Session 2: Biological responses of arthropods to treatment with CA/fumigation

C.H. BELL[1], and Z. KORUNIĆ[2]

[1] Central Science Laboratory, Ministry of Agriculture, Fisheries and Food, London Road, Slough, Berks, SL3 7HJ, United Kingdom

[2]Medoviçeva 12, 41000 Zagreb, Croatia

Rapporteurs' Report

Work on the effect of fumigants or atmospheric gas mixtures on insects has been conducted for many years at different laboratories all over the world. Our knowledge of the action of certain gases against certain pests of stored-product insects is extensive, and yet changes in food storage practice, and pest status, together with the withdrawal from former fields of use of several compounds, have continuously created the need for new lines of investigation. Major gaps exist even where changes have not occurred, and even for a fumigant such as methyl bromide, which has been in world-wide use for over 50 years, there are still common insect pests (for example *Ahasverus advena, Ptinus fur, Endrosis lactella* and *Corcyra cephalonica*) for which data are almost entirely lacking.

In the developing world there is currently increased concern over food additives and contaminants, and the presence of pesticide residues in products is viewed as undesirable in many quarters. Toxic compounds still in use face restrictions and further review, with the result that much research effort has been directed towards exploring non-chemical alternative control methods such as modified atmospheres. The current session reflected this shift of emphasis in that of the five papers presented, four were on modified atmospheres and only one on fumigation with phosphine.

The first paper described the effect of oxygen levels on large populations of *Rhizopertha dominica* and reported survivals at oxygen levels as low as 1% for over 50 days at 25°C, the longest time ever reported as necessary for control of a stored-product pest at this temperature. With 0.5% oxygen about 30 days were necessary for complete kill. The extended times were considered to be due to a statistical probability arising from the 12,000 or more insects tested per sample. These results were not consistent with the findings of smaller scale tests already published, and would give rise to the need to revise target oxygen levels in treatments based on nitrogen generating systems or gas burners. The implications for the use of nitrogen at lower temperatures are that exposure times would need to be even longer and this may seldom be practical.

The three other papers on modified atmospheres, one on carbon dioxide (CO_2) and two on nitrogen, described success in achieving control of a number of other pests in much shorter exposures. Tests in Canada on

Cryptolestes ferrugineus with different CO_2 levels indicated that only 3 days were required to achieve complete kill of all stages with 60% CO_2 at 30°C. The other two papers, from Germany, reported control of two bruchid species within 11 days at 25°C, and of the common wood-boring pests within 28 days at 22°C, in a 1% oxygen atmosphere. Some survival of the cigarette beetle *Lasioderma serricorne* was observed in the 28-day exposure.

The session thus described prospects for the use of modified atmospheres to treat wood and museum artifacts, beans, seeds and pulses as well as cereals. The paper on phosphine largely took the form of a review of the toxicity and mode of action of the fumigant against insects but the results of some recent work in India on resistance were presented. Resistance factors differed according to the insect stage considered, but the doses required for kill tended to become more similar for the different stages in the resistant strains.

The title of the session did imply that some information may have been presented for arthropods other than insects but in fact no such paper was given. There is indeed a considerable gap in our knowledge of the dosage levels of fumigants or the composition of modified atmospheres require for the control of mite species and this is clearly becoming a priority need for further research.

Also, in spite of the many thorough studies that have been carried out over the years, gaps remain for many insect species, especially in the area of modified atmospheres. Information is required on the gas composition and duration of exposure necessary at different temperatures, on the influence of fluctuating levels, particularly of low oxygen concentrations, and on the effect of intermittent exposures in an attempt to solve the problems associated with very long exposures. Thus even after so many years of research, much remains to be done in this field.