ROUNDTABLE II. ADVANCES IN BIOLOGICAL CONTROL
Discussion Moderator: R. Arbogast, USA.

We opened our round-table with presentations summarizing recent and current work on the use of parasites, predators, and pathogens for the control of storage pests. Several points emerged from the discussion that followed:
(1) The frequent occurance of parasites and predators in association with heavy pest infestations indicates that natural control is often inadequate. It may be possible, however, to overcome this inadequacy by proper manipulation of control measures and augmentation of natural enemy populations by means of periodic releases. An instance was cited in which the parasitic wasp Bracon hebetor provides efective natural control of Ephestia cautella on bagged maize seed when chemicals were used judiciously.
(2) In some circumstances, the unacceptability of living insects or insect remains would preclude introductions of parasites and predators. However, in other circumstances, these factors are not important, as for example in stored inshell peanuts and in grain stored for seed.
(3) The interactions between hosts and parasites or predators and prey, are often very complex and more research is needed on these relationships before natural enemies can be used effectively as control agents.
(4) The future of parasites, predators, and pathogens as practical pest control agents will depend upon development of economical methods of mass production and upon interest in this development by commercial biological control companies.

It was generally agreed that biological control cannot be used in every storage situation but that it could be used to advantage in some, especially as a component of an integrated management scheme.

ROUNDTABLE III. ADVANCES IN THE HOST PLANT RESISTANCE METHOD
Discussion Moderator: J.G. Rodriguez, USA.

There is a lack of research interest in the Host Plant Resistance (HPR) strategy in pest management of stored grains which is more or less directly proportinal to the research funding available for studies in this area. The obvious reason for this situation is that grain surpluses occur in the developed countries, and this reflects on funding for this type of research. As you (we) have seen there has been a real dearth of papers in this general area at the Conference. Some of the International Research Centers such as IITA (Ibadan, Nigeria) and CIAT (Cali, Colombia), of course, have excellent programs in HPR, but unfortunately the workers involved are absent from this Conference.

Nevertheless, there are a host of reasons why HPR should be getting more research attention. The following are the most obvious:

1. Genetic resistance to a pest is one of the most economical strategies that can be applied within the content of integrated pest management.
2. The benefits that spin-off from this strategy include the reduction of pesticide usage (residues in the stored commodity).
3. With the problem of increasing levels of resistance to chemicals, and the banning of certain chemicals/fumigants from current usage, the HPR method takes on added significance.

The discussion on the HPR method focussed mainly on rice and maize. The discussant on rice informed us that rice forms the major cereal of 65 to 75 percent of the world population and a post harvest insect-resistant rice would be of considerable value. The wild genotypes have proved to be the best source of resistant (R) germ plasm. About 1,000 Chinese varieties have been screened for resistance to Angoumois grain moth (Sitotroga cerealella), and about a dozen genotypes have shown resistance consistently. Our promising line, CI 12273, was resistant to the lesser grain borer, (Rhyzopertha dominica) in no-choice tests for antibiosis and to several other species in one-year multi-species free choice tests. Resistance appears to be conferred by two factors, it is dominant, and centers on the hull.

Although none of the resistant genotypes have been released, one (CI 12273) is being crossed and bred with favorable plant types for possible release of either a commercial variety or elite germ plasm for breeding purposes.

Some of the recent work on post harvest HPR on maize was discussed. A significant range of resistance to the Maize weevil (Sitophilus zeamais), is present in the most commonly used inbred lines of corn in the U.S. corn belt. These include resistant lines like B31 and B*. Among the susceptible identified were were Pa91 and B13. The latter is a component of hybrids grown on 35(?) percent of the U.S. corn acreage.

Several studies on the mechanisms of resistance have indicated a major role for the kernel pericarp. First, through an inheritance study, a significant maternal effect in the F_1 genotype was found. The pericarp is 100% maternal tissue. In addition, general and specific combining ability effects were found to be significant.

Second, SEM studies on the feeding behaviour of the maize weevil have shown differences in feeding strategies on resistant and susceptible corn genotypes. The maize weevil was found to feed in a shallow and deep manner. Shallow feeding sites were irregular-sized penetrations of the pericarp with shallow feeding on the endosperm. Deep sites were smaller, usually circular, with extensive endosperm feeding. With susceptible varieties, shallow feeding was more highly correlatedwith oviposition while the reverse was true in resistant varieties. The texture of the pericarp was rougher on the susceptible lines and smoother on the resistant lines. Because of the ease of gripping and penetrating the non nutritious pericarp on susceptible lines, the weevils did not feed extensively on the endosperm.

Conversely, with the difficulty of gripping and penetrating the smoother pericarps on resistant lines, there was selection to fully utilise the exposed endosperm by more extensive feeding. This resulted in a deep feeding site.

Following the SEM studies, the texture of the pericarps with varying levels of resistance was quantitatively measured. This was done with a profilometer. Significant differences were found among the lines. When the number of eggs that were oviposited in these lines was regressed on these measurements, there was a clear trend of greater oviposition in those genotypes with higher measurement values or rougher textured pericarps.

These studies have led to the conclusion that the texture of the kernel pericarp is an important mechanism of resistance in whole kernel corn to Sitophilus zeamais and it can be measured

Finally, there were two points that surfaced as important considerations for future research:

1. Research findings indicate that there are chemicals on maize pericarp that need to be studied (as they affect insect behaviour) using more sophisticated techniques than those previously used. The reason being that current results are contradictory.
2. In view of future work, utilizing genetic engineering techniques in improving the HPR strategy, it is imperative that the precise resistance factors in question are quantitatively and qualitatively identified.

ROUNDTABLE IV. ADVANCES IN EARLY DETECTION IDENTIFICATION AND PREVENTION OF MYCOTOXINS

Discussion Moderator: J.R. Cole, USA.

Discussion were centered around three basic topics: New methods of detection and identification, methods for detoxification and methods for prevention of mycotoxins.

Although the ELIZA (Enzyme-Linked-Immunosorbent Assey) type asseys are not new, the application of this assey to mycotoxins (small non-immunogenic molecules) is a new and rapidly developing technology. At least seven different commercial companies are now presenting or will be presenting ELIZA type asseys for aflatoxin. These asseys have taken three forms, (1) card tests, (2) microtiter wells (standard ELIZA tests) and (3) Affinity columns. These all have different application potential. A discussion concerning these applications to developing countries suggested a possible application of the ELIZA card test to more primitive situations, while the other two types probably would be applicable to more of an analytical laboratory situation. The advantages and dissadvantages of each assey were presented and included sensitivity, reproducibility, economics, time required for analysis, number of aflatoxin detected and whether an ELIZA reader was required. It was concluded that this type of assey will no doubt have application to aflatoxin analysis at several application situations and ultimately may result in a multi-toxin assey in the form of a card type assey.

The second item discussed related to use of Ammonia detoxification of aflatoxin contaminated grain and meal. It was noted that ammoniation of corn and cotton seed meal in the USA was being routinely conducted in Arizona and Georgia. The technique has not yet