EXPERIENCE WITH A NEW STORED-GRAIN PEST IN TOGO AND BENIN: THE LARGER GRAIN BORER, *PROSTEPHANUS TRUNCATUS* (COLEOPTERA, BOSTRICHIDAE)

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Abstract

In January 1984 a stored-grain pest on corn, Prostephanus truncatus (Horn) (Coleoptera: Bostrichidae), was discovered in Togo and 2 years later in Benin (West Africa). Since then extensive surveys of its distribution were carried out and various programs to control the pest were started. To detect the beetle, pheromone-baited traps (Trunccall I" of the Tropical Development and Research Institute, Slough, England) were tested. Maize loss assessment proved the danger of the new pest. During an 8 months storage period average dry weight loss on maize was 44.8 %. Trials were started with binary mixtures of insecticides (pyrethroid + organophosphorus compound) to find a control method valid for the small-scale farm level were P. truncatus occurs together with other, well-known stored-grain pests.

Preliminary tests in the laboratory with a mixed population of P. truncatus and Sitophilus sp. on corn kernels confirmed the superiority of binary product in comparison with the treatment with one active ingredient only. A field trial is being carried out with six different active ingredients (pirimiphos-mehtyl, etrimphos, fenitrothion, deltamethrin, cyfluthrin, fenvalerate) in different combinations (always an organophosphorus compound with a pyrethroid) and dosages. The substrate is corn stored as loose grain in bags with a mixed infestation, including P. truncatus.

During the 2½ years since this new stored-grain pest was discovered in West Africa, difficulties have been experienced in obtaining effective control at small farm level. To date, successful control has been achieved only in some individual cases.

This paper reflects the efforts of three projects of the German Technical Cooperation.

Introduction

In January 1984, the stored-maize pest P. truncatus which originates in Central America, was discovered for the first time in West Africa by a German-Togolese Post-Harvest Project team in Togo (Krall, 1984; Harnisch and Krall, 1984).

Proc. 4th Int. Work. Conf. Stored-Product Protection, Tel Aviv, Israel, Sept. 1986 [Eds. E. Donahaye and S. Navarro], pp. 623-629.

Its introduction probably dates back to a cereal shipment in 1981. Within the years 1984-1986, the beetle spread in such a way that by 1985 it has also been found in Benin (Krall and Favi 1986) (Figure 1).

Presently there are two projects of the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH engaged in controlling this new stored-maize and stored-cassava pest. There are: in the Republic of Togo, the German-Togolese Project for the Control of the Larger Grain Borer, and in the People's Republic of Benin, the German-Benin Plant Protection and Post-Harvest Project.

In addition, there exists a supraregional GTZ-Project for research on biological control methods for P. truncatus and a regional German-Kenyan GTZ-Project for the control of the larger grain borer.

In the following, some results of 2½ years' work on this new pest in Togo and Benin are presented.

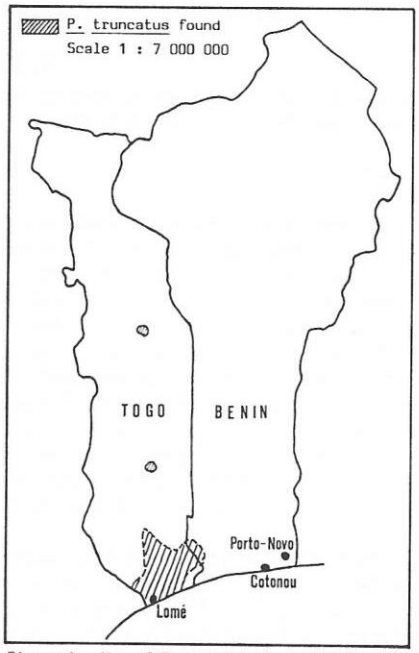

Figure 1 - Map of Togo and Benin indicating the extent of P. truncatus infestation within the countries

We have to note that we are not presenting the results of a concluded research project, but rather of experimentation and extension work.

Pheromone Trapping

In Togo, the pheromones 'dominicalure' and 'trunc-call 1' have been tested in collaboration with the Tropical Development and Research Institute (TDRI), Slough, England in January 1984 (Hodges, 1984; Hodges et al., 1984; Krall, 1984).

'Trunc-call 1' a newly synthesized pheromone of P. truncatus, had until this time never been tested in the field. The test compared this new pheromone with the one of Rhizopertha dominica (F.), also a Bostrichid which has been used in the past for the monitoring of P. truncatus. The pheromone showed, as expected, better results being twice as effective on P. truncatus as 'dominicalure'.

Meanwhile TDRI has synthesized an improved 'trunc-call 2' which has not yet been used either in Togo or Benin.

In Benin, 'trunc-call 1' was tested in 1984/85 on a large scale for monitoring (nearly 1000 traps) without conclusive findings. Besides being a rather laborious process (placing of the traps, refinding, collection and evaluation after 20 days), the method failed to detect the new pest.

During the next season, monitoring was done by visual observations which was deemed possible because of the very distinct method of attack of P. truncatus. With this monitoring procedure, the pest was actually found without pheromone baited traps.

Whether the beetle had not yet been in Benin during the preceeding season 1984/85 or the pheromone trapping had not been effective remains an open question. The fact is that visual observations enabled detection of the beetle and represented a smaller input in manpower and money.

Maize Loss Assessment

Pantenius (1985) of the University of Kiel (West Germany) included P. truncatus, after its discovery in 1984, in his ongoing research project on 'loss assessment in traditional maize stores of South-Togo'. The following are some interesting aspects of the results of this work (Pantenius and Schulz, 1986):

- Weight losses of local maize varieties in traditional stores without the appearance of P. truncatus rarely exceed 10%. Often they are below the 5 % level (average 5.5 %) after eight month of storage. In stores with hybrid varieties losses reach an average of 15.8 %.

- After the appearance of P. truncatus, weight losses increased under the same conditions by up to four times: an average of 44.8 % dry weight loss after eight months of storage.

- A laboratory trial proved that P. truncatus alone caused higher total weight losses than in a mixed population with Sitophilus zeamais (Motsch.). This test also showed a four times higher loss when P. truncatus was present in addition to other common storage pests.

- Whereas with S. zeamais only one larva develops in a kernel, there are up to eight in the case of P. truncatus (different stages of development). There was never a mixed attack in one maize kernel.

- The production of dust and frass (indicating inefficient utilisation of its diet) is with P. truncatus much higher than with S. zeamais. This may explain the high losses incurred by P. truncatus infestion.

Laboratory Insecticide Trial

As proved by experience in Tanzania and Togo, and from laboratory trials in West Germany, England and other countries, the efficiency in controlling P. truncatus with organophosphorus compounds is very low (Anonymous, 1985). On the other hand, the principal pest on stored maize S. zeamais is extremly insensitive to pyrethroids. However, each of these pests is highly susceptible to the opposing insecticides.

Since in practice there is always a mixed population of both, as well as of other common stored-grain pests, the efficiency of using binary products (pyrethroid + organophosphorus compound) is evident.

In Togo a laboratory trial proved this fact very clearly (v. Berg and Biliwa, 1985). The following active ingredients for controlling single and mixed populations of P. truncatus and S. zeamais on loose grain of local maize were tested:

1. Deltamethrin (DP 0.2 %) at 1 ppm
2. Pirimiphos-methyl (DP 2 %) at 10 ppm
3. Fenitrothion + Fenvalerate (DP 1.5 + 0.3 %) at 5 + 1 ppm
4. Fenitrothion + Cyfluthrin (EC 80.6 + 2 %) at 4 + 0.1 ppm

There was no real effect of the binary fenitrothion/cyfluthrin insecticide. The reason for this may have been due to its liquid application as opposed to the dust application of the other products. The latter products showed the following interesting results:

In samples attacked solely by S. zeamais good results were achieved with pirimiphos-methyl and fenitrothion/fenvalerate, whilst deltamethrin alone proved to be inefficient. In samples attacked solely by P. truncatus good results were achieved with deltamethrin and fenitrothion/fenvalerate,pirimiphos-methyl being ineffective.

In a mixed population of both species, only the binary product fenitrothion/fenvalerate was able to control the pest. These findings confirm the above mentioned hypothesis.

Field Insecticide Trial

In April 1986, a field trial was initiated in which the two GTZ projects in Benin and Togo collaborated (Krall et al., 1986).

This test was designed on the basis of preceeding laboratory trials and the consideration that only a product containing both a pyrethroid and an organophosphorus compound is able to control mixed attacks of P. truncatus and other common storage pests.

As there were only two products of this kind available commercially, we had to mix our own binary insecticides. Presently, we are testing the following active ingredients:

1. Pirimiphos-methyl 7.5 ppm + Deltamethrin 0.25 ppm
2. Pirimiphos-methyl 7.5 ppm + Cyfluthrin 0.25 ppm
3. Pirimiphos-methyl 5 ppm + Deltamethrin 0.5 ppm
4. Pirimiphos-methyl 5 ppm + Cyfluthrin 0.5 ppm
5. Etrimphos 7.5 ppm + Deltamethrin 0.25 ppm
6. Etrimphos 7.5 ppm + Cyfluthrin 0.25 ppm
7. Etrimphos 5 ppm + Deltamethrin 0.5 ppm
8. Etrimphos 5 ppm + Cyfluthrin 0.5 ppm
9. Deltamethrin 1 ppm
10. Fenitrothion 5 ppm + Fenvalerate 1 ppm
11. Fenitrothion 10 ppm + Cyfluthrin 0.25 ppm

The test covers in addition to loss assessment the dynamics of pest populations, and residue analysis. Preliminary results after four months seem to show the superiority of all binary products vis-à-vis the single active ingredient (deltamethrin) and vis-à-vis the control. Definite results cannot be expected before early 1987.

Extension Work

In the extension work for controlling *P. truncatus* we are faced with different situations in Togo and Benin.

TOGO

When the pest was first discovered in Togo, its distribution was quite limited although the infested area already covered 400 km². Therefore one had to react immediately without the possibility of carrying out preliminary tests and investigations. The initial radical control measures (fumigation of all stores in which infestation was detected) were intended to slow down the spread of the pest or even stop it altogether. However this in fact was not possible (Krall, 1984).

The extension work that followed was carried out to show simple measures for obtaining effective control by the farmer himself. Noting that the multiplication of *P. truncatus* is inferior in loose grain than in maize cobs, and effective control measures are possible only in the first case, extension specialists proposed storage of loose grain in sacks under insecticidal treatment. However, maize is stored traditionally in cobs with the husks intact and piled up on wooden platforms. As a control method, treatment with locally available pyrethroid (deltamethrin dust at 1 ppm) was proposed hoping also to control other common storage pests like *S. zeamais*. In general, this method showed an acceptable success, although the choice of insecticide is not yet considered ideal.

Small farmers are reluctant to change their traditional storage techniques; often there is no space to store the sacks. Above all, there is a lack of manpower for dehusking and shelling of the maize after harvest and drying. Possibly, a heavy attack by P. truncatus may persuade farmers to adopt the new technique.

In order to stimulate the farmer, the material necessary for storing one ton of maize is supplied free of charge (sacks, insecticide), or as a loan (hand operated maize sheller). Additional material has to be bought. For rural cooperatives, the building of a warehouse suitable for fumigation is recommended (capacity of 25 t) (Harnisch and Krall, 1986). Its construction does not require skilled labour and costs for the material are provided by different funds.

BENIN

In Benin the situation has been quite different. At the time when P. truncatus was discovered in Togo no attack had been recorded in Benin. Therefore we had the time and possibility to prepare for its appearance.

Besides regular monitoring, there has been extensive training of technicians and of all extension workers in the endangered areas. Technical leaflets have been distributed as well as samples of dead beetles of P. truncatus for comparison, in case of attack. Furthermore preparation has been made for the distribution of binary insecticides.

In the meantime the pest has in fact been found in Benin (Krall and Favi, 1986). Its distribution is still limited and attack in the infested areas is non-homogeneous. A broad campaign seems therefore not yet necessary.

Only at a governmental seed farm have severe control measures been taken (fumigation of maize cobs, shelling, treatment with deltamethrin 0.5 ppm and pirimiphos-methym 5 ppm, treatment of the empty cribs with deltamethrin EC). Presently, we are considering the possibility of protecting maize also in traditional stores in cobs.

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