der Bund will identify Onychiurus spp. for those in difficulty.)
2. Take soil samples and assess nematode populations (minimum 100 gm soil).
3. Take presample of soil (minimum 100 gm taken in small subsamples), and send to C.A. Edwards for pesticide residue analysis and assessment of soil type.

Treatments

1. The herbicide used (a & b) is the most commonly used in local sugar beet growing.
2. Lindane should be applied as a dust or spray over whole area and cultivated in as close as possible to sowing (if lindane is unsuitable an organo-phosphate such as diazinon can be used).
3. Aldicarb is applied as a granular inrow treatment.
4. The no-herbicide plots can be treated with herbicide after the six-leaf stage of sugar beet.

Sampling and assessments

Main assessments

1. Plant counts at cotyledon, 2 rough leaf and 4-6 leaf stages on centre three rows or whole plot.
2. Damaged plants dug up as found and cause of damage assessed.
3. Microarthropod populations. Recommended that five 5 cm diameter x 15 cm deep soil cores be taken per plot and animals extracted in Tullgren funnels; alternatively other sized samples can be used. Samples should be taken around plants. If funnels not available, immerse cores in buckets of water, gently crumble and stir. Collect arthropods floating to the surface. This should be done pretreatment and at least once subsequently and preferably at monthly intervals.

4. Macroarthropod populations. Five pitfall traps* (recommended size 10 cm diameter) should be placed in each plot and catch assessed at weekly intervals (or more frequently if possible).
5. Millipede and slug baiting. Five bran baits moistened with beer, placed under covers, and slug millipede numbers counted at weekly intervals. Baits should be replaced when necessary.
6. Yields. Suitable samples of crop should be weighed at harvest and recorded.
7. Nematode populations can be assessed by convenient and available methods. It is recommended that both cyst and larval counts be made.
8. A rainfall gauge and temperature recorder should be set up at each site and continuous rainfall and temperature records kept.

2.6 INTEGRATED CONTROL OF BRASSICA PESTS

(Gent, Belgium, 5 & 7 May 1975)

Participants:
E. DELCOUR, L. HERTVELDT, C. PELEREMTS (Belgium); B. BROMAND, P. ESBERG (Denmark); M. RYAN (Ireland); L. BRADER, J. VAN DINTER (Netherlands); J. FRUELER (Switzerland); T. COAKER - Convenor, S. FINCH, G. NORTON, A. THOMPSON (England)

It was agreed at the last meeting that the principle subject for discussion at this meeting would be "Methods of pest and damage assessment in brassica crops". The purpose behind this decision was to attempt to standardize on the methods used by members of the Group. Without such standardization, it has been difficult in the past to make direct comparisons of the results obtained from the different sources.

The discussion was opened by two papers that critically reviewed the methods that have been used for Hylemyia brassicae in assessing their numbers (Finch) and damage (Thompson).

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* It is hoped that standardized traps can be supplied to all collaborators if they will notify C.A. Edwards of their requirements.

It was agreed that extensive sampling such as that reported from Switzerland (Freuler) was our main concern, that is, sampling carried out over a large area to establish:

1. the distribution of insect spp.;
2. the relationship between pest numbers and crop damage;
3. the prediction of damage and the application of control measures.

In such cases a particular area is sampled one or at the most a few times during the season. The difficulties encountered in obtaining data for life-tables etc., were discussed but were considered to be too difficult and time-consuming for most members to include in their existing programmes. This is because large numbers of samples of each stadia have to be taken at regular intervals throughout each generation for the data to be accurate enough to make valid comparisons between generations, years and sites.

Standardized sampling techniques were agreed for sampling H. brassicae eggs, larvae, pupae and adults. Methods for damage assessment from the aerial and root systems of the plants were also agreed. Details of these methods are available from the Convenor and have been circulated to all members of the Group.

One valuable aspect of the relationship between H. brassicae root damage and plant growth, in the context of integrated control of the pest, is that providing larvae damage is not caused too early during the growth of the plant, the plant is able to tolerate a considerable amount of damage before its yield is adversely affected. Growing conditions also regulate the amount of damage it is able to tolerate.

Data presented (Coaker) from field trials in which different amounts of diazinon were applied to cauliflower plants as root drenches soon after planting out, indicated that providing damage was controlled for the first three to four weeks after planting, no significant yield losses occurred. During this period damage caused by only a few larvae per plant was sufficient to reduce yield. Similar results have been obtained with Savoy cabbage (Maack).

In consideration of our knowledge on plant tolerance to root damage and of the desirability to establish pest incidence thresholds, to enable a

decision to be made as to whether insecticide treatment should be applied or not, it was the general feeling of the meeting that some form of cooperative trial should be done to provide more information in this field. It would also provide an opportunity to use the standardized methods for pest and damage assessment. Two types of trial were suggested, one using insecticides to establish the critical control period under different conditions of growth, and the other using egg inoculation to establish a pest incidence/damage/yield relationship. Several members agreed to undertake one or both of these experiments. Results from them will be collated and discussed at the next meeting. Details of these experiments are available from the Convenor.

Research Reports

In addition to the above discussions the following research reports were presented:

Sterile male release: work is continuing on the development of this technique for the control of H. brassicae (Delcour & Pelerents). Release of sterile flies in different ratios with normal flies into field cages containing brassica plants was made. The best control of damage was obtained from releasing a 12:1 ratio of sterile to normal males with the same number of normal females as normal males. It may be possible to reduce this ratio, but four sterile to one normal male did not produce an acceptable level of control.

The successful outcome of this technique is dependent on an artificial rearing method for H. brassicae larvae. Some progress has been made (Delcour), but since the time required to produce a satisfactory medium is to some extent based on chance, other members were encouraged to participate in this work.

Integrated control: the use of intra-crop diversity obtained by undersowing brassicas with clover to encourage some ground living natural enemies and to reduce the number of pest-insects entering the crop is being continued (Coaker) and has been extended to Ireland (Ryan). Although competition effects between the clover and the crop remains a problem, the beneficial effects can be pronounced under certain growing conditions. In addition to the reduction of H. brassica eggs laid

around the plants being reduced by 50% when under sown with clover, this reduction has also been achieved by interplanting a brassica crop with lettuce. In this instance, an increase of 50% marketable cauliflowers was obtained.

Biological control: Aleochara spp. released inundatively into an infested brassica crop can provide a good control of H. brassicae. Attempts at rearing Aleochara bilineata in the laboratory (Herdveldt and Bromand) on H. brassica pupae is proving successful, although there is still room for improvement. Currently only 10% of the maximum number of eggs laid by the beetle develop into adults, thus giving 30% parasitism. The same situation exists with Tribliographa rapae, where 38% parasitism has been achieved.

Conclusions

This meeting could be claimed to be a milestone in the progress of the Group in that agreement was reached on the best techniques to use for the study of H. brassicae populations and the damage caused by them. Also collaborative experiments will now be done to establish the basic requirement to any integrated control programme, the pest and damage thresholds that can be tolerated by the plant before yield reduction occurs. Progress is also being made in providing the various components that may eventually be utilized in the establishment of integrated control programmes.

The next meeting will be held in Nyon, Switzerland in early 1977.

2.7 GENETIC CONTROL OF THE MEDITERRANEAN FRUIT FLY (Ceratitis capitata Wied.)

(Sassari-Cagliari, Italy, 14-17 May 1975)

Participants:

R. CAVALLORO, U. CIRIO, C. CONTINI, A. CROVETTI, G. DELRIO, B. DONINI, G. LOI, P. LUCIANO, R. PROTA, I. SANTONI, M. SOLINAS, C. USCIDDA, D. ZANARDI (Italy); L. BRADER (the Netherlands); L. MELLADO, J.P. ROS (Spain).

Four sessions were held, at the Istituto di Entomologia agraria of the University of Sassari (14-15 May) and the CRAI in Cagliari (17 May). 16 May was spent on an information tour and transfer of the participants to Cagliari.

The following communications were presented and discussed:

MELLADO, L. - Information about ongoing projects on application of the SIT against fruit flies in Peru, Japan and the USA.

MELLADO, L. - Application of the SIT on the Spanish mainland.

ROS, J.P. - Present erradication programme of Ceratitis capitata Wied. on the island of Hierro (Canary Island, Spain).

CIRIO, U. - Development of sterile insect technique against Ceratitis capitata Wied. in Italy.

CAVALLORO, R. and DEL RIO, G. - The use of fast neutrons on Ceratitis capitata Wied. with particular regard to the sterilization.

CAVALLORO, R. and DEL RIO, G. - Semi-sterility in Ceratitis capitata Wied.

CAVALLORO, R. and DELRIO, G. - Edaphic factors influencing the pupation of Ceratitis capitata Wied.

SOLINAS, M. - Anatomo-physiological observations of male and female "genitalia" on Ceratitis capitata Wied.

DELRIO, G., CONTINI, C. and PROTA, R. - Observations on trapping of Ceratitis capitata Wied. with colour traps in a biotope in Nord Sardinia.

DE MURTAS, I. - Studies on the Mediterranean fruit fly in Sardinia in connection with an autocidal control programme.

CONTINI, C. - Prospective organisation of the CRAI with regard to fruit fly control in Sardinia.

GENDUSO, P. - Control programme against C. capitata in Sicily.

Conclusions and Recommednations

a) Having discussed the progress achieved since its last Meeting (November 1973 in Vienna), and considering the impossibility of carrying out its action programme on Cyprus, the Group proposes that a cooperative programme on the genetic control of C. capitata be applied as soon as possible on the island of Sardinia. Reasons for this proposal are
   - increase in the agricultural output of the island (especially stone fruit and citrus) and the consequent need for improved plant protection methods;

- massive presence of C. capitata in wide areas of the island;
- growing concern over pollution due to overuse of pesticides and hence the need for application of environmentally sound techniques of integrated control;
- scientific feasibility of this approach and potential availability of technical facilities.

Some suggestions for such a programme are outlined in the programme description which follows.

b) A major point of discussion was the "quality control" of artifically produced insects. The Group stressed the need for further research and international cooperation on this aspect.

c) Although the Group recognised the potential possibilities of the use of sub-sterile insects, it nevertheless concluded that more fundamental research is needed in this field before its practical applications can be evaluated.

d) The Group also discussed in detail new developments in sterilisation techniques, particularly in view of increasing the quality of the flies to be released, e.g., the use of fast neutrons.

The Group wishes to express its sincere thanks for the excellent working conditions and warm hospitality offered by Prof. Prota and the staff of the Istituto di Entomologia Agraria of the University of Sassari, as well as to the Centro Regionale Antimalarico e Antiinsetti in Sardegna.

The next meeting of the Working Group will be scheduled according to the development of the programme.

Programme description:

General considerations

To ensure the success of the proposed programme, full collaboration of all the Authorities and Institutions present in Sardinia is required. This is particularly true for organisations operating in the field of plant protection, as well as the existing Centres currently in the phase of restructuring to carry out programmes like the one suggested.

The Group feels that a local representative is urgently needed to act as scientific coordinator for the various aspects of the programme. It is suggested that Prof. Romolo Prota, Director of the Istituto di Entomolo-

gia Agraria of the University of Sassari serve in this capacity.

The Group also points out the need for a coordinator for the operation of the programme, who should be a representative of the CRAI.

National (CNEN) and international (IAEA, EURATOM) cooperation will be decisive for the success of the programme. OILB will continue to assist in the planning and development of the programme.

Tentative plan of action (Preliminary work)

1. Ecological studies.
   Personnel requirements:
   - 3 scientists
   - 9 technicians
   - approx. 30 workers, whose main task will be the survey of the distribution of host plants and evaluation of damage by C. capitata.
2. Small scale mass rearing of C. capitata.
   Personnel requirements:
   - 1 scientist
   - 2 technicians
   - 2 assistants
3. Irradiation techniques.
   Personnel requirements:
   - 1 technician
4. Small scale experimental field releases to evaluate behaviour and performance of the reared insects.
   Personnel requirements:
   - 1 scientist
   - 2 technicians
5. Planning of large scale releases: Development of methods and logistics.
   Personnel requirements:
   - 1 specialist.

The final plan of action for control of the insect will be established on the basis of information collected from the preliminary work.

2.8 INTEGRATED CONTROL OF COTTON PESTS

(Teheran, Iran, 19-23 May 1975)

Participants:
M. HAFEZ (Egypt); D.G. CAMPION (England); P.M. VERMES (Israel); Mr. BIAT, M. HEIDARI, A. KHARAZI-PAKDEL, Mr. KEYMANESH, M. KHEIRI, A. KHEIRKHAH, Mr. MONSEF, M.J. MORADESHAGI, Mr. MOVASSAG, H. WOLUMI-SADEGI, Mr. ROHANI, M. SHOJA, K. ZAHEDI (Iran); L. BRADER (the Netherlands); U. ARIK, Miss J. DINÇER, M. KARMAN (Turkey).

The first meeting of the Working Group was held at Izmir in May 1974, in order to establish the programme for a Working Group on integrated control of cotton pests. The importance of the pest species attacking cotton plants and the ongoing researoh on these pests were reported at that occasion by the participants for each country (Cyprus, Iran, Israel, Turkey).

This second meeting was held at the College of Agriculture at Karadj. It was opened by a special inaugural session, during which Dr. S.A. Afghahi, Dean of the Agricultural College welcomed the participants. He stressed the fact that these international seminars will promote cooperation between scientists of different countries.

He noted that cotton cultivation in Iran, being an intensive and monoculture production with specific climatic conditions suitable for the reproduction of cotton pests has made the protection of this crop very complex. Several perennial and annual insect pests are damaging cotton in Iran and must be combatted every year. The use of broad spectrum insecticides in large acreages has brought about some serious problems and the contamination of the environment.

The Vice Chancellor for Education and Research of the Teheran University, Dr. P. Mostashfi further developed the significance of international cooperation. He said that this kind of cooperation reminds us of the fact that scientific investigations have no limitations and do not belong to any specific nation; these investigations must therefore be oriented according to the needs of the people of the whole world. Fortunately

Iran and other Mid-Eastern countries are aware of the importance of this type of international collaboration, and they have developed their technology and raised their standard of living accordingly. An excellent example of such cooperation is this seminar, which is the product of cooperation between the IOBC and the Department of Plant Protection of the University of Teheran.

Dr. H. Sepasgozarian, Head of the Plant Protection Department of the Agricultural College dealt with some of the general plant protection problems encountered in Iranian Agriculture. He stressed the importance of the integrated control approach as a means of building up a reliable plant protection system.

Finally Dr. L. Brader, Secretary General of the West Palaearctic Regional Section of IOBC gave a brief history of the Working Group on Integrated Control of cotton pests. He briefly reviewed the activities of some of the other Working Groups and demonstrated progress achieved in recent years in our Regional Section.

During the technical session of the Working Group, the conclusions and recommendations of the first meeting servied as a guideline for discussions. Dr. Sepasgozarian was elected to chair these sessions.

Lepidopterous pests

Dr. Hafez discussed in detail different aspects of the control of lepidopterous pests in Egypt. Pectinophora gossypiella needs at least three applications of insecticides per season. Early infestations start around the villages where the cotton stalks from the last season are stored on the roofs of the houses. These stalks constitute a reservoir of overwintering P. gossypiella, and measures to date have failed to reduce the impact of this.

The application of control measures is based on regular observation of the number of infested bolls. The economic damage threshold is fixed at 10% of the bolls infested. For reasons still unknown, Heliothis armigera has recently gained more importance in cotton growing in Egypt. Originally 5 - 10 eggs and young larvae per 100 plants were considered to be the economic damage threshold. But eggs have proven to be a rather unreliable indication. Many are not viable, and there is always a high

degree of lacewing activity which can reduce the number of eggs, and many other predators can reduce it still further. The economic threshold is therefore now based solely on the number of young larvae: 10 young larvae per 100 plants.

Spodoptera littoralis is still the main pest; the explosive and unpredictable development of the larval populations has made it impossible to work with a satisfactory economic damage threshold. Hand-picking of egg masses during the first period of infestation gives satisfactory results.

Dr. Arik reported on the situation in Turkey, mentioning the development of resistance of Sp. littoralis to different insecticides such as DDT, Toxaphene and Monocrotophos. This insect is of particular importance in the Mediterranean region. One to two egg masses per five plants or two larvae per plant are the accepted economic damage threshold for S. littoralis, and that for P. gossypiella is 10% infested squares. At blooming 30-40 infested blooms per 1000 blooms and for green bolls, 15-20% infestation are given as justification for treatment.

Some details on the economic damage threshold of Heliothis were given by Dr. Vermes. For the first warning, eggs and small larvae are counted per 2 m row; larval sizes are later divided into three classes, such as 4 mm - 1.5 cm, 1.5 - 2.5 cm and 2.5 - 4 cm. Numbers found in the first class are multiplied by a factor of one and those in the second and third classes by factors of two and three respectively. The threshold at the beginning of the season is then established at 6 larval factor/m.

Eight or less egg masses per 100 m row has been given as an economic damage threshold for S. littoralis in Israel. Dr. Vermes also mentionned that field checking for P. gossypiella is very expensive in Israel; trapping with lures has been used to avoid this expense. Captures of more than 5 males on two consecutive nights is considered an indication of the need to spray. This method is also valid for Earias insulana Boisd.

Mr. Kheirkhah and Mr. Heidari reported on the latest research results from Iran. The main lepidopterous pests there are Earias insulana and Heliothis armigera. In certain regions cutworms may cause considerable

damage. Attention is drawn to control of cotton pests by cultural practices such as plowing after harvest, winter irrigation, destroying of weeds around the fields, crop rotation and early sowing.

Sucking pests of cotton in the countries concerned: spider mites, aphid, leafhoppers and whiteflies

Research work on the population dynamics of cotton aphids in the Aegean region in Western Turkey was presented by Miss Dinçer. Particular attention was paid to the establishment of the economic damage threshold. Except in some years, aphids are an early seasons pest in Turkey, while spider mites are found during mid and late season. Thrips were mentionned as an important early season pest in Iran. Together with aphids, they require 1 - 2 regular sprays per season. The required early season applications of organophosphorus insecticides may increase the vegetative development of the cotton plant, resulting in a retardment of the fruit setting. This may favour the different bollworm species.

Biological control of cotton pests

The use of viruses for the control of Sp. littoralis is still under study. One of the main problems to be solved is the rapid inactivation of the virus after its application. Attempts are being made to contaminate adults in specially designed traps.

Moradeshaghi mentionned the importance of Chrysopa species for the control of Lepidoptera in Iran. Predatory mites are regularly found in mite infested fields.

In Egypt the main predators are Coccinellids, Staphylinids, Chrysopa spp. and spiders. Populations of these beneficial arthropods have decreased considerably during the last 20 years, however. During that period, Braconids have become relatively more important.

The participants felt that a better evaluation of the significance of natural enemies for the control of different cotton pests was urgently needed.

Use of non-conventional methods against cotton pests

Research work on the comparison of the catches of moths of the cotton leafworm, S. littoralis, in light traps and pheromone traps was presented

by Dr. Campion. The Working Group recognised the importance of this type of research and was willing to collaborate where possible.

Conclusions and Recommendations

The following topics were considered to be of prime importance for the further development of integrated control programmes:

- Lepidopterous pests (H. armigera, S. littoralis, E. insulana and P. gossypiella) and sucking pests (Aphids, thrips, mites, whiteflies) need further attention to specify their economic damage threshold in the various countries.
- Research should be done to determine the abundance of natural enemies and their effectiveness and possible use against cotton pests.
- Pheromones for the estimation of populations and seasonal changes of S. littoralis will be used in different countries to analyse their possibilities for use in integrated control programmes.
- More emphasis should be placed on the screening and selection for host plant resistance.
- The next meeting of the Group will be held in about two years; Cairo was the suggested meeting place.
- The meeting was followed by a technical excursion to Gorgan and Gonbad (Caspian area), where the participants obtained an excellent impression of a large part of the Iranian cotton growing area.

It should be mentioned that the meeting was perfectly organised by the Iranian colleagues. Their kind hospitality deeply impressed the participants.

2.9 INDUSTRY LIAISON GROUP

(Visit to CIBA-GEIGY AG, Basle, Switzerland, 1 July 1975)

Participants:

Drs. ESSER, FLUCK, GASSER, KNUSLI, LEGGE, SPEICHER (CIBA-GEIGY); BILIOTTI, BRADER, MATHYS, PRICE-JONES (IOBC)

Introduction

Dr. Gasser opened the discussion by outlining the organisation of pesticide research and development in CIBA-GEIGY, with special reference to the biological work. Mr. Legge then traced the progres of a new material from discovery to marketing, describing the investigational procedure in some detail and explaining the philosophy behind it. During the course of the day, Dr. Flück demonstrated the work in progress on the rearing of beneficial insects and Dr. Esser showed the scope of the biochemical work, particularly in the field of pesticide metabolism in plants and animals. Drs. Biliotti and Brader outlined the structure of IOBC/WPRS and described the activities of the Commissions and Working Groups. Possible liaison between CIBA-GEIGY and IOBC/WPRS was discussed against this background.

Summary of discussions

1. It now takes almost five years of intensive work to define the commercial potential of a new material and to meet registration and approval requirements; thereafter, another two to five years are required to develop it commercially.

2. CIBA-GEIGY have evolved an effective system for speeding up the operation while ensuring that (a) safety and environmental requirements are fully satisfied and (b) heavier expenditures are incurred only as the prospects of the material become increasingly assured. Nevertheless, there is always a considerable financial risk in the development of a new product.

3. In screening for new insecticides, the selection of range test insects is related to market opportunities. At an early stage, the experimental work is geared to a particular market segment, e.g., rice borers, or a group of cotton insects (say, three species of Heliothis) that would merit collective treatment.

4. In the first stage, only preliminary data on bird, bee or fish toxicity are required, according to the anticipated environmental impact. Attempts are now being made to breed beneficial insects (in addition to bees) for inclusion in early stages of screening.

5. The model closed ecosystems devised by Professor Metcalfe have been found effective for the particular conditions to which they refer, but they do not embrace a sufficiently wide sample of the conditions in real-world ecosystems. CIBA-GEIGY prefer a more comprehensive biochemical approach coupled with ecological studies in the field.

6. The tracing of metabolic pathways in plant and animal (and in soil or water, if required) provides a more fruitful and convincing approach. All significant metabolites are submitted to toxicological examination.

7. Field experiments are designed primarily to investigate efficiency of pest control and integration into agronomic systems, but they also provide opportunities for studying side-effects. In particular, effects on beneficial insects are routinely observed. The effectiveness of this approach could be improved if adequate information was available on the most important beneficial organisms on the major crops. Field experiments specifically for ecological studies, e.g., on birds, are mandatory in some countries.

8. The tight time-schedule and the nature of the work make it impossible to delegate any of the screening or characterisation to research institutes. In the development stage, special field units in 13 countries are responsible for expediting a carefully planned programme. These units are staffed by biologists, including some agronomists, and the head is usually an entomologist or a botanist (weed specialist). Again, the ultimate responsibility rests with CIBA-GEIGY: they must ensure that all the requisite information is obtained in the minimum of time, as efficiently as possible and to the standards specified by registration authorities and by themselves.

9. CIBA-GEIGY are interested in new developments in pest control and crop protection and are currently working on insect growth regulators. They feel that these new developments are extremely expensive and that they require as much time for development as do more traditional pesticides.

10. During a discussion of an IOBC preliminary list of beneficial insects, it emerged that CIBA-GEIGY would prefer a more detailed treatment of those beneficial insects associated with commercially important pests. This would provide comparable information from IOBC and industry and

would facilitate registration of those products with minimal effect on parasites and predators.

11. CIBA-GEIGY routinely seek selectivity between target pest and (a) man, (b) beneficial organisms associated with the crop concerned, and (c) selected test organisms (bird, bee, fish). Other aspects of selectivity receive attention according to the environmental implications of the particular material concerned, a process greatly assisted by sensitive feed-back from field experience during development.

12. IOBC/WPRS Commissions and Working Groups offer many opportunities for liaison with CIBA-GEIGY, for example, in such areas as the definition of important parasites of major pests, the development of techniques and standards for evaluating the effect of pesticides on beneficial organisms, the promotion of integrated control on selected crops.

13. It was agreed that the discussions had been valuable, that each party now had a better appreciation of the others's problems, procedures and philosophies, and that this should lead to closer liaison in the future.

14. Dr. Biliotti thanked CIBA-GEIGY through Dr. Gasser for the hospitality extended and for the readiness with which Dr. Gasser and his colleagues had been prepared to discuss details of their organisation and working methods.

2.10 INTEGRATED CONTROL OF PESTS AND DISEASES IN HOPS

(Linz, Austria, 16-18 July 1975)

Participants:
G. NIEDER, W. PINDUR, K. RUSS, I. STEYRL, R. SZITH (Austria); I. HRDÝ (Czechoslovakia); C. AVELING, R.C. MUIR (England); K. BORDE (German Democratic Republic); H. AICHELE, U. HORNUNG, Th. KREMHELLER, H. STEINER (German Federal Republic); B. MICINSKI (POLAND); M. KAĆ (Poland); representatives of the Österreichisches Bundesministerium für Land- und Forstwirtschaft.

Subjects considered

1) Developments and current situation in hop protection in the major hop-growing areas;
2) Economic importance of various pests and diseases and their possible resistance to control measures;
3) Antagonists (parasites, predators) acting in hop gardens and attempts so far to put them to effective use;
4) Rapid field methods to determine the degree of resistance to pesticides;
5) Projects for integrated control of diseases and pests of the hop, including selection of varieties and problems of fertilizing;
6) Summary of discussions, resolution;
7) Draft agenda, term and place of next meeting, themes to be considered.

Excursion and social events

On 17 July the Upper Austrian hop-growing area was visited. The Working Group members profited from a pleasant bus-ride to view hop growing in Oberes Mühlviertel and Auberg, including the local experimental hop cultures.

Thanks are due to the Austrian colleagues for the excursions, the social programme, and the exemplary organization which, against the background of the well-known Austrian hospitality and "Gemütlichkeit", provided excellent conditions for all participants, their mutual understanding and effective work during the specialised deliberations of the Commission.

Hop growing regions

In England there are three major hop-growing areas: Southeast, comprising Kent and Sussex (3892 ha); South, in the neighbourhood of Farnham (279 ha); and West Midlands, comprising Herefordshire and Worcestershire (2392 ha). The average size of the holdings is 11.7 ha. In Austria, hops are grown in Styria (Steiermark), about 68 ha near Leutschach; and in Mühlviertel (Upper Austria); and about 50 ha near Rohrbach. In Czechoslovakia there are three major hop growing areas: the Czech area (9,612 ha); the Moravian area, centred around Tršice (582 ha); and the West Slovakian area centred around Piešťany (770 ha). The East Slovakian

area includes only a few hop gardens and is of much less importance. Similar to the German Democratic Republic, hops are grown in Czechoslovakia on large plots (even exceeding 100 ha) in several specialised large-scale farming establishments. Accordingly, the approach to hop protection in these areas is somewhat different compared with small hop gardens in providing an additional farming product and a source of extra revenue to the farmer. In Yugoslavia there are two major hop-growing areas differing in both the climatical and the soil conditions: a) the Slovenian area (centred around Žalec) with mean annual and mean monthly (summer months April-August) temperatures of 9.6 and 16.2° C, and mean precipitation of 1200 and 590 mm respectively; b) the Vojvodina area (centred around B. Petrovac) with mean annual and mean monthly (summer months) temperatures of 10.8 and 17.7° C and mean precipitation of 640 and 330 mm respectively. The Savinja Valley in Slovenia is the largest and most important area (half of all the hop growing acreage in Yugoslavia) where one fourth of cultivated land is devoted to hops. In this area hops have been grown for 100 years. In the USA, hop production is confined to the Western states of Washington (8742 ha in the Yakima Valley, the most important hop production area), Oregon (2062 ha in three localities), Idaho (1740 ha mainly in the Boise Valley, the major area) and California (600 ha in the Sacramento Valley). Hop production has shifted from the East to areas where, due to the dry summer climate, diseases, particularly mildew, do not cause a serious problem. The USA is the second largest hop producer after the Federal Republic of Germany with a total of 13,112 ha and an output of nearly 57 million pounds (517,000 hundredweight = "Zentner").

Survey of diseases and pests of the hop. The problem of pesticide resistance

a) Downy mildew (Pseudoperonospora humuli) is generally reported as the most important disease. In England, it is prevalent in all hop growing areas, but protection can be obtained through adequate spraying programmes. Fungicides in use are copper, streptomycin, propineb, zineb. Investigations have resulted in the development of a system for predicting the severity of infection periods so that fungicides may be applied in a more timely and efficient manner. The system is likely to be of particular

value in suggesting when to apply the one or two sprays each year required in plantings of some resistant varieties. Resistant varieties include "Wye Challenger", on which no fungicide sprays are necessary and "Wye Northdown", which may require two sprays in seasons favourable to Peronospora.

In Austria until quite recently, formulations based on copper were in use almost exclusively. It is only since 1973 that new organic fungicides have been tested. Attempts are being made at present to exploit microclimatical data for a negative forecasting service (Negativ Prognose-Warndienst), making it possible to omit sprays in periods free of imminent danger.

In the Federal Republic of Germany where downy mildew constitutes a serious hazard, up to 25 sprayings in one season have occasionally been necessary to protect susceptible varieties. New varieties, such as "Hüller Bittere" and "Hallertauer Gold" are tolerant and perform satisfactorily with only three sprays annually. The "Hallertauer mfr." and "Brewer's Gold" varieties, on the other hand, are very susceptible. The amount of cupric compounds used for control tends to decrease steadily, whereas the proportion of organic fungicides of the dithiocarbamates group is on the increase. Due to intensive treatment (accounting for about 800 DM/ha/year), losses in terms of yield and quality have remained low of late.

In the German Democratic Republic, increased occurrence of primary infection has been reported, particularly in stands of the "Nordischer Brauer" variety. In 1970 late invasions were generally mild, but mounted to 80% in some places. Copperoxychloride and bercema-Zineb 80 sprayings have been applied preventatively.

Downy mildew also constitutes the most serious hop disease in Poland. Primary infections are governed by conditions prevailing within the hop garden, whereas wild hops only play a secondary role. The infection spreads from side shoots and those primary invasions provide the main source of later secondary infections. The spreading of the disease may be restricted through the application of a set of measures. These include suppression of the primary infection and chemical spraying to protect the cones; they further include hop picking outside the hop garden as well as

precise pruning in spring performed close to the stock. As a rule, five to eight sprays with copper-based formulations or organic fungicides, mainly Polyram Combi (metiram), Dithane M45 (mancozeb), and Cynkotox are applied during the growing season.

In Czechoslovakia Ps. humuli is also the major hop disease. An empirically chosen formula based on evaluation of climatical conditions (assessed from meteorological network data) is used to prepare the negative forecast, i.e., an estimation of situations in which preventive sprays may be disregarded. Generally five to eight sprays per season are necessary to suppress the disease, and the compounds used include organic fungicides based on mancozeb, zineb and metiram, or combined cupric-organic formulations.

Peronospora has occurred in Yugoslavia since 1929. As a result, susceptible varieties were gradually discarded and replaced by new varieties of which one ("Savinjski golding" of English provenance) proved relatively tolerant. Up to the present, performance has been satisfactory with two to three sprayings annually; against Peronospora usually two sprays during blossom time. The main control measures include selection of tolerant varieties and, along with forecasting, adequate farming practices, particularly correctly performed pruning.

In the USA the downy mildew problem (primarily occurring in the Willamette Valley, Oregon) has been tackled through selection of resistant varieties. "Fuggle" is the most resistant variety. "Cascade" is a new variety (released in 1972), which carries some "Fuggle" germplasm. "Bullition" and "Brewer's Gold", the English high-alpha varieties, have also proved sufficiently tolerant. Two new triploid selections will be released as new aroma varieties with mildew resistance derived from the tetraploid "Fuggle". Due to the low summer rainfall in the hop growing regions of the USA, the primary concern is with crown infection by the downy mildew. Chemical control has been restricted to dusting with zineb in early spring; other control measures are not necessary as a rule.

b) Powdery mildew (Sphaerotheca humuli) is widespread through all areas in England, but control is usually achieved with dinocarp, pyrazophos or sulphur. Varieties resistant to this disease are "Wye Challenger" (this resistance has broken down in some areas) and "Wye Target".

In the German Federal Republic, powdery mildew occurred only locally in some years to date; more important occurrences were reported only as late as 1974. Marked susceptibility has been manifested by the "Northern Brewer", "Brewer's Gold" and "Hersburges spät" varieties. Apart from chemical treatment, the removal of soil shoots to decrease the hazard of primary infection has been recommended. Similarly, in the German Democratic Republic, powdery mildew was unknown until recently. But its importance is increasing in parallel with the more extended cultivation of the "Nordischer Brauer" variety.

In Chechoslovakia, powdery mildew occurs normally on wild hops; whereas it has been reported only sporadically from commercial hop gardens. The disease has not been included so far in reports from Austria, Poland and Yugoslovaia. In the USA, powdery mildew is considered to have been one of the causes for the gradual shift of hop production from a number of Eastern states to the Pacific Northwest.

c) Wilt diseases (Verticillium sp. and Fusarium sp. resp.)

In England, Verticillium is the most serious disease. To prevent damage, emphasis is being placed on planting tolerant varieties and paying careful attention to the nutrition of the hops.

From the Federal Republic of Germany, two pathogenic agents have been reported: V. alboatrum and V. dahliae. The disease is winning ground, and the planting of tolerant varieties, namely "Northern Brewer" and "Hüller Bitterer" is therefore under way. Extreme susceptibility has been manifested by the "Hallertauer Mittelfrüher" variety. Expert fertilization (avoiding over fertilizing with nitrogen in particular) reduces the susceptibility of the plants to this disease. Losses incurred in Hallertau during heavy occurrence of the disease were reported to amount to about 8 million DM in one single year.

In Poland this disease was considered rare until 1971. More recently, dangerous spreading has been reported, however,,particularly in the major cultivation area of Lublin county. Plant mortality was found to be caused by the Fusarium sambucinum and, in addition, the fungus Verticillium alboatrum was isolated. The degree of infestation in hop gardens is estimated at 10% and efforts are being made to curb the spread of the

disease by sanitary and cultural measures. Brestan (fentin-acetate) and Benlate (benomyl) are under testing as possible suppressive agents.

In the USA mild Verticillium symptoms were found only occasionally in certain yards with the "Fuggle" variety. It is believed that selection of tolerant varieties will be possible. It seems unlikely, on the other hand, that chemical control might prove effective under field conditions. For example, benomyl gave little control in a two-year experiment in Oregon.

d) Virus diseases have been mentionned in reports from the German Federal Republic and the USA, Bothrytis from the Federal Republic of Germany (as being of limited importance) and physiological diseases from Poland. Work in England has established that the Arabis mosaic virus is involved in the "nettlehead" and "split leaf blotch" diseases but can also cause serious reduction in yield in plants which show only transient disease symptoms. Prunus necrotic ring spot virus causes no visible symptoms in hops, but consistently reduces alpha-acid content and may also reduce yield.

e) The hop aphid (Phorodon humuli). With the exception of the USA, the hop aphid has been reported as the most important hop pest of the last decade, especially in connection with the increasing insecticide resistance problem. In England, resistance in the hop aphid to organophosphorous (OP) compounds has been suspected since 1961 when growers reported difficulties in control with Metasystox. Laboratory tests in 1966-1971 revealed the levels of resistance to Metasystox (methyl demeton) to have become stabilized. Strains isolated from areas receiving commercial sprays were 17-30 times as resistant compared to strains from unsprayed hops. A similarly high level of resistance to omethoate was observed, although this insecticide has been in use for a shorter period of time. A low level of cross resistance characterised by Resistance Factors (RF) of about 2-6 occurred to methidathion, methomyl and endosulfan. In all commercial hop growing areas the hop aphid has actually developed resistance to many insecticides and control has become increasingly difficult. The following chemicals have been used in practice. OP: acephate, demethon-s-methyl, dimethoate, menazon, mevinphos, methidathion, omethoate,

phosphamidon, schradan, TEPP, vamidothion; Carbamates: methomyl, proxopur; Others: nicotine, endosulfan. Dimefox or mephosfolan are used as soil drench in June. The uptake depends on the prevailing weather conditions; e.g., foliar sprays are used to control aphids only until the soil drench has become effective.

In Austria, the hop aphid occurs almost regularly, and sometimes in great numbers in all hop growing areas. At present the insecticide Wacker S 14/10 (dimefox) is used for soil watering (1%, o,5 litre/stock) and OP compounds and Lannate (methomyl) for spraying.

In the German Federal Republic, the hop aphid has occurred in great numbers almost every year since 1950 (OP insecticides have been in use from about the same time). About 50–60% of hop growing areas are treated with dimefox; Folimat (omethoate), Ultracid (methidathion) and Lannate (methomyl) follow in the order of amounts applied. The "Northern Brewer" and "Brewer's Gold" varieties are particularly susceptible to aphid infestation. Control starts upon finding 10–20 wingless first-generation females per leaf. Through intensified chemical treatment, freedom from substantial crop losses can be obtained. The control of the hop aphid costs 300–400 DM/ha per year.

In the German Democratic Republic, serious damage was caused by the hop aphid in 1973, whereas in 1974 its harmful occurrence was limited to certain places. Recently dimefox has been in use for soil drenching and has failed to give satisfactory results; resistance is believed to be the cause. Tests performed showed that aldicarb, methidathion, methomyl and omethoate provide the best control.

From Poland the following bionomical data are available: under favourable conditions, invasion by winged females may continue for three weeks, but the flight might be discontinuous resulting in a protracted period of invasion. Invasion reaches a peak between the 10th of June and the 5th of July. Nine to ten generations complete development on the hop as a rule. Population density depends on weather conditions as well as on the initial intensity of the aphid attack on hop gardens. The number of aphids on winter hosts cannot be relied upon as a basis for forecasting infestation. Control measures include soil drenching with Terra

Sytam (dimefox) and spraying with Metasystox (methyl demeton) and Ultracid (methidathion). Nogos (dichlorvos) is used for pre-harvest treatment.

From Czechoslovakia life table data such as the rate of development and fecundity in the individual morphs of the hop aphid are also available. In the Czech hop growing area, 8 generations of the pest should be anticipated. Whereas, when contact insecticides were being used, aphid calamities occurred at irregular intervals, the introduction of preventive watering with OP insecticides (1956) brought about a break. While formerly it was possible to prepare a forecast based on the number of eggs present on winter hosts, the index numbers have today become unworkable in spite of being adjusted, and the threat of calamities has become imminent. Intensity of flights and, subject to weather conditions, particularly the development of the populations on the summer host, the hop, have become the crucial factors. Resistance to thiometon, which was proved in 1967 (RF=6) was the major cause of the calamity. Since that time, although the use of thiometon-based insecticides has been discontinued for hop aphid control, the levels of resistance have been more or less maintained. Cross resistance includes a great number of OP compounds such as mevinphos (RF=5.5), monocrotophos (4.8), dicrotophos (3.1-4.6), phosphamidon (6.8), fenitrothion (3.6), formothion (4.3), dimethoate (19.3-22.7), etoate methyl (23.8), Teration (2.9-27.4), dimefox (3.3-11.4), mephosfolane (2.5), methidathion (3.8), omethoate (6.9), amidithion (13.8) and some carbamates as e.g. oxamyl (9.6). Further substances are under examination. It should be pointed out, however, that the foregoing data are related to resistant populations isolated in Czechoslovakia. Laboratory tests have shown that dichlorvos, phosalone, asinphosmethyl, chlorpyrifos, carbofuran, methomyl and endosulfan are effective against resistant aphid populations. Phosalone, methomyl and possibly chlorpyrifos for pre-harvest treatment (provided that freedom from phytotoxicity is safely assessed in the latter) show promise for field control of resistant aphids. Monitoring has proved the rapid spread of resistant populations not only in hop gardens subjected to regular treatment but also to wild hops in places remote from commercial plantations.

In Yugoslavia contact insecticides (nicotin, pyrethrin) were used against the hop aphid until 1950. Since 1954, systemic insecticides have been introduced (demeton methyl, dimefox). One single treatment has frequently failed to give sufficient control in the last year, however, and up to five sprayings must now be used.

The statement by A. Haunold and E.C. Horner that "disyston, an organic phosphate, gives systemic mite aphic control ..." provides the only hint at the occurrence of aphids in the USA. There is obviously little cause for concern in this country.

f) The two-spotted spider mite (Tetranychus urticae) is the second most important pest in most areas. In England acaracides have been used on hops since 1970 as a result of resistance developed in spider mites to OP compounds used in aphid control. At present it is therefore necessary to apply dicofol, mormetanate or tetradiform.

In Austria spider mites are scarce; special control measures are therefore not necessary.

In the German Federal Republic spider mites occur in the Spalt and Tettnang areas and to a lesser degree in Hallerstau. Most control measures against aphids also have an impact on spider mites. Similarly, some fungicides applied against peronospora (Antracon, Cupravit, Euparen) also have a limiting effect on spider mites. Populations resistant to older OP insecticides (demeton methyl) as well as to dimethoate have existed for about 15 years. Acaricides like binapacryl, chlordimeform, or dicofol should be used. The initial infestation by spider mites may be decreased by removing nettles from the surroundings of hop gardens. Costs arising in connection with spider mite control are estimated at about 100-200 DM/ha.

In the German Democratic Republic the low occurrence of spider mites in recent years is assumed to be connected with the application of dimefox watering against aphids. Similarly, in Czechoslovakia, spider mites have been no cause for concern in recent years. However in connection with the development of resistance and the changing methods of hop treatment against aphids, spider mites made their re-appearance and occurred in greater numbers for the first time in 1975 (mainly in the Czech hop

regions). A situation similar to that in England may be anticipated.

In 1952 and 53, a heavy outbreak of spider mites was encountered in Yugoslavian hop gardens following the application of DDT and lindane. More recently, control of the spider mite has been possible through drenching with systemic OP insecticides.

In the USA spider mites constitute a serious problem in Washington, Idaho, Southern Oregon and California. Malathion, dicofol, demeton, TEPP, etc. are no longer sufficiently effective against the developing resistance. Omite (propargite) and Plictran (cyhexatin) are newly registered additions available for spider mite control. There are differences in the natural resistance in hops to spider mite attack, but they are difficult to evaluate. Those most resistant under field conditions are the "L-8" strain of "Late Cluster" and a new selection from the "Talisman" variety.

g) Other pests are of much less importance. In Czechoslovakia the recent relatively dry years combined with mild winters have contributed to heavier occurrences of the Otiorrhynchus ligustici weevil in a number of places. Formerly this polyphagous species was harmful to the hop only during spring migrations from its breeding grounds (mainly alfalfa). However, due evidently to large monoculture areas, this species has today become locally a primary pest inflicting damage to the hop through the frass of both larvae and imagos on roots and shoots respectively.

Similarly in the German Democratic Republic, serious damage was inflicted locally by this weevil and it is reported to have become an important pest because of its natural resistance. Available control measures include either older type formulations based on lindane or the fairly effective carbofuran for example. No serious damage has been reported recently from the hop flea beetle (Psylliodes attenuata). Undoubtedly, the suppression of this pest has been largely due to the application of OP pesticides against aphids and evidently also to changes in farming practices (introduction of herbicides).

At present the hop flea beetle is also reported to be of limited importance in Austria, the German Federal Republic and Czechoslovakia, as is also the case for Pyrausta nubialis, Cnephasia wahlbomiana and nematodes in reports from the German Federal Republic.

Natural enemies and attempts to date to make use of them

At present no experience is available concerning direct use of biological methods in control of hop pests. But remarkable results are available on the importance of some natural enemies for the regulation of population density in hop pests, particularly the most destructive, the hop aphid. Work on this is being carried out in England (Wye College), Czechoslovakia (Institute of Entomology) and Poland.

In England the anthocoride bugs Anthocoris confusus, A. nemoralis and A. nemorum are considered to be among the most important predators of the hop aphid. From Czechoslovakia data are available on the occurrence of coccinellids (Adalia bipunctata is the most important species), predacious Diptera (Aphidoletes aphidimyza and several Syrphids), neuropteran predators (Chrysopa carnea is a commonly occurring species) and bugs (Anthocoris is the most abundant predator).

In Poland predators are also listed in the order of their importance: Adalia bipunctata, Propylea quatuordecempunctata and to a limited degree also Coccinella quinquepunctata and C. septempunctata. Stethorus punctillum, a predator of spider mites, occurs very abundantly in the August-September period.

In the USA the release of the spider mite predator Typhlodromus occidentalis is under consideration.

Methods for detection of pests and measurement of their resistance

In the German Federal Republic resistance to insecticides in the hop aphid and the spider mite was assessed. In England (East Malling) and in Czechoslovakia (Institute of Entomology, Praha, and Hop Research Institute, Žatec) resistance in the hop aphid is under continuous testing. The methods employed in East Malling include direct treatment of aphids on leafcuts in a Potter tower and post-treatment confinement of aphids on leafcuts in Petri dishes. In Praha and Žatec the leaves are sprayed in a sedimentation tower by a Potter nozzle, the aphid batches confined on treated leaves and mortality is evaluated, usually after 48 hours. Both methods are suitable for the assessment of dose-mortality regression lines, but a simple field method for monitoring aphid resistance

is still needed. Resistance testing in spider mites infesting hops is standard practice in England; it is under preparation in Czechoslovakia (Žatec, Praha). Methods based on dipping or leaf spraying are available.

Integrated control projects

Diseases of the hop: In some places efforts are being concentrated on obtaining basic data permitting the prediction of peronospora infection hasards. In Czechoslovakia it is intended to test and implement the principles of negative prognosis (i.e., conditions under which planned sprayings might be discontinued). Similar objectives are envisaged in the German Federal Republic, Austria and Poland with due respect being paid to local geographical-climatical conditions, farming practices, varieties and hop growing methods (including fertilizing). A similar device, modelled on the apparatus for signalling danger of fungus infection in orchards designed by H. Steiner will be constructed and tested in Czechoslovakia based on data available in this country (Petrlík and Peyml).

Attention in the USA, England and the German Federal Republic is directed towards cultivating varieties resistant to fungus infection. Research in the German Federal Republic concentrates on resistance to Peronospora and Verticillium wilt; in the USA, apart from "Fuggle", other genotypes are available as starting material for the cultivation of resistance to Peronospora and Verticillium. In the German Federal Republic and in the USA, according to available data, the influence of the environment and chemicals on the process of infection is under consideration particularly in Verticillium.

Pests of the hop: Attention is in general being concentrated on the hop aphid and spider mite in relation to the natural environment and the different species of parasites and predators in hop culture. In England ways are being sought to limit the use of insecticides in order to ease the selection pressure for pesticide resistance and to encourage predators. A similar approach to the problem is being taken in Czechoslovakia. Here the question is the proportion of insecticide stress which is effective in reducing both pest and natural enemy numbers under the application of a) systemic insecticides introduced as soil drench

and b) different insecticides applied as foliar sprays.

In the German Federal Republic the research programme is directed mainly towards the search for those critical stages in the life-cycle of the hop aphid which would be suitable for manipulation of population development, making it possible to at the same time alleviate the pressure exerted by pesticides on the natural environment (e.g., disruption of the developmental cycle during aphid migration, etc.). The following research projects have been suggested as having important implications for the hop aphid problem:

i) Investigation of the problem of establishing an economically justifiable level (economic damage threshold) of aphid infestation within an integrated control programme;
ii) Study to increase knowledge of predators and parasites and to find ways to encourage them (e.g., preserving plants which provide substitute prey) and protecting them against target pest species during the application of insecticides;
iii) Search for new tools, particularly more selective insecticides and evaluation of suitability of such new substances in terms of integrated pest control;
iv) Evaluation of hop varieties potentially tolerant to aphids;
v) Study of all aspects of resistance (including genetical stability) in order to estimate the course of development and choose appropriate alternative insecticides for the control of resistant pest populations.

A similar approach would be desirable in the control of the spider mite. However, the availability of research facilities makes it possible to cover only certain stages of such a project. In the USA attention is being focussed on the selection of resistant varieties and seeking predators which can be released in hop gardens. The practicality of using findings on spider mite pheromones is also under consideration. The following projects could possibly be effectively undertaken in the near future:

i) monitoring spider-mite resistance; investigating the life-cycle and ecology of biotypes sensitive or resistant to acaricides; standardization of resistance-measuring methods;

ii) investigating spider-mite predators and appraising the influence of insecticides directed at other target species (particularly aphids) on the development of spider mite populations.

Resolution

The participants of the first meeting on integrated control of pests and diseases in hops note that in many hop-growing areas hop cultures have been subjected to severe pesticide treatment in order to decrease losses incurred through diseases and pests. These chemical treatments have mostly been applied preventively. Hop protection has run into difficulties in recent years because of swiftly mounting resistance to pesticides in aphids and mites and the increasing occurrence of diseases.

The participants agreed to contribute to the overcoming of the present difficulties by developing integrated control methods in accordance with the FAO definition: "Standard practices in control should be replaced as quickly as possible by methods which permit, through the consideration of ecological aspects, the reduction in expenditure on pest control techniques to a justifiable minimum."

In their future activities, members of the Group intend to pay particular attention to the following projects:

1. Investigating population dynamics or epidemiology of harmful organisms including all biotic and abiotic factors of ecosystems, in order to provide basic data for the preparation of monographies on the most important pests and diseases.
2. Establishing economic damage threshold data for pests, diseases and weeds as criteria for assessing the necessity for control measures. This inquiry should also include the study of natural enemies of pests as well as climatic conditions in the diverse hop growing areas.
3. Investigating the effect of pesticides on the natural enemies of pests of hops. In selecting particular pesticides, regard should be paid to partial results already available for many effective substances(1).

(1)see "Introduction à la lutte intégrée - Les organismes auxiliaires en vergers de pommiers"; OILB/SROP, Wageningen, 1974, pp. 231-235.

4. Developing workable forecasting and warning methods for signalling the danger of exceeding the economic damage threshold level with a sufficient degree of reliability.

Results which can reasonably anticipated in due time should be immediately subjected to scrutiny as to their general applicability and appropriate cultivation measures should be put into effect (selection of varieties and localities, fertilizing, etc.). Any method potentially capable of levelling off the danger of resistance should be given serious consideration.

Draft agenda

i) Czechoslovakia was proposed as the location of the next meeting of the Working Group in 1977.

ii) It was suggested that the programme should possibly focus on a narrower range of issues, such as for example, the device for forecasting peronospora, the problem of resistance in the hop aphid including standardization of methods, concept of a quick field monitoring method, etc.

iii) It was recommended that research workers from Czechoslovakia (Praha, Zatec) and England (East Malling) undertake standardization of their methods for testing resistance in the hop aphid with the aim of arriving at at least a fair degree of comparability.

iv) Attention is drawn to the list of participants and interested workers in the field, whose names should be given priority on mailing lists for all papers dealing with problems of hop diseases, pests and control.

Acknowledgement

The organisers of the meeting thank Messrs A. Haunold and C.F. Horner (Corvallis, Oregon) for valuable information on the situation in hop protection in the USA.

Shortly after the meeting the distressing news of the death of our distinguished colleague, H. Aichele, who took a particularly active part in the proceedings of our first meeting was announced. He will be gratefully remembered and missed.

2.11 GENETICAL METHODS OF PEST CONTROL

(Cadarache, France, 8–12 September 1975)

Participants:
H.M. AL-MASHHADANI, L. COOK, G. DAVIDSON, E.D.G. DAVIES, S. MAITLAND-KRAFT, D.I. SOUTHERN, R.J. WOOD (England); R. CAVALLORO (Euratom Biology Group); L. BUSCARLET, G. CHAUVET, M. COUSSERANS, G. GUILLE (France); H.J. HAMANN, J. HANDL, B. HERKART, H. LAVEN (German Federal Republic); W.Z. COKER (Ghana); M.G. FRANCO, P.G. RUBINI (Italy); A.M. FELDMAN, P.J. OVERMEER, J.P.W. NOORDINK, A.S. ROBINSON, L. VOSSELMAN (Netherlands); E. BOLLER (Switzerland); G.L. BUSH, E.S. KRAFSUR (USA); C.F. CURTIS (WHO)

Twenty-seven people representing nine countries and two international organizations took part in presenting papers or in discussion at this Sixth Meeting of the Working Group. Perhaps more than usual with this Group, considerations of genetic control methods in insects of medical importance formed a prominent part of the programme. To acquaint agricultural and veterinary colleagues with the medical problems involved, Davidson (London) reviewed the main vector-borne diseases with special emphasis on malaria, filariasis, schistosomiasis, trypanosomiasis, onchocerciasis and some of the arbovirus diseases. He stressed that as these are characteristically diseases of developing countries with limited resources, assessment of their relative economic importance will be necessary in the allocation of priorities in public health programmes. Present difficulties in accurate assessment of importance stem from lack of fundamental vital statistics information and from the fact that most of the diseases, though chronic and debilitating, are seldom dramatic in their symptoms and often go unrecorded. The most effective form of control so far has been against the vector by the use of insecticides and molluscicides. Drugs and vaccines have had only limited local effects. Now that vector resistance to chemicals is common and peoples all over the world are becoming more and more sensitive to environmental contamination hazards from these chemicals, alternative methods of vector control are urgently needed. Genetic methods have

been seriously considered in relation to malaria, filariasis and arbovirus diseases (mosquitoes) and trypanosomiasis (tse-tse flies).

Laven (Mainz) spoke about the control of the mosquito Culex fatigans and in particular about a field trial in 1973 at a village near Delhi where males of an integrated strain were released carrying a combination of cytoplasmic incompatibility and a Y-linked translocation. Within two months sterility had reached 60-70%, but did not increase further. The limitation on sterility was generally attributed to the immigration of already inseminated females. But Laven had also noticed a decline in adult emergence due to predation of larvae by another mosquito species Lutzia, and he offered this an an alternative explanation (sterility did not rise because there were too few females to show it). Despite incomplete sterility, eggs in water-filled receptacles decreased to near zero in II weeks. However, breeding continued in irrigation wells around the village.

Curtis (W.H.O.) described a field-cage experiment carried out at the WHO/ICMR Research Unit on Genetic Control of Mosquitoes in New Delhi in which the same integrated strain of C. fatigans used by Laven in the village of Gomanhera was tested as a population replacement mechanism against the local Delhi population. Replacement of Delhi by Paris cytoplasm (from the integrated translocation/cytoplasmically-incompatible strain) was demonstrated but "recombinant" males with the Paris cytoplasm and no translocation appeared as a result of partial compatibility between the two cytoplasms (due to a polymorphism for incompatibility type in the Delhi strain). An increase of the "recombinants" was prevented by continuing releases and when a deliberate immigration rate of the Delhi strain of 5 per cent was introduced, no serious build-up of the "recombinants" occurred for five months after stopping integrated strain releases. The competitiveness of males of the integrated strain and chemo-sterilized males was compared in the field by releasing marked virgin females with them and then recording the fertility status of such females recaptured at a later time. This method avoided any ambiguity attributable to immigrants. Equal competitiveness was indicated.

Laven was critical about using "maximum sterility induced" (i.e., observed) in egg rafts as an index to evaluate different methods of genetical con-

trol. He claimed that the sterility observed can be influenced by the number of sterile females acoidentally released, and this should be taken into account.

Cousserans (Montpellier) spoke of an experiment at a well near Montpellier, where the fate of a heterozygote Y-linked translocation released into a population of C. pipiens was studied. The frequency of the translocation declined from its highest frequency of 90% (but rather more slowly than predicted, Curtis).

The population was polymorphic for autogeny (the ability to lay eggs without a blood meal). When the well was covered, the mosquitoes were prevented from feeding and there was in consequence, selection for autogeny. But when the well was uncovered anautogenous mosquitoes increased again in frequency.

Curtis gave an account of a comparison of the efficiency of different genetic control systems in Aedes aegypti in artificially managed field experiments in Delhi. A combination of sex ratio distortion, due to meiotic drive at the M^D locus, with a double translocation (DT_I T3 strain) gave complete population eradication, comparing well with chemosterilization. Both methods were better than translocations alone.

Field studies using the method employed for C. fatigans (see above) showed males of the DT_I T3 strain to be fully competitive with wild type, although the T_I T3 strain (translocations but no drive) was less so.

Robinson (Wageningen) pointed out that a high estimation of competitiveness in the field reached by this method might be an artifact brought about by assortative mating between released marked males and released marked females. Curtis accepted this but said that several of the experiments were done with marked females of wild origin.

Wood and Southern (Manchester) described work by themselves and their colleague Martha Newton, on chromosomal and fertility changes associated with meiotic drive at the M^D locus in A. aegypti. The sex chromosomes of this species are metacentric and morphologically similar although they may be distinguished by a Giemsa C-banding technique. Maleness is determined by a gene or gene complex M situated somewhere within an achiasmate region around the centromere of the Y chromosome. There

is a similar achiasmate region on the X chromosome carrying the female-determining gene m. M^D is a variant of M which shows meiotic drive when associated with a sensitive X chromosome. The effect of M^D is to cause the sex chromosomes to fragment, with the X chromosome affected differentially to an extent dependent upon its sensitivity, resulting in a depletion of X-bearing sperm. This leads to a marked reduction in the absolute number of sperms produced, but does not greatly affect progeny size because sperms are normally produced in excess.

Wood and Cook (Manchester) described a cage experiment in which the drive mechanism was shown to be capable of transporting a marker-gene (red-eye) into a black-eyed distorter-sensitive population. Actual changes in eye colour ratios agreed well with computer predictions to begin with, but later an unexpected increase in red-eyed females and decrease of red-eyed males occurred. This discrepancy might indicate that parameter values in the computer model need revision or that new parameters have to be put in. The practical use of M^D as a transporting mechanism under field conditions depends, among other factors, on the sensitivity of wild populations to M^D. An ongoing survey of wild populations for sensitivity to M^D was reported.

In the area of agricultural pests we first considered the red spider mite Tetranychus urticae with Overmeer (Amsterdam) reporting on natural reproductive barriers between glasshouse strains. From crosses he concluded that the mechanism is an interaction between genome and cytoplasm. He does not consider that natural sterility has practical usefulness in comparison with chromosomal mutation stocks produced by irradiation, which show a higher percentage of lethality in the F_I gametes. These are not as simple as he had supposed, but probably all contain multiple translocation complexes. He demonstrated this using a Giemsa C-banding technique.

Feldman (Wageningen) reported on studies with spider mites in relation to the effect on competitiveness of two levels of X-irradiation (4 Krad which gives substerility and 32 Krad which gives full sterility). He has found that irradiation at the lower dose impairs competitiveness. Males become less competitive as they get older, the effect being observable after 48 hours. Older males also give rise to a lower level

of F_I sterility. This suggests a repair mechanism or selection within the spermatocytes. 300 hours after irradiation, males are virtually the same as non-irradiated males, giving almost normal survival in F_I. These aging effects must be radiation-induced, since they do not occur in non-irradiated controls. Neither of the effects ("repair" or loss of competitiveness) takes place after irradiation with 32 Krad.

Robinson described a study on the onion fly Hylemyia antiqua, the sperm of which he had irradiated with X-rays, demonstrating that 3 Krad produced nearly complete sterility. In the few F_I individuals, fathered by males at this dose and above, no abnormality was observed at pupation, emergence or in sex ratio. 2 - 2.5 Krad did not reduce the F_I fertility. Thus there is little point in using substerilizing dosages because very little radiation damage is inherited (c.f., spider mites and some lepidoptera).

Being convinced by previous work on Drosophila and spider mites that the lower the radiation dose, the higher the chance that induced rearrangements can be made homozygous, Robinson irradiated onion flies with 0.2 and 0.5 Krad. He kept F_I's with reduced fertility and from these derived two inversion stocks and nine translocation lines. The inversion homozygotes are lethal but there is hope that at least two of the translocations can be made homozygous. (N.B. Van Heemert has already produced one sex-linked translocation homozygote in this species). A practical problem with using low dosages for inducing translocations is the need to screen many families. Davidson stressed that this technique cannot be recommended for investigators working alone and unaided.

The Mediterranean fruit fly Ceratitis capitata is one of the more serious pests of soft fruit throughout the world. It shows potential for genetic control and is likely to be much investigated from a genetic point of view in the future. Initial studies on the chromosomes were reported by Southern (Manchester). The species is heterogametic with rather small chromosomes. Somatic pairing occurs in the autosomes but not in the sex chromosomes. The Giemsa C-banding technique reveals bands adjacent to the centromere in the autosomes and stains the entire

short arms and a portion of the long arms in the X and Y chromosomes. Polytene chromosomes were observed.

Discussion followed on the development of a genetic sexing technique for this and other species based on the use of an insecticide resistance gene linked to the Y chromosome by translocation. Application of the insecticide would in theory leave only males, although this would depend on the total absence of crossing over of the resistance gene.

Another contribution relating to genetic sexing techniques came from Rubini (Pavia). From crosses between laboratory populations of the house fly Musca domestica of different origin, it is possible to produce families with highly distorted primary sex ratios, some being all male. Rubini also reported on the first recorded case of sex ratio distortion in the field, a population near Pavia with a marked excess of males. Cytological examination of the F_1 from the field collected marked females, revealed some XY and YY females, and some YY males as well as the normal karyotypes. F_2's from these matings gave some families with excess females, some with only males, others normal. The mode of sex determination in this population does not appear to be the same as any observed previously. It seems probable that the YY males are responsible for all-male progeny while a female determinant, epistatic on the Y chromosome determines sex ratio distortion in favour of females.

Increasing interest is being shown in the selection of refractory populations of vector insects for their potential as replacements for disease carrying populations. One such example is in the selection of a population of Anopheles gambiae species A, refractory in the first place to various species of mouse malaria parasites and apparently partially refractory to a human parasite also. Al-Mashhadani (London) gave an account of his work on this subject and gave the results of the crosses of refractory and susceptible lines. Two different hybrids result. Refractory male crossed with susceptible female produces hybrids in which about half are susceptible and half refractory. The reciprocal cross produces mostly susceptible hybrids. Backcrosses to both parents produce susceptible and refractory offspring in proportions inconsistent with any known simple genetic interpretation and it has been suggested

that cytoplasmic factors might be involved. A detailed study of the fate of the ookinete in the two strains show that this stage develops normally in the refractory line and may even encyst in the stomach wall. Such oocysts as are formed soon degenerate however.

In discussion it was suggested that if a complicated non-chromosomal inheritance mechanism is involved in this phenomenon it will not be of great value for genetic control purposes. However, if there is a total sterility in crosses between refractory and wild populations, as there would be if compound chromosomes were involved, then replacement could still occur.

Two contributions were made concerning the screw-worm control campaign in the new world. Krafsur (Texas) related the history of happenings to the source of flies used for mass-production. Several sources have been used since 1955 and success was not necessarily due to the use of local flies or recently-colonised ones. Details of the southwestern states (USA) programme were given. Original estimates of the pre-release infestations of 1962 as some 50,000 is now considered a gross underestimate; the actual figure was probably 10 times this. Up until 1972 low annual incidences were recorded (as low as 92) and attributed to immigrant flies. In 1972 there was a breakdown in control and 92,000 infestations recorded. This breakdown actually coincided with the use of sterile males derived from a new source - 5 screw-worm families from Mexico inbred 6 to 27 generations before being combined. The annual incidence since 1972 has exceeded 6,900 despite the annual introduction of new release strains and the production for release of 150-250 million flies per week. A recent complete-eradication success has been in Puerto Rico with released flies being derived from Texas and Mexico.

Several reasons were suggested for the erratic results obtained in the southwestern programme form 1972. Among them are larger cattle populations at risk, increased risk due to decreased cowboy/cattle ratio on ranches and poor case reporting. It was also suggested that the abnormally-extended range of the wound-causing Gulf Coast Tick (Amblyomma maculatum) may have contributed as well as an increased deer population. Field trials made in recent years to assess the effect of sterile male "dose", mean number of fly containers ("missiles") per square

mile, width between flight lanes of dispersing aircraft, frequency of treatment and sizes of wild populations on percentages of sterility achieved, showed frequencies of sterile matings similar to those recorded earlier in more successful years. However, Krafsur is not satisfied with the sampling methods being employed, which rely on liver-baited traps and deliberately wounded "sentinel" animals and which assess only females. In particular it is not known how far males disperse.

Using electrophoresis, Bush (Texas) has compared the frequencies of a large number of enzymatic and non-enzymatic proteins in natural and colonised or factory-produced flies. All the factory-adapted populations show an increased frequency of systems associated with flight-activity, especially α GPDH-I, ahd he suggested this as a possible reason for failure of control in the southwestern states. He favours quality control based on periodic monitoring of certain protein frequencies (an "early warning system") and perhaps the deliberate manipulation of these frequencies in factory populations to improve competitiveness.

Davies (Manchester) described a cytogenetic investigation of a strain of the tsetse fly Glossina morsitans morsitans, collected from an area near Tanga, Tanzania, where a joint research programme by USDA and the Tanzanian Ministry of Agriculture is in progress, and where attempts at eradication by genetic methods are envisaged. When compared with a compatible population from Kariba in Rhodesia, the Tanga strain showed lower fertility. Using a Giemsa C-banding technique, Davies observed a morphological difference on the sex chromosomes of the two strains. Associated with this he found both the rate of spermatogenesis and fecundity to be lower in the Tanga strain.

To assess the efficiency of pest control, the field worker requires accurate methods to estimate population size, longevity and dispersal. The mark-release-recapture technique will give this information, and marking with radioactive isotopes has proved of great value. ESNA has in fact a separate working group (No. 10) dealing with Radioisotopes in Insect Ecology, and at every annual meeting there is a combined session of groups 9 and 10. This year Chauvet (Montpellier) gave an account of his use of P^{32} and S^{55} to make a study of the different behaviours of

species A and B of the Anopheles gambiae complex when in sympatric association in a locality in Madagascar. He is now directing his attention to Aedes rusticus and other species in the organisation concerned with mosquito control on the Mediterranean coast (Entente Interdepartementale pour Demoustication du Littoral Mediterraneen). The group later visited part of the area and saw how mosquito control was being achieved by insecticide application.

One possible outcome of releasing large numbers of insects into wild populations is genetic adaptation by the target species. Such adaptation was discussed by Cook in terms of his experience from studying another man-made situation: air pollution leading to melanism in many insect species. He concluded that the selective effects of man-made changes are very unpredictable but selection can be rapid. Broadly speaking the rate of selection is influenced by the gene pool, by local conditions (leading sometimes to co-adaptation) and by migration from outside the area of application. When changes have occurred it is often difficult to account for them because of difficulties in determining the panmictic unit and in estimating numbers and movement.

Many failures of genetic control techniques have been attributed to lack of quality control of mass-produced insects intended for release in the wild. A questionnaire on the subject in which opinions on various topics connected with quality control were solicited, was circulated by the Group Chairman prior to the meeting. A good response was received and an initial analysis of answers has been made. This was considered by the group participants and also be a committee of the group (Boller, Bush, Cook, Robinson, Wood) meeting later at Wädenswil, Switzerland. A final analysis is being prepared and will be circulated.

2.12 GENETIC CONTROL OF RHAGOLETIS CERASI L.

(Wädenswil, Switzerland, 16–19 September 1975)

Participants:
K. RUSS, R. ZELGER (Austria); S. MATOLIN, V. VALLO (Czechoslovakia); R. CAVALLORO (Euratom); A. HAISCH, H. LAVEN (German Federal Republic); T. JERMY (Hungary); I. MOORE (IAEA/FAO); U. CIRIO, P. FIMIANI (Italy); E. BOLLER, E. JOSEPH, B. KATSOYANNOS, U. REMUND, E. SCHLÄPFER (Switzerland); G.L. BUSH (USA)

1. Review of investigations carried out in 1974/75

1.1 Sterile Insect Technique (SIT)

One day was devoted to SIT as primary objective of the group. Field experiments carried out in phase I (research) were reported by Russ, Vallo and Boller for Austria, Slovakia and Switzerland respectively. Experiments in the first two countries were carried out partly under difficult logistic conditions but yielded significant reduction of high cerasi populations. In Switzerland control experiments were carried out in three orchards simultaneously with releases of 2.5 and 5% of fertile flies in orchards B and C during every release of sterile flies. In these two orchards wild fly populations were eliminated by 1974 and 1975 respectively. In orchard A releases started in 1974 after a preceeding suppression programme with visual traps. 0.07 infestation was observed at harvest in 1974 and 4.8% in 1975 due to delayed ripening of the cherries caused by extraordinary weather conditions and hence an early exhaustion of the sterile fly supply in the release schedule. Provisions have been made to avoid similar logistic failures in the future.

Production of fly material: Field mass-collection operations were reported from Austria and Switzerland and indicated their feasibility but dependance on favourable weather conditions during the susceptible stage of cherries. Lonicera plantations along super-highways with high Rhagoletis infestation will be investigated as a possible supplementary source of pupae in the future after completion of comparative behaviour

tests. Substantial progress has been made in rearing flies on a liquid diet that increases yield and decreases production costs (Katsoyannos, Switzerland). Most interesting reports were received from Vallo (Czechoslovakia) working on methods for the prevention of diapause and thus giving for the first time a promising outlook for continuous rearing of cerasi. Other studies on diapause and optimal storage procedures for pupae were reported by Haisch (Germany) and Remund (Switzerland).

Sterilization, marking techniques, logistics: The need for irradiating adults was again stressed and new irradiation procedures demonstrated in the irradiation centre of the Wädenswil station. A review on chemosterilization and JH research was given by Vallo and the conclusion reached that they did not yet provide alternatives to irradiation. A double-marking system using topical fluorescent sprays (KRYLON) and oral markers for neutron-activation and autoradiography was described by Remund, providing almost 100% reliability of identification of recaptured marked flies without impairing flight and mating properties. Quality control procedures developed for field and laboratory monitoring of fly quality were reported by Remund, Haisch and Boller.

Implementation of SIT: Models for implementing SIT in phases I, II and III were described by Boller and the conclusion reached that small scale experiments (phase I) can be carried out now by any individual having acoess to an irradiation source. It was also pointed out that phase II should be started by the group. A hearing was held at the end of the discussions on the question of whether technologies and expertise had reached a stage where phase II (development, large field experiment with 1400 trees) could be initiated. The organization and experimental site of such an experiment in northwest Switzerland was discussed. The group concluded that the technologies were available to handle such a programme as a joint international project with three objectives:

- Elimination (eradication) of the target species in two steps between 1976 and 1980 on a 2.5 Km^2 area with 1400 trees;
- testing of the efficiency of natural and man-made isolating barriers;
- establishing a realistic cost-benefit analysis.

1.2 Incompatible and host races

An introduction to cytoplasmic and genic incompatibility was given by Laven (Germany) based on his experience with mosquitoes. Russ, Vallo and Boller presented their latest data on the distribution of the two compatible races in Europe leading to a new distribution map indicating that the incompatibility originated most likely in Southern Italy and continues to spread into Central Europe eventually replacing the original cerasi race. Males of the Southern race crossed with Northern females produce unidirectional sterility of the eggs laid. Matolin reported his histological investigations on embryogenesis and possible mechanisms of the observed incompatibility phenomena. There are indications that in cerasi we have a case of cytoplasmic incompatibility, but further investigations are necessary to elucidate this hypothesis. Investigations on mechanical sexing techniques were reported by Russ and Remund, and a pupal separator-machine developed in Austria for cerasi was demonstrated. It was concluded that the sterility barriers should be investigated further in South and East Europe by additional collections of pupae and hybridization experiments. There was general agreement that a joint international project for the Incompatible Insect Technique (IIT) should be initiated in the Austria Slovakia region.

The present situation with respect to host races and on-going speciation of R. cerasi in Europe and other Rhagoletis spp. in North America was reviewed by Bush (USA). Novel techniques such as the allocyme analysis allowed new insight into the phylogenetic relationships, genetic distance and evolutionary time of Rhagoletis species. Phylogenetic trees have been established now for Lonicera and Prunus races of R. cerasi based on 8 polymorphic loci, and at the genetic level it was proposed that the two races should be regarded as two distinct species. This point of view was partly supported by comparative ecological and behavioural studies carried out in Switzerland on the two sympatrically occurring host races (Boller and Katsoyannos). Further investigations with respect to the recently established "high-way" host races are in progress.

1.3 Attractants, repellents and varia

Recent data on the presence of a fruit-marking and male-arresting pheromone produced and deposited by the cherry fruit fly female immediately after oviposition were presented by Katsoyannos and Cirio. Katsoyannos was the first to carry out small scale field experiments with laboratory collected pheromone that produced a highly significant decrease of infestation in treated cherries. Purification and crude characterization procedures for the active principle were reported (Katsoyannos & Hurter). Also, the discovery of a sexual pheromone produced by the male and attracting virgin females was reported by Katsoyannos (the second known case in any Rhagoletis sp.). Evidence that probably no acoustic signals are involved in the mating bahaviour of cerasi was demonstrated by Russ who is investigating the bioacoustics of Ceratitis and Rhagoletis as well as of lepidopterans in his laboratory. The Group encouraged the continuation of these studies in progress.

Ecological studies carried out in the region of Naples were reported by Fimiani, providing an important supplement to the so far strictly Central European investigations. Research on larval morphology and symbiotes was reported by Vallo on behalf of his co-worker Linderova.

2. Decisions and recommendations of the Group (Research coordination 1976/77)

The Group devoted the last afternoon of the meeting to drawing conclusions and making decisions and recommendations to be submitted to the Council for approval as follows:

2.1 Organization of the Group

The Group has decided to maintain the present organization and to limit full membership to those individuals devoting all or the majority of their efforts to Rhagoletis cerasi research and operating appropriate facilities. Full members are requested to carry out a minimal programme established at the end of each meeting. The Group decides on future memberships of interested scientists based on their contributions in the framework given by the minimal programme. Scientists involved in major

research programmes supporting the Group's activities will be appointed members on temporary assignment. This status is again given to Prof. Bush (USA). Other experts and scientists can be invited to meetings as observers.

2.2 Minimal programme 1976/77

2.2.1 Joint International SIT Field Project (Phase II)

The Group has decided after a hearing among the experts present at the meeting to pool their resources in one large-scale field project in order to demonstrate the feasibility of SIT under respresntative field conditions. Headquarters of this international project will be in Wädenswil, Switzerland and the experimental area in Northwest Switzerland involving a surface of approximately 2.5 Km^2 and 1400 cherry trees being almost completely isolated by forest. The area is subdivided into three distinct sub-areas: South, Center and North. Sub-area North requires a population suppression programme prior to release of sterile flies and over a relatively short distance a man-made buffer-zone. Preparations in progress (mapping, density estimates and production of pupal material) allow the initiation of a first step by releasing sterile flies in sub-areas South and Center (600 trees) to be continued in three consecutive years 1976, 77 and 78. During the same period a suppression programme by means of improved traps and insecticide application will be carried out in sub-area North that will be treated with sterile flies in 1978, 79 and 80.

The objectives of this two-step experiment are:

a. Elimination of the pest by 1980 in the entire area and keeping the area pest-free for a maximum period of time by adequate quarantine procedures;
b. Testing of the feasibility of this approach in a situation typical for most European cherry producing areas;
c. Establishing a realistic cost-benefit analysis as a basis for future recommendations.

Over 90% of the total costs will be covered by Switzerland.

2.2.2 Joint International IIT Field Project (Phase I)

The Group has decided to pool all available resources in an international Incompatible Insect Technique (IIT) Project to be carried out in the Austrian-Slovakian region. Headquarters of this second international project will be in Vienna, Austria. By using mechanical sexing techniques, pure male material will be provided by the joint cerasi pool of the Group to be used in a field cage study (1976) and in small scale field experiments (1977). Joint planning of this experiment will make sure that appropriate non-leaking strains are used in this research project. Major supporting countries will be Switzerland (provision of pure male material and research on genetic sexing techniques) and Slovakia (research on genetic sexing techniques and establishment of non-diapausing cerasi strains).

2.2.3 Impact study (SIT) (small scale)

The Group considers it highly desirable to carry out in 1976 and 77 small-scale and repeated field experiments in isolated cherry orchards to test the impact of overflooding ratios (sterile : natural flies) of 20:1 up to 50:1 on the wild population, and to investigate the emmigration of marked flies out of the release area (effectiveness of natural and/or man-made barriers). It is desirable that such studies be initiated in Germany and other countries interested in doing such type of research. Arrangements will be made to provide the necessary fly material from the joint cerasi pool. Training of personnel can be provided by most member laboratories upon request.

2.2.4 Bibliography of Rhagoletis cerasi

The Group has learned with great satisfaction that preparations for the urgently needed bibliography have reached an advanced stage and it anticipates that the document can be submitted through OILB channels to an appropriate publisher in early spring 1976 by Dr. Haisch.

2.2.5 Comparison of 4 trapping systems

This joint investigation will be coordinated by Remund (Switzerland) and will involve the comparison of 4 trap models (OILB standard, OILb standard and olfactory additive, Jermy translucent trap and Haisch

translucent fluorescent trap) according to standardized procedures. The costs for standardized trap-kits will be free for Rhagoletis workers in Europe, and order forms and prices will be distributed by end December 1975 to other individuals wishing to test these traps against other fruit fly species.

2.2.6 Definition of incompatibility lines

All participants of the meeting were asked to assist in our efforts to get cerasi pupae from Sardinia, Sicily, Spain and distant East European or Asian origins. Test crosses will be made in Austria with all East origins using the Lackendorf strain as reference and all material should be sent by air mail to Dr. K. Russ, Bundesanstalt für Pflanzenschutz, Trunnerstrasse 5, A-1020 Vienna, Austria.

Material from Italy and Spain should be sent to Dr. E. Boller, Swiss Federal Research Station, VH-8820 Wädenswil, and crosses will be made by using the Hellikon strain (or continental Italian strains) as reference.

Participants were also asked to assist in an European collection campaign of other Rhagoletis spp. to be shipped to E. Boller, Wädenswil and sent as frozen specimens to Prof. Bush, USA.

2.2.7 Definition of developmental thresholds of pupae from various geographic origins

Diapausing pupae will be sent for physiological studies to Dr. Bakker, England who is coordinating this specific programme. All members and individuals from Italy and Hungary are participating in this study.

2.2.8 Establishing density-yield relationships on artificial diets

All members were requested to carry out larval density-pupal yield studies using their own artificial diets and report to the Group in two years.

2.3 Recommended studies

The following investigations were proposed during the meeting and are recommended by the Group, without any obligation to the participants, as follows:

2.3.1 Measuring Ecdyson titre in pupae (Haisch, Vallo)

2.3.2 Investigation on intrapopulation incompatibility (Bush)

One hundred single-pair crossings of cerasi (from one tree or limited area) are checked in standard mini-cages, the individual fertilities measured and spermathecae and bursa copulatrix checked for mobile sperma in those females producing infertile eggs. Data will be analysed by G. Bush upon request.

2.3.3 Investigation of genetic background of incompatibility (Laven)

Repeated back-crossing of hybrids between incompatible races should produce decreased fertility rates in single-pair crossings if genetic mechanisms are involved (Crossing design in Appendix I). Prof. Laven is prepared to assist in the interpretation of the data. This study should be done in those laboratories having an ample supply of pupae of both races (A,D;CS).

2.3.4 Bioacoustics

The Group encourages Dr. Russ to continue his investigations on the bio-acoustic aspects of fruit fly mating behaviour, especially in Rhagoletis cerasi, Dacus oleae and Ceratitis capitata. Of special interest is the investigation of possible alterations of the typical sound patterns by colonisation and extrinsic factors such as sterilisation and marking procedures.

3. Joint publications in preparation or in press

Haisch et al. : Bibliography of Rhagoletis cerasi

Vallo, Remund & Boller: Optimal storage conditions for obtaining high emergence rates in stockpiled cerasi pupae

Remund & Boller : Evaluation of size criteria for quality control and sexing techniques in Rhagoletis cerasi

Russ & Zelger : The development of a device for the mechanical sexing of cerasi pupae based on pupal diameter

Boller, Russ & Bush: Incompatible races of Rhagoletis cerasi and their potential use in genetic control

Boller, Katsoyannos & Bush : Evidence for two host races of R. cerasi based on ecological and behavioural differences

Bush & Boller : The genetics and evolution of two host races of R. cerasi

Boller & Prokopy : Bionomics and Management of Rhagoletis. Ann. Rev. Ent. 21: (in press)

4. Sixth meeting of the Group

We propose to the IOBC Council that the 6th meeting be held in fall 1977. Location and dates will be specified at a later time.

* * *

Appendix I

Procedures to test genetic component of observed incompatibility (Laven)

S = Southern race N = Northern race First position = Female

♀ S x ♂ N = + (fertile)
♀ N x ♂ S = – (sterile)

	Produce the following hybrids	Test the following hybrids	
P	S x N		
F_1	♀ S/N x ♂ N	♀ S/N x ♂ S	♀ N x ♂ S/N
F_2	♀ (S/N)/N x ♂ N	♀ (S/N)/ x ♂ S	♀ N x ♂ (S/N)/N
F_3	♀ ..... x ♂ N	♀ ..... x ♂ S	♀ N x .....

If the observed incompatibility between races has a genetic basis, fertility rates should decrease rapidly with each consecutive generation produced (replacement of one genom by the other through crossing (remark by Boller)).

2.13 THE USE OF INSECT PHEROMONES IN INTEGRATED CONTROL

(Wageningen, the Netherlands, 7-8 October 1975)

Participants:

C.A. PELERENTS, M. v.d. VEIRE (Belgium); C. DESCOINS, C. OUANNES (France); B. GERKEN, C.M. HARRING, R. LANGE, A.R. LEVINSON, H.Z. LEVINSON, A. PREISE, E. PRIESNER (German Federal Republic); G. ROTUNDO, E. TREMBLAY (Italy); W.M. HERREBOUT, A.K. MINKS, C.J. den OTTER, C.J. PERSOONS, F.J. RITTER, L.M. SCHOONHOVEN, S. VOERMAN, K. van ZEGEREN (the Netherlands); G. BERGSTROM, J. LÖFQVIST (Sweden); H. ARN, P.J. CHARMILLOT (Switzerland); P.S. BEEVOR, A.N. CLEMENTS, A.R. GREENWAY, T. LEWIS, E.D.M. MACAULAY, B.F. NESBITT, C. WALL (United Kingdom)

Introduction

This was the first meeting of the Working Group on insect pheromones. The main object of this meeting was to get an idea of what is being done in Europe in this rapidly expanding field.

There were 32 participants from eight different countries, including entomologists, chemists and electrophysiologists.

Programme

The meeting was opened with a short introduction by Prof. C.A. Pelerents, Treasurer of IOBC/WPRS.

After that, three lectures were presented which summarised the main problems of research on lepidopterous sex pheromones, particularly in the Netherlands. Their titles were

"Positional, geometrical and optical isomerism and their significance for pheromone activity" (F.J. Ritter)

"The significance of sex pheromone trapping for survey and disruption" (A.K. Minks)

"Pheromones and the problem of the species in the genus Yponomeuta" (W.M. Herrebout).

These lectures were followed by short contributions. Two gave brief outlines of pheromone research at some institutions:

1. Identification studies on lepidopterous pests in (sub)tropical

regions at the Tropical Products Institute, London (B.F. Nesbitt)

2. Field studies on the pheromones of bark beetles at the Institute of Forest Zoology in Freiburg, BRD (B. Gerken).

The other contributions were arranged in four topics as follows:

1) Chemistry: Stereoselective synthesis (C. Descoins) and chemical analysis of certain lepidopterous sex pheromones (C.J. Persoons).
2) Relation chemical structure/biological activity: Characterisation of pheromone secretions in Hymenoptera (G. Bergström) and in the female Khapra beetle (H.Z. Levinson); chemicals with behavioural effect (A.R. Greenway); specifity of the sex pheromone system of certain moth species (S. Voerman). New bioassay techniques like a device for continuous EAG monitoring of gas chromatograms (H. Arn), a micro-olfactometer (H.Z. Levinson) and a modified electric condensor for measuring locomotor activity (J. Löfqvist). Also: detailed studies of the receptor organs: morphology of the antennae of a moth (C. Wall) and electrophysiological analysis of receptor cells on the antennae (C.J. den Otter).
3) Behaviour: Mating behaviour of Khapra beetles (film by H.Z. and A.R. Levinson), of the codling moth (P.J. Charmillot) and of Coccoidea (E. Tremblay).
4) Trapping in the field/pest control methods: A warning system for pea moth populations (T. Lewis), trapping of moths in warehouses (H.Z. Levinson). Application of the disruption method in plum orchards in Switzerland (H. Arn); commercial aspects of pheromone control of insects (A.N. Clements).

During the discussions between lectures and contributions, it became evident that many participants were badly informed about each other's work, so that the meeting proved to be extremely useful.

General Discussion

The meeting ended with a general discussion. Remarks and conclusions on the following broad topics are noteworthy.

a) Patenting: Ritter invited comments on the commercial attitude to patenting the small amounts of chemicals necessary for monitoring. Clements thought that small firms in general could not obtain the

exclusive rights to produce a compound, because most of the research was financed from public funds. Nesbitt suggested that companies were more interested in selling formulations. In reply to a question by Wall, Ritter mentioned that patents on the use of several pheromone blends for the attraction of fruit tortricids had been filed and accepted in several countries including Holland and the USA. Levinson pointed out that the use of bombykol had been patented for many years.

b) Coordination of Research: Minks thought that the fragmented approach to insect pheromone research in Europe compared with that in the USA could be improved and proposed the compilation of a reference list of pheromonal compounds available at different laboratories in Europe. Persoons stressed that the impurities should also be listed.

After much discussion, it was generally agreed that: 1) a list of attractant compounds and mixtures would be prepared for Western European insects; 2) the Working Group will approach small chemical firms (preferably European) to see whether they would manufacture small quantities of fine chemicals of maximum purity to the requirements of, and for purchase by, perhaps 10 laboratories. Voerman agreed to collect and disseminate this information.

c) Sticky materials: Minks remarked that the American product "Bird Tanglefoot" was in his experience the best sticky material. Several people commented on the variable quality of different batches of the same sticky material (e.g. Stikem Special). Minks also drew attention to the central purchasing scheme for "Bird Tanglefoot" organised by Dr. E. Boller of Wädenswil, within the frame of IOBC. Herrebout thought that some sticky materials, including "Stikem Special", inhibited attraction for 2-3 days after application. Tremblay said that it was too strong for coccid males. Vaseline was suggested as better material for his research.

d) Standard traps: Minks raised the question of standardisation of sex pheromone traps, pointing out that the IOBC Working Group on genetic control of codling moth and Adoxophyes recommended a standard trap for codling moth some years ago. This approach was generally con-

sidered impractical because of the great and unexplained differences in the behaviour of closely related species.

e) Publication outlets: Nesbitt invited advice on publication outlets for the chemical aspects of pheromone papers. Nature, Tetrahedron Letters and the Journal of Chemical Ecology were suggested.

Further Meetings

Pelerents suggested that a smaller committee could meet earlier than 1977. The general consensus of opinion was against this, because it was felt very strongly that the value of the group was its multidisciplinary content.

Finally, Lewis, on behalf of Rothamsted Experimental Station, Harpenden, England, invited the group to meet there in 1977. The invitation was gratefully accepted. After that this highly successfull meeting was closed.

2.14 JOINT FAO/IAEA AND IOBC/WPRS RESEARCH COORDINATION MEETING ON THE USE OF THE STERILE INSECT TECHNIQUE FOR THE CONTROL OF LEPIDOPTEROUS INSECTS ATTACKING TREE FRUIT

(Vienna, Austria, 17-21 November 1975)

Participants:

P. FISCHER-COLBRIE, O. RUPF, K. RUSS, R. ZELGER (Austria); M. PROVERBS (Canada); D. GLEN (England); R. CAVALLORO (EURATOM); E. DICKLER, J. HUBER, G. NEUFFER (German Federal Republic); T. JERMY, L. SZALAY-MARZSO (Hungary); I. MOORE, P. VAIL (IAEA); Gh. RADJABI (Iran); E. NIEMCZYK, Z. SUSKI (Poland); J. ESTEBAN-DURAN (Spain); P.J. CHARMILLOT, E. MANI, Th. WILDBOLZ (Switzerland); B.A. BUTT, H. MOFFITT (USA)

Introduction

The Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture, together with IOBC/WPRS, sponsored a meeting at IAEA, Vienna, Austria 17-21 November 1975. This joint meeting convened with ten scientists

participating in or guiding the Agency's programme of Coordinated Research on the use of the Sterile Insect Technique (SIT) for the control of Lepidopterous Insects attacking tree fruit, as well as twelve scientists collaborating in the IOBC/WPRS Working Group on codling moth.

As a result, the scope of the discussions was broad and included, in addition to projects aimed at codling moth control with the SIT, other research concerned with integrating various types of control methods into a pest management system for this insect. In several countries much progress has been made in the management of the codling moth through actual application of a number of techniques. The meeting thus offered a timely opportunity to review these achievements and to delineate areas of research needing further development. The following summarizes the statements and recommendations of the meeting.

1. REARING AND ATTENDANT PROBLEMS

1.1 Although some aspects of mass rearing Laspeyresia pomonella are still problematic; such rearing is being implemented in Canada and Switzerland on artificial diets and in the USA on thinning apples. In other countries, mass production has yet to be achieved.

1.2 Of the methods extant, mass production on artificial diets is the best solution.

1.3 The participants strongly recommend the creation of a multiple purpose facility for rearing Lepidoptera. The functions of this facility would include:

- serving as a centre for the development of optimum mass rearing technology, particulary for codling moth;
- producing in large quantity and continuously certain pathogens (especially the codling moth granulosis) and other biotic control agents of Lepidoptera.

1.4 The following areas of research listed in order of priority, require further development for optimum production and quality of codling moths.

- Determination of the best rearing conditions, e.g., nature and

intensity, and duration of illumination, fluctuating temperature, humidity and ventilation; (see also 4.3 - long range research)

- Developing the technology of rearing and storing diapausing larvae;
- Pathology and the impact of various micro-organisms on codling moth quality, particularly microsporidia; prophylactic and curative measures against pathogenic as well as non-pathogenic micro-organisms (e.g., Aspergillus spp.); (see also 4.3 long range research)
- Reduction of production costs, including, in order of importance
  - labour, e.g., through improvement of egg collection and development of various methods of mechanical or genetic sexing;
  - dietary ingredients (replacement by cheaper and locally available materials such as industrial by-products);
  - production management;
  - energy conservation

2. HANDLING

Little is known about the influence of handling procedures (collection of emerged adults, irradiation, marking, cooling, transportation, releases, etc.) on behaviour of released insects. Therefore, the meeting recommends intensifying studies on the impact of handling on behaviour.

3. RELEASE METHODS

Depending on the stage released (adults or mature larvae) and local conditions, release methods vary. Thus no generalisation is possible; each situation needs to be considered on its own merits.

4. QUALITY CONTROL

4.1 The meeting recognised quality as the ability of an insect to compete with other members of its species in nature, competitiveness being its ability to react to environmental conditions at least as well as natural populations.

4.2 Most problems of codling moth quality encountered so far (e.g., unsatisfactory behaviour under marginal conditions like cold weather) probably resulted largely from rearing under more or less artificial

conditions.

4.3 In order to overcome quality difficulties, the participants recommend as target research:

- Short range: comparing the following parameters in laboratory and reared and field populations under conditions as natural as possible:
  - number of matings, sperm transfer;
  - activity (daily cycle, flight, dispersal);
  - fertility, fecundity;
  - longevity;
  - reaction to stressors (density, climate factors, natural enemies).
- Long range: based on results obtained from short range research,
  - developing improved rearing techniques, especially those avoiding undesirable selection;
  - investigating the feasibility and methods of periodically introducing new genes from healthy individuals into the laboratory population;
  - devising ad hoc quality measurement techniques for use under given field conditions.

5. POPULATION DYNAMICS AND OTHER ECOLOGICAL ASPECTS

Investigation or improvement is needed in the following areas:

- Determination of minimum ecological requirements for implementing codling moth control (by SIT or other strategy) in the given location, mainly isolation from hot spots and migrating fertile females;
- dynamics of populations prior to, during and after application of any control strategy for a better understanding of population ecology;
- methods for the field estimation of various codling moth stages, particularly eggs and female moths;
- interpretation of trapping data, especially from pheromone traps;
- population modeling for predictive assessments in particular during SIT campaign.

6. FIELD PROGRAMMES

6.1 The participants recognise the need for cost-benefit studies in terms of finance, resources and energy as a rational basis in the choice between various integrated procedures for codling moth control. Codling moth resistance to insecticides, limitations of natural resources, changes in faunal complexes and horticultural practices, and consumer standards must be anticipated.

6.2 With regard to programmes involving sterilization, the participants recommend the use of such programmes for suppression or eradication of the codling moth, and in particular

- continuing research and demonstration of SIT in Western North America and in regions of Europe where reasonable isolation can be achieved;
- emphasising research on F_1 sterility in cold, wet climates;
- integrating the SIT with the use of sanitation, pesticides, sex pheromones, mating inhibitors, pathogens, parasites and predators as well as other techniques;
- conducting further research on methods of releasing sterile codling moths from the ground and air, including studies on release patterns and time intervals, as well as mechanisms for releasing moths at low cost and with minimum insect damage.

6.3 The participants recommend the continuation of research with sex pheromones and mating inhibitors for codling moth detection or control with emphasis on formulation, rates of application, and ecological requirements. The participants noted that sometimes pheromones are not available from industry when they are needed most. They therefore recommend pooling pheromone procurement to establish a reserve.

6.4 In view of the promising results obtained with pathogens, especially granulosis virus, in field tests, the participants recommend

- further testing in isolated or large areas, these tests lasting two to three years;
- intensifying research on the efficacy, characterisation, safety and production of pathogens to facilitate their registration.

7. SURVEY OF CODLING MOTH LITERATURE

7.1 The participants commend Dr. B.A. Butt on the publication of his "Bibliography of the Codling Moth". (Agricultural Research Service - US Department of Agriculture; Publication ARS W-31, issued November 1975, 221 pp.).

7.2 The participants consider this survey as most useful to codling moth workers and therefore strongly recommend the continuation of this literature survey.

7.3 The participants recommend future expansion and completion of this survey and, for bridging possible linguistic difficulties, appoint Dr. Jermy of the Research Institute for Plant Protection, Budapest, Hungary, to send a questionnaire to codling moth workers. The completed questionnaires will be used by Mr. Butt for key subject compilation.

2.15 PUNAISES DES CEREALES

(Palerme, Italie, 20 - 22 novembre 1975)

Participants :

C. GALLEGO (Espagne); J. VOEGELE (France); H. STAVRAKI (Grèce); S. VOJDANI (Iran); P. CAMPANELLA, M. CITATI, F. DI RAIMONDO, G. FENILI, A. FIBUERA, P. GENDUSO, G. LIOTTA, G. MINEO, C. SCHICCHI, A. SERVADEI (Italie); A.M. TALHOUK (Liban); M. LARAICHI (Maroc); L. BRADER (Secrétaire Général, OILB/SROP)

1. Introduction

Une Réunion pour la lutte contre les punaises des céréales organisée par l'OILB a eu lieu à Palerme du 20 au 22 novembre 1975. Le programme comportait en outre une visite des lieux d'hivernation d'Aelia rostrata.

Lors de la séance inaugurale, le Professeur GENDUSO de l'Institut d'Entomologie de Palerme a souhaité la bienvenue aux participants à la réunion et a souligné l'importance des pertes causées par les punaises des céréales durant les années de forte pullulation comme ce fut le cas

en Sicile pour l'année 1974.

Après avoir remercié les responsables de l'Université de Palerme et plus particulièrement le Professeur Genduso, M. Brader, Secrétaire Général de l'OILB/SROP a tracé l'historique de cette Organisation qui vise essentiellement à favoriser les moyens nécessaires pour se réunir et développer des actions de lutte biologique et de lutte intégrée. Il a cité l'exemple de deux de ces Groupes de travail (Group lutte intégrée en vergers et Groupe lutte biologique contre cochenilles et aleurodes des agrumes) qui sont parvenus actuellement à mettre au point des programmes de lutte opérationnels permettant à un pays comme le Maroc, par exemple, d'exporter pour la première fois des lots d'agrumes traités exclusivement par la voie biologique.

Monsieur Brader a formulé par ailleurs le souhait que de tels groupes de travail puissent à l'avenir réunir à la fois des entomologistes, des phytopathologistes et des malherbologistes afin de parvenir à des programmes communs de protection. Dans le cas des punaises des blés, il y aura lieu également de ne pas travailler "en clôture" mais de penser à l'ensemble du problème céréalier.

A la suite de l'intervention de Monsieur Brader, les différents participants ont pris successivement la parole pour faire le point de la situation concernant les Punaises des Céréales dans leurs pays respectifs.

2. Discussions

Différents thèmes ont été discutés, ce qui a permis d'aboutir aux recommandations suivantes :

2.1 Systématique des Aelia et des Eurygaster :

une reconnaissance exacte des espèces présentes dans chaque pays, avec mention de leur degré de nocivité, serait souhaitable. Une attention particulière sera portée à la mise en évidence de l'existence éventuelle de races géographiques.

2.2 Migration des zones d'altitude ver les plaines céréalières :

- Déterminisme : on s'efforcera de préciser pour chaque espèce le caractère obligatoire ou facultatif de la migration. On pourra notamment tester l'hypothèse d'une migration en rapport avec un manque de nourriture dans les lieux d'hivernation ou d'estivation

en interdisant le pâturage dans certaines zones ou en procédant à un renforcement des plantes-hôtes naturelles à l'aide de cultures associées de blé ou d'orge.

- Existence de phases éventuelles : Délimitation de populations morphologiquement différentes. Caractérisation morphobiologique des formes observées et recherche de corrélations possibles avec des phénomènes de densation.
- Signalisation des vols de migration : cette signalisation permettra de suivre les échanges probables de populations au niveau des zones frontalières.

2.3 Etude de la dynamique des populations en plaine :

- Découverte de la plante-hôte : tester l'influence de la couleur (jaune, rouge, bleu, vert) à l'aide de pièges colorés englués de grande taille du type impluvium.
- Etude de l'influence du stade phénologique de la plante-hôte sur l'attraction des punaises vers tel milieu plutôt que tel autre.
- Etude du processus de la dispersion à partir des lieux de rassemblement nuptiaux ou zones de convergence des longs vols.

2.4 Analyse des mécanismes de pullulation : on s'efforcera, à l'exemple de ce qui a été fait au Maroc pour Aelia cognata, de préciser pour chaque espèce les conditions favorables à une invasion et de mettre en évidence les facteurs intervenant dans les fluctuations du niveau de population d'une année à l'autre.

2.5 Méthodes de lutte :

- Définition du seuil économique :
  - Appréciation des densités de punaises dans les champs de blé : La technique d'échantillonnage préconisée par Remaudière et al. (1962) pour Eurygaster intergriceps est la suivante : quatre prospecteurs s'alignent à 50 m l'un de l'autre sur le secteur à examiner. Ils disposent devant eux à plat sur le sol un cadre carré de 0,5 m de côté. Après une fouille minutieuse toutes les punaises trouvées à l'intérieur du cadre sont dénombrées, par espèce, sexe et stade. Lorsque les prospecteurs ont effectué un premier comptage, ils progressent parallèlement de front de 50 m et font un deuxième comptage. Le nombre total "n" de comptages à faire dépend du nombre total "N" de punaises

trouvées; moins on relève de punaises au premier comptage, plus "n" est grand; c'est ainsi que

$n = 2$ quand $N > 200$
$n = 5$ quand $40 < N \leq 200$
$n = 10$ quand $10 < N \leq 40$
$n = 20$ quand $N \leq 10$

Cette méthode d'échantillonage devra être adaptée à chaque cas particulier selon notamment le type de distribution spatiale de l'espèce étudiée.
La corrélation entre densités et risques de dégâts pourra se faire en procèdant à plusieures estimations de densité (tous les 15 jours, par exemple) dans des parcelles témoins et en comparant ensuite avec des parcelles traitées.

. Influence du stade phénologique de la plante-hôte sur la gravité des dégâts. On pourra tester les 4 stades suivants :

- . Taillage
- . Epi dans le fourreau
- . Epi grains laiteux
- . Epi grains mûrs

A chacun de ces stades, trois densités seront étudiées :

- . 1 punaise au m^2
- . 2 punaises au m^2
- . 4 punaises au m^2.

Pour chaque cas, un minimum de 4 répartitions serait souhaitable.
Cet essai pourra se faire à l'aide de cages en mousseline de 1 m x 1 m x 1,5 m.

- Lutte chimique :
La date de traitement sera déterminée en fonction de la densité des punaises et de l'activité des parasites.

- Lutte biologique :
. Les Phasiinae semblent exercer un rôle limitatif important à l'égard des populations d'Aelia et d'Eurygaster dans certaines parties de leur aire de distribution et mériteraient une étude approfondie.

. L'étude du complexe des Hyménoptères oophages devrait être envisagée dans chaque pays en vue de leur utilisation dans un programme de lutte intégrée contre les punaises des céréales. On s'éfforcera également d'établir l'inventaire de leurs hôtes complémentaires en précisant les noms des plantes sur lesquelles on les rencontre.

- Lutte microbiologique :
  Etude des facteurs susceptibles de favoriser le développement des mycoses à Beauveria bassiana dans les lieux d'hivernation. On précisera notamment l'influence des plantes refuges et du factuer exposition sur l'intensité de l'attaque.

- Lutte culturale :
  . Utilisation des variétés résistantes : la résistance peut être d'ordre physiologique ou écologique (cas des variétés précoces qui parviennent à maturité avant l'attaque des punaises).
  . Utilisation de plantes pièges : certaines plantes adventives sont plus attirantes pour les punaises que le blé et devraient être préservées comme plantes pièges.
  . Etude de l'influence des rotations sur la dynamique des populations des punaises.

3. Visite des lieux d'hivernation :

Les participants à la réunion ont pu se rendre compte du niveau de population important d'Aelia rostrata en Sicile en visitant certaines de ses lieux d'hivernation. C'est ainsi qu'ils ont pu dénombrer par endroits jusqu'à 260 punaises par touffe de graminées.

4. Date et lieu de la prochaine réunion - coordination du Groupe de travail

A l'issue de la réunion, les participants ont remercié les organisateurs siciliens pour leur accueil chaleureux et le bon déroulement des trois journées d'étude puis ont formulé le vœu que la prochaine réunion puisse se tenir dans deux ans en Iran. Ce pays est particulièrement intéressant en raison de l'expérience acquise en matière de lutte biologique contre les punaises des céréales et de lutte intégrée contre divers ravageurs

de grande importance économique.

LARAICHI a été désigné et mandaté par le Secrétaire Général de l'OILB comme coordinateur de ce nouveau Groupe de travail intitulé "Punaises des céréales".

2.16 INTEGRATED CONTROL IN CEREALS

(Gembloux, Belgium, 10-12 December 1975)

Participants:

R. de CLERCQ, G. LATTEUR, R. OGER, C. PELERENTS, J. PELSENEER, L. RIXHON (Belgium); Mr. STARY (Czechoslovakia); J. REITZEL (Denmark); K.S. GEORGE, S.D. WRATTEN (England); M. BOUCHERY, E. CHOPPIN DE JANVRY, C.A. DEDRYVER, F. LECLANT, M. LESCAR, J.P. MOREAU, B. PAPIEROK, G. REMAUDIERE (France); Th. BASEDOW, E. BODE, A. SAGENMULLER, F. SCHUTTE (German Federal Republic); W.P. MANTEL, W. NIJVELDT, P. VEREYKEN (Netherlands); M.P. AUSTRENG (Norway); K. ANDERSSON (Sweden); H. SUTER (Switzerland)

I. ECONOMIC DAMAGE THRESHOLD

Introduction

Dr. F. Schütte took the chair. After welcoming delegates to the meeting, he asked Mr. K.S. George to act as Chairman for the morning session, which was devoted to reports and discussion of work done by the Group in 1975.

Reports and discussion

1.1 Chemical control

Mr. Latteur opened the discussion by giving a summary of work carried out in the field on the control of cereal aphids by members in 1974 and before. Copies of the paper were distributed. Two points were discussed: the possibility of aphids being more injurious on a crop suffering from lack of water, and the methodology and timing of aphid assessments for crop loss appraisal.

Mr. George summarised the U.K. work in 1975. Fourteen single-spray experiments were done, in eight of which the aphid numbers at the beginning of flowering or shortly thereafter were greater than five per ear. Eliminating differences due to sites showed that the mean grain yield from treated plots was just significantly higher than that from the controls.

M. Leclant reviewed results from experiments in the Bordeaux region of France. On two of three experiments, significant increases in grain yield resulted from a single spray of pirimicarb; plots were infested with padi as well as avenae.

Mr. Mantel circulated a paper describing single spray and other experiments done in the Netherlands in 1975. In general, the aphid populations in the Netherlands were small with avenae as the most numerous species.

Copies were circulated of a summary of field trials made in Denmark, France and Germany in 1975. In Denmark, Mr. Reitzel's trials were on barley and wheat. Unfortunately, the aphid infestations were slight on all four trials and no significant differences were found between the variables. In France, M. Moreau and M. Warin did one experiment on winter wheat. At the time of the single spray application there were 18 avenae per ear, but the population declined thereafter. Before harvest, a hailstorm completely destroyed the crop. In Germany, one trial was made on spring barley on the effectiveness of a single pirimicarb spray. Although the maximum number of aphids per tiller was only five, the yield difference between untreated and treated was highly significant (29 per cent gain over controls).

M. Mescar described his experiments using parathion and a fungicide together. He obtained maximum yield increase by spraying at the beginning of flowering.

Mr. Suter's results were inconclusive for there were very few aphids on the spring barley crop and ice rain three weeks before harvest seriously damaged all plants. The persistence of pirimicarb was bad.

Mr. Anderson's two experiments were not seriously attacked by aphids, which were of little importance in Sweden in 1975.

Mrs. Armstrong reported that aphid populations in Norway were negligible in 1975.

1.2 Biological control

Mr. Devdryver described his work on parasites, predators and fungi attacking cereal aphids, and said that late development of parasites and fungus in any one season could lead to an increased population the following spring with a consequent increase in their importance as aphid-reducing organisms.

Mr. Basedow and Mr. George reported their work on carabid predators of cereal aphids and the end of the morning discussion was taken up with this topic.

1.3 Cultural practices

Mr. Vereijken circulated a paper summarising his second year's work on cereal aphids. His work on the effect of different levels of nitrogen dressing on the aphid/winter wheat relationship showed that N can stimulate padi and dirhodum but does not affect avenae. High N may make the plant more sensitive to aphid damage. Plant growth stage and site of aphid infestation were both important factors in establishing any relationship.

M. Latteur's paper gave the results of an experiment with eight replications of five variables. He concluded that sprays of pirimicarb and menazon applied too early resulted in the possibility of secondary infestations arising after treatment, and that water stress in the soil and hence in the plant could affect the potential of cereal aphids.

Dr. Wratten circulated a paper giving the results of his experiments on the influence of feeding site in Metopolophium dirhodum on wheat grain weight and quality. He concluded that aphid feeding accelerated senescence of the lower leaves and therefore the nitrogen uptake period, removed nitrogen directly during feeding and blocked or reduced the relocation of leaf nitrogen to the grain.

Mr. Choppin de Janvry circulated two papers describing observations on the evolution of aphid populations in relation to plant growth stage and the effects of different pesticide treatments on cereals in the absence of aphids.

Techniques and projects

Techniques and criteria for spraying against cereal aphids in individual countries were discussed in the afternoon. These can be summarised as follows:

Belgium.- 20 aphids per ear at growth stage 10.5.4 on 50 ears at random. This assessment is based on the need for a cash return to the farmer of twice the overall cost of spraying.

Denmark - on spring barley and wheat 20 aphids per tiller not later than one week after ear emergence.

Germany - 10-15 aphids per ear at growth stage 10.5.1.

Holland - 10-15 aphids per tiller at flowering or shortly thereafter.

U.K. - an average of five aphids per ear on winter wheat at growth stage 10.5.1 subsequently rising.

Project: Predatroy arthropods of the soil surface

Investigations concerning predatory arthropods have been running since May 1973 in Belgium (R. de Clercq), the German Federal Republic (Th. Basedow, F. Scherney), the Netherlands (W. Nijveldt) and Sweden (Å. Borg). Pitfall traps are used. The aims of these investigations are:

1) To show the abundance of beneficial epigean predators in cereal fields. In the first two years of experimentation it was shown that epigean predators are relatively abundant in European cereal fields in summer. Both the number of species and the number of individuals were taken into consideration. (Entomophaga 21, 59-72, 1976)

2) To show the extent to which beneficial arthropods are influenced by the application of pesticides over large areas. In 1973 and 1974 the effects of Parathion, Fenitrothion and Methoxychlor were studied. Nearly all predator species were killed by the first two compounds, while Methoxychlor killed only the bigger Carabid species. These results are in press (Eng. exp. & appl. 19, 1, 1976). In 1975, the effects of Demeton and Dimethoate (mostly used as aphicides) were tested in comparison with Parathion and Fenitrothion. The results are still being worked out, and some of the experiments will be repeated.

There is also a good chance to investigate the influence of pesticide use on arthropod predators in one of the new Ijselmeer-Polders in the Netherlands. An area of 70 hectares which has never been treated with pesticides is being compared to an area where pesticides are used to the normal extent. The 1975 results, which show that on the untreated area there were nearly seven times as many Carabid beetles as on the treated area, are very promising. In addition, two farms in Northern Germany, one of which is being treated with pesticides and the other not, have been under comparison since 1975.

It is hoped that this group of investigations will allow the inclusion of epigean predators in programmes of integrated control of cereal pests in the near future.

Project: Cereal aphid ecology

In Switzerland a study on the ecology of different aphid species living in perennial and annual crops has been in progress since 1971. Its aim is to elaborate a prognostic system for aphids in field crops and to evaluate the possibilities for biological control programmes.

The basic work is done in a closed area of about 25 km^2. Samples are taken in other parts of Switzerland at critical times. The importance of aphid antagonists in various host populations is measured periodically during the whole time of aphid activity. Special attention is given to the relationship between aphid antagonist development in annual and perennial crops.

As a contribution to the discussion on the activities of the cereal aphid ecology subgroup, the working methods and a part of the results were described.

Seven members of the Working Group agreed to search for a suitable area in their working region for joining this project.

II. CEREAL APHID ECOLOGY

Working area

Cereal aphid ecology must be investigated for at least three years within the same ecosystem. This ecosystem should be an easily attainable, typical cereal growing area in the region. Migration and dispersal of aphids and antagonists can be followed easier in a closed area.

The following climate data must be available: daily average (eventually only minimum-maximum) temperature, measured two meters above the soil surface and daily precipitation in mm. If these data can be obtained from a meteorological sub-station, try to get the whole year's data. If you have to measure them yourself, reduce the measurements to the period of sampling.

Methods

Periods of sampling for different programmes:

Full programme (2 1/2 - 3 man-days per week from April/May to July/August, in Scandinavia probably May/June to August)

In regions with normally holocyclic hibernation of aphids, the springtime development of aphid antagonists in aphid populations in perennial crops (winter hosts) may be a key factor for aphid and antagonist development later on in annual crops (cereals). During the progression of aphid population density at least three consecutive samples should be taken at these places (intervals 7 - 10 days). On each sampling day the health status of populations of three to four different aphid species (the most common ones) should be analysed. The last sampling should be taken at the beginning of the aphid infestation in cereals.

Also in regions with anholocyclic hibernation of aphids it could be an advantage to look at the development of different aphid species in the neighbourhood of the cereal fields in order to get a general view of the springtime development of aphids and antagonists within the ecosystem.

During the progression of aphid density in cereals, sampling activity should be concentrated tc this crop (weekly samples). Two or three consecutive subsamples, taken during this period at interesting

times of aphid population development in other important field crops, will give a better final view of aphid antagonist activity during the season.

Further obsrevations of aphid population development after the general summer regression are of minor importance.

Reduced programme

Activity is restricted to three samples in cereals
- first: at low aphid infestation;
- second: during the progression of aphid densities;
- third: near the peak of aphid density.

Between the full and the reduced programmes, intermediate activity steps are possible:
- weekly samples in cereals;
- weekly samples in cereals and subsamples in other important annual crops;
- consecutive samples in perennial crops in spring, reduced programme in cereals.

Observations

At each sampling in both the full and reduced programmes, the following factors should be measured:
- Average plant height or growing stage;
- Number of aphids per m^2. At places with irregular distribution of aphid host plants (fallow land/springtime samplings) estimates of aphid abundance according to a scale established by Remaudière will give a better view than exact measurements; (see pages 121-122)
- Number of predators per m^2 (instars feeding on aphids). The relative abundance of different species can be determined in the full programme;
- Parasitism in percentage of the living aphids. The parasitoids should be conserved (encapsulated, not in alcohol) for later determination of the relative abundance of the different species.
- Fungus infested aphids in percentage of the living aphids. Only in the full programme should the relative abundance of the different species from cereal aphids be determined.

For our work in Switzerland we have elaborated the following method: Field work: In spring, choosing a field and informing the farmers. At the best moment during the vegatation period, counting the number of plant units per m^2 (average of eaoh field). For sampling we bend single plant units over a board and cut them. Then the plants and insects which fall on the board are put into bags of nylon gauze. The bags are kept cool (+5° C) during transportation. The number of sampled plant units varies from 50 to 100 per field. During periods with low aphid infestation, the higher number is sampled. If there are less than 2 aphids per unit (estimated during sampling), additional aphids are collected in the field by tapping them on a board. During the progression of aphid density, the number of plant units is reduced, and average samples are taken in the diagonal of the field. In some years, the distribution of aphids in the field remains very irregular, making it difficult to get a good average sample of the field. In such a situation, two methods are possible: (1) increasing the number of plant units; and (2) taking a normal average and a second sample at places with high aphid densities. Very often the higher abundance of antagonists in the sample taken at places with high aphid densities explains why there is no propagation of the aphids over the entire field.

Field samplings are done on Monday morning.

Laboratory workout: In the afternoon a minimum of 200 aphids is taken from the bags and groups of 25 aphids are placed on young potted plants. Only first instar aphids are left out and the different species are separated. This work is done with a self-made "mini"-aspirator. The aphids are placed in round transparent plastic boxes with nylon gauze on the bottom 10 cm ⌀ and 14 cm high, and the units are brought into a climatic chamber (22° C, 50% relative humidity, 16 hours artificial light). The mumified aphids are collected once a day during the first four days (fungi and parasitoids). There are further controls on parasitism at the seventh day and the tenth day. Fungus-attacked aphids are not considered in these two controls. They are secondarily infested aphids which are not frequent if the humidity is held at the 50% level. This system is less time-consuming than the dissection method and much more exact than estimations of parasitism and fungus attack by counting

mumified aphids on the sampled plants.

When the aphids have been taken from the bags the samples are cooled (1° C) until Tuesday morning. At this time they are put into water with some detergent. The plants are washed and the insects filtered through a piece of fine nylon gauze. The numbers of aphids and predators are then counted. After the addition of the aphids taken away before, the numbers per m^2 are calculated.

Determination of the predator species is normally done with the adults. The larvae must be removed from the plants before washing (only syrphid larvae survive the bath) and reared up to this stage. The most common predator larvae can be determined by the naked eye with some practice.

Number and sites of the fields

In our 25 km^2 area we work at two plots within a distance of about 4 km. Plot 1 is randomly situated near large surfaces of natural grassland. We do the control in one field of each important annual crop. Plot 2 is in the center of the area. Up to now we have used two cereal fields, one of each of the most common winter wheat varieties and one field of each of the other annual crops. The springtime samplings on perennial crops are done in an alfalfa field near each of the two locations. In addition we look at the development of different aphid populations in fallow land in the neighbourhood of the plots and on hills surrounding the area.

During the progression of aphid density in annual crops we make an extensive control in other fields in order to be certain that the main fields in which we are working are typically infested.

* * *

Scheme for an estimation of aphid abundance in places with irregular distribution of host plants:

Level of infestation	Number of aphids
1	– On a few plants less than 5 aphids per plant
2	– Some populations with 6 – 25 aphids per plant or less than 5 aphids on many plants
3	– Some populations with 26 – 125 aphids per plant or many plants infested with 6 – 25 aphids

4 - many plants infested with more than 26 aphids

5 - Heavy general infestation.

III. INTEGRATED CONTROL OF WEEDS

Two experiments are proposed for an international scheme on integrated control of weeds.

Experiment I: Estimation of thresholds for weed control in cereals. The main purpose of this experiment is to find the minimum weed density which causes a significant loss in grain yield. Fields with a moderate weed infestation should be selected in order to operate approximately in the range where the threshold can be found. The weed flora should represent the local conditions, but it seems desirable to consider at least one or more of the following species: Alopecurus myosuroides, Apera spica-venti, Avena fatua, Gallium aparine.

Plot size should be 1000 m^2 (10 m x 100 m or 30 m x 33.3 m) and the plot should be placed in a homogeneous part of a commercial field without replication. The plot will either be treated with an herbicide using tractor-mounted spraying equipment if the farmer doesn't apply any herbicide at all to the rest of the field, or viceversa, i.e., will be kept herbicide-free if the rest of the field is treated. The herbicide used must be one which is registered and should be selected according to the main weeds present and existing soil conditions.

Harvest should be done by cutting three continuous rows of 1 m 6 times each from the experimental plot and the commercial field. These subsamples must be taken at random and may afterwards be mixed into one total sample. If facilities are available the whole plot and an equivalent area from the adjacent part of the field can be combined. Weight of grain should be expressed at standard 16% water content.

Observations: Number of weeds growing on 1 m^2 in a minimum of six places (replications) selected at random in the experimental plot and the adjacent field. Weed countings should be made at three stages of the cereal crop:

- at the three to four leaf stage;
- at the end of the tillering period;
- at the flowering period (count ears and panicles of grass weeds);

Water content of the grain samples should be recorded.

Each participant should try to do at least a total of three experiments with one of the following crops: winter wheat, winter barley or spring barley. If there is enough interest and time for doing more research, the following experiment might be of value.

Experiment II: Effect of different weed densities upon grain yield and quality.

The main purpose of this experiment is to find the relationship between different densities of important weeds and the yield of cereals for calculating economic thresholds.

Several fields with weed infestations ranging from low to high should be selected or weeds should be seeded to make sure that the desired weed density is present. If enough technical assistance is available weeds can be thinned by hand in order to have at least three different weed densities in one location. The main weeds considered should be one of the following: Galium aparine, Alopecurus myosuroides, Avena fatua, Apera spica-venti, or any other species which is important in the area or of interest to the investigator.

Fields with natural weed infestation should have one dominant weed species and only a minor density of other species. If possible, the density of one weed should not increase arithmetically, but logarithmically from one plot to the other.

Plot size should be 10 m^2 or at least 2 m^2 if the weeds are to be thinned by hand. The check must be treated with a registered herbicide which should be selected according to the main weed present and existing soil conditions in order to obtain a weed-free control. Use four replications.

Harvest should be done as in Experiment I.

Observations: Number of weeds per m^2 in the plots
- at the three to four leaf stage of the crop;
- at the end of the tillering period;
- at the flowering period (count ears and panicles of grass weeds);
- at harvest.

Number of crop ears per m^2.
Water-content of grain samples.
1000-grain weight.

IV. INTEGRATED CONTROL OF DISEASES

This experiment is designed to investigate the nigrogen effect on pathogens of wheat. Because of the contrary statements in literature about the effect of nitrogen fertilization on footrot diseases of wheat, the dependenoe of variable climates and fertilizations on footrot of wheat should be investigated in several countries. This experiment will be carried out in experimental stations in West European countries.

Materials, plot design and methods

The experiment is to be carried out on fields with wheat as a pre-crop. The wheat cultivars to be used are Maris Huntsman and one important variety of the respective country.

Plot size : 5 x 5 m = 25 m^2
Replications : 4
Time of sowing : as practiced in the region
Amount of seed : as practiced in the region
Fertilization : sufficient supply of K_2O and P_2O_5

N applications (as calcium ammonium nitrate):

a) 80 kg/ha N
b) 140 kg/ha N
c) 180 kg/ha N

The amount to be applied should be divided as suitable in the district. The corresponding growth stages of wheat have to be recorded when the fertilizers are applied.

Plots should be kept free from weeds by the method normally used in the region.

- Determination of Cercosporella infestation and stalk breaking

One hundred plants are to be investigated. The degree of the disease should be evaluated according to preliminary BBA proposals:

Disease note = $\frac{\%\ \text{weak infested plants}}{2}$ + % infested culms.

Infestation is counted as weak when the culm circumference is attacked to less than 50%. Culms with more than 50% of the circumference discoloured are heavily infested.

Culm breaking: This should be determined according to preliminary BBA proposals. The share of broken culms is recorded and evaluated according to the following scale:

1. No breaking
2. Single broken culms
3. Numerous broken culms

Square dimension of the disease of plots

4. up to 10%
5. 10 to 15%
6. 15 to 25%
7. 25 to 35%
8. 35 to 67.5%
9. more than 67.5%

- Barren ears are to be recorded according to the following scale:

1. No barren ears
2. Single culms starting to be discoloured, but not yet empty
3. Up to 15% barren ears
4. Up to 30% barren ears
5. Up to 45% barren ears
6. Up to 60% barren ears
7. Up to 75% barren ears
8. Up to 90% barren ears
9. Up to 100% barren ears, ears completely barren

Ophiobolus infestation should be recorded immediately after harvest according to the following scale:

1. No symptoms
2. Few roots slightly browned
3. More brown roots
4. Half of the roots dark brown, the base of the culm partially black
5. Roots dark brown, the base of the culm partially black
6. All the roots black, visibly reduced, the base of the culm black, but still strong and not disintegrated
7. Roots black and heavily reduced
8. Only a few roots visible and black, the base of the stem rotten
9. Stem base completely rotten and disintegrated so that roots are no longer adhering.

- Determination of yield is recommended but not necessary.
- Determination of the inoculum potential of the soil in greenhouse experiments

These experiments are only to be carried out at the experimental station in Kiel-Kitzeberg. The cooperators are kindly asked to supply the soil.

Soil samples are to be drawn:

In autumn before starting the experiment. Samples are to be taken from 20 places in the entire experimental area (over all the plots). The soil is mixed and 2 kg should be sent to Kitzeberg. The depth of the soil samples should not be more than 10 cm.

At the end of the experiment from each plot. Soil from 10 places is mixed and 2 kg from each plot are to be sent to Kitzeberg for further use. Depth of sampling should be as in the autumn sample.

2.17 GENETICAL METHODS OF PEST CONTROL

(Manchester, England, 17-19 December 1975)

Participants:
C. PETIT (France); R. BIJLSMA (Netherlands); C. GREEN, R.J. MAHON (Rhodesia); A. PREVOSTI, J. RUBIO (Spain); N. BAILEY, M. BEGON, B. CHARLESWORTH, B.C. CLARKE, L.M. COOK, C.F. CURTIS, T.H. DAY, W.L. EASTWOOD, Y. GHANDI, C.J. GLIDDON, J.M. SMITH, P.J. NAYLOR, A. ROBERTSON, G.B. WHITE, R.J. WOOD (U.K.)

This meeting was held jointly with the Population Genetics Group. Approximately 200 geneticists and entomologists attended, representing 12 countries. The two groups were combined on this occasion with the intention of (1) brining the latest thinking in population genetics to the attention of applied entomologists, (2) interesting pure scientists in genetical aspects of pest control, (3) seeking their advice on applied problems, and (4) encouraging their future cooperation in solving them.

Contributions and discussion were wide-ranging, but included the following points:

1. Genetic control of mosquitoes

Judged by field cage experiments, small field trials and field estimates of competitiveness carried out in northern India, the best prospects for controlling Culex pipiens fatigans were seen by C.F. Curtis (London) to be by the resease of males chemosterilised with thiotepa or of an "integrated" strain (1S31B) combining cytoplasmic incompatibility with a male-linked translocation. 1S31B also holds out good propsects for population replacement.

Curtis believes two systems, DT_1T_3 (combining meiotic drive (D) with double translocations) and chemosterilised males, are potentially useful for controlling Aedes aegypti and should be tested in the field. R.J. Wood (Manchester) has screened wild populations from throughout the tropics for sensitivity to D, finding extreme sensitivity in parts of

the Far East and Pacific.

2. Effective population size and the assessment of genetic control procedures

Difficulty is experienced in predicting the outcome of genetical control procedures. A major problem lies on the assessment of the effective population size (N_e) in nature. This value is central to the calculation of many other parameters in population genetics. L.M. Cook and R.J. Wood (Manchester) described the problems in calculating N_e in an artificial laboratory population of A. aegypti about which a good deal is known: the input and output of both sexes has been recorded on a weekly basis; the absolute population size can be roughly estimated; and the population is not subject to invasion from outside. Yet minimum and maximum estimates of N_e were so different as to make prediction of (for example) the effect of random genetic drift, meaningless. The stumbling balock was lack of knowledge of the yield of eggs per female in the particular conditions of this cage.

The population concerned is one in which genetic control (by population replacement) is being simulated, using meiotic drive (D) tc transport a red-eye gene into the normally balck-eyed stock. This appears to have been very successful, but before accepting the result unconditionally, it is necessary to know whether drift might produce the same effect.

The measurement of N_e in nature is even more problematical because information is required on intra- and inter-population dispersal, on the age structure of the population with time (to get generations), population densities for both sexes, as well as the number of offspring per female. However Mr. Begon (Liverpool) has calculated N_e in a wild population of Drosophila subobscura throughout a single season.

3. Fitness components and quality control

One solution to the question of quality would be to find physical, behavioural or biochemical correlates of fitness which could be kept under observation on a regular basis and so provide an "early warning system" for any deterioration in quality. From his studies on wild populations of Drosophila, Rubio (Orviedo) concluded that mating time (the time copulation takes) is more critical for fitness than mating speed (time be-

tween meeting and mating). W.L. Eastwood (Sheffield) spoke of sexual responsiveness in males as a fitness factor in D. melanogaster and stressed the importance of measuring this in relation to females of a standard age.

A. Robertson (Edinburgh) noted that the heritability and variance of sternopleural bristle number tends to be reduced when stocks are introduced into the laboratory. This does not imply of course that the variance of sternopleural bristle number is the best guide to fitness, but it is the kind of measurement which might be followed up. A similar trait in mosquitoes (larvae) is pecten spine number which in A. aegypti is known to be subject to a reduction in variance under unfavourable conditions (Wood).

Electrophoretic variants (i.e., enzymes) could be suitable for factory monitoring as a guide to fitness. Regarding the fitness of individual proteins, this is still an area concerning which there is much speculation, even to the opinion that some (or most perhaps) of the electrophoretic genes are selectively neutral in nature, a view strongly contested by B.C. Clarke (Nottingham).

Evidence was presented by a number of speakers that at least some electrophoretic variants are subject to selection in the laboratory. Changes in the frequencies of electrophoretic variants in Drosophila can be brought about by chemical changes in the larval diet. Examples include sodium actanoate (a fatty acid) on the G6PD and 6PGD loci, influencing survival in both larvae and adults (R. Bylsma, Groningen), and methyl parahydroxybenzoate, n - propyl formate, isoamylalchol, DDVP, malathion and dieldrin on the Esterase - 6 locus (N. Bailey, Edinburgh; P.G. Naylor, Swansea).

Apart from selection by pesticides or dietary constituents, a further kind of selection was reported by Naylor. This was frequency-dependent, i.e., selection against the most frequent alleles at the Esterase - 6 locus. Frequency-dependent seleotion was also reported by C. Petit (Paris) for other loci in Drosophila. Naylor suggested that each allele produces a substance which inhibits its own action as it becomes more common.

4. Speciation

Intraspecific mating barriers may be more common than we realise. Studies by Petit on mating systems in geographic strains of D. melanogaster from France and Japan show mating barriers to be evident, leading to a degree of isolation and possibly incipient speciation. Isolation between populations was as common within France as between France and Japan.

G.B. White (London) outlined the state of knowledge on the cytogenetics of Anopheles mosquitoes in relation to speciation. Three thousand Anopheles species have been described, 100 of which have been investigated cytogenetically, most of which exhibit inversion polymorphisms. Correlations have been observed between chromosome variation and various physical, physiological and behavioural variables, which could be relevant to the transmission of malaria. However, such associations can arise by chance and can be reversed in different populations (R.J. Mahon and C. Green, Rhodesia). This subject has been studied in detail in Drosophila, in which mating associations ("linkage disequilibria") tend to disappear when they are investigated stringently by isolating chromosomes on a common genetic background, and backcrossing to a marked laboratory stock (D. Charlesworth, Sussex).

However, a number of stable linkage disequilibria have been observed in Drosophila, the most common of which are between electrophoretic variants and inversions (A. Prevosti, Barcelona). Close associations between genes are much less usual and inconsistent between populations (Charlesworth). Linkage disequilibria when present are likely to be selectively advantageous because it is reasonable to assume that the present recombination rate is optimal (J.M. Smith, Sussex).

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