Pande, S., and Singh, S.D. 1992. Successful transfer of ICRISAT downy mildew resistance screening technology: an example of transfer of technology. Pages 331-334 *in* Sorghum and millets diseases: a second world review (de Milliano, W.A.J., Frederiksen, R.A., and Bengston, G.D., eds.). Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Williams, R.J. 1984. Downy mildews of tropical cereals. Pages 1-103 *in* Advances in plant pathology. Vol. 2. (Ingram, D.S., and Williams, P.H., eds.). London, UK: Academic Press.

Entomology

Incidence of Stem Borers on Postrainy-season Transplanted Sorghum in Cameroon, Nigeria, and Chad in 1995/96

O Ajayi, R Tabo, and D Ali (International Crops Research Institute for the Semi-Arid Tropics, Western and Central Africa Region, Sabo Bakin Zuwo Road, PMB 3491, Kano, Nigeria)

Introduction

Postrainy-season sorghum, known as *muskwari* in Cameroon, *masakwa* in Nigeria, and *berbere* in Chad, is a very important cereal crop in Chad where it constitutes about 10% of the total cereal production and 20% of the total sorghum (rainy season + dry season) (Lotar Mougabe, Head, Systeme de I'Information du Marche, personal communication, 12 Oct 1995). *Muskwari* represents about 25-30% of the sorghum production in northern Cameroon (Djonnewa and Dangi 1988). Although its proportional production, relative to rainy-season sorghum, in Nigeria has not been determined, it is frequently the only sorghum crop available to many farmers in Borno State where it fetches a higher price than rainy-season sorghum. The grains are used to prepare a stiff porridge known as *boule* (*tuwo* or *to* in western Africa) while the stems and leaves are fed to animals, or used for fencing and as firewood. Earlier surveys had revealed that stem borers are the only important insect pests of postrainy-season sorghum in Cameroon and Nigeria (Tabo et al. 1993). Little seems to be known about the insect pests of this crop in Chad, although Versteeg (1995) reported that farmers who were involved in a diagnostic survey in the Canton de Madiagho in 1995 ranked stem borers 5th among the constraints to the production of postrainy-season sorghum in the area. The more important constraints recognized by the farmers were birds, grasshoppers, shortage of water, and storage problems. A survey was, therefore, conducted from 5 to 9 Feb 1996, to determine the incidence of stem borers on postrainy-season sorghum in Chad and parts of Cameroon and Nigeria that had not been surveyed earlier.

Materials and methods

The survey involved counting 50 randomly chosen stands of sorghum per field, and recording the percentage of plants that were infested by stem borers. Observations were made on four farms in each of Cameroon and Chad, and one in Nigeria. Symptoms of stem borer infestation that were sought included: leaf feeding, deadhearts, holes, tunnelling, and the presence of frass, larvae, and pupae in the stems. Larvae and pupae were collected and reared to adulthood on fresh sorghum stems in Kilner® jars in the laboratory. The incidence of natural enemies, particularly parasitoids, was also noted. Pupae of natural enemies were collected and kept until adult emergence. Dead larvae and pupae of the stem borer were similarly treated.

Results and discussion

The incidence of stem borers on the nine farms surveyed is presented in Table 1. Stem borer incidence was often quite high, ranging from 10% at Zigi Chokrai in Chad to 100% at Maltam and Fotokol in Cameroon. In Chad, infested stems were usually bored at the base or in the peduncle; in Cameroon and Nigeria, the stem was often riddled with tunnels and up to 15 larvae and pupae were found per stem. Consequently, the stems frequently

Table 1. Incidence of stem borers on dry season sorghum in Cameroon, Nigeria, and Chad, 1995/96.

Country	Surveys	Locations	Mean % infected	Percentage range
Chad	4[1]	6	38.3	10-71
Cameroon	4[2]	4	72.3	13-100
Nigeria	1[2] 1	70		70

1. Conducted 5, 6, and 8 Feb 1996.
2. Conducted 10 Feb 1996.

lodged due to the weakening effect of the tunnelling. Peduncle attack caused some panicles to be chaffy while others snapped off. Where the stems had been harvested, most of the stem borer larvae and pupae were found in the stubbles and the young shoots that had developed after the harvest. Where the stems were still standing, however, the insects were found in the stem tillers, within the tunnels in the stems, or between the leaf sheath and the stem. Some of the crops had been harvested at the time of the survey and birds had destroyed the panicles that were yet to be harvested; it was therefore, not possible to determine the effect of stem borer attack on grain yield. However, poor panicle exsertion, chaffiness, and snapped off panicles are bound to lead to a reduction in grain yield. One farmer at Miskine Bananan reported that he harvested only 3 bags ha^{-1} (about 300 kg of sorghum) where he had obtained 13 bags (1300 kg) in 1995. He attributed this huge loss to damage caused by birds, stem borers, and panicle pests. On this particular farm, we observed nymphs of the head bug, *Eurystylus oldi* Poppius, feeding on the panicles, and nestled under the leaf sheaths, indicating that this pest survives the dry season in this area by feeding and multiplying on this type of sorghum. Another farmer at Fotokol, who called the stem borer *tsutsa,* was aware of the incidence and damage caused by this insect, but did not know of any control measure. Stem borer infestation was higher in the traditional postrainy-season sorghum-producing areas in the three countries than in the rice-growing areas (that are flood plains but not real Vertisols) of Chad, such as Kolobo and Zigi Chokrai, where *berbere* is a relatively new crop. The stem borers collected were *Sesamia poephaga* Tarns and Bowden (Lepidoptera: Noctuidae), *Sesamia ca~lamistis* Hampson (Lepidoptera: Noctuidae), an unidentified *Sesamia* sp, and *Eldana saccharina* Walker (Lepidoptera: Pyralidae). Of the 113 stem borers collected, 19% were pupae, 81% were at different stages of larval development, and 13% were dead, indicating parasitism. Death from parasitism was higher in pupae (46%) than in larvae (5%). The percentage of larvae and pupae from which natural enemies emerged was low (less than 1%), The parasitoids identified were *Sturmiopsis inferens* Towns, *Pediobius amaurocoela* Waterston (Hymenoptera: Bulopidae), and *Apanteles sesamia* Cameron (Hymenoptera: Braconidae); while *Nesolynx phaeosoma* Waterston (Hymenoptera: Eulopidae) was recorded as a hyperparasitoid on *Apanteles.*

This preliminary survey will be followed up by a more comprehensive study of the 1996/97 dry-season crop, that will be conducted earlier in the year, possibly in early to mid-Jan 1997, before the crop is harvested. The 1995/96 crop was harvested early, probably because the scanty rainfall in 1995 adversely affected crop growth and hastened crop ripening. Farmers also harvested early to minimize acute bird damage, and to avoid the crop being grazed by cattle. Later surveys will look more critically at the effects of stem borer infestation on yield, and the incidence of natural enemies of the insect. Other dry-season hosts of *E. oldi* will also be identified.

Acknowledgments

We thank the farmers who readily allowed us to sample their fields despite the huge losses suffered by them this year. We acknowledge the help of Drs Aboubakar Ourde Ousta, Director of Direction de la recherche et de la technologic agricole (DRTA) (for making arrangements for our visit to and within Chad), Nadingar Alladoumngue, Director of CIRAD-CA in Chad, and Yagoua NDjekounkosse, Sorghum Breeder at Bebedjia, Mr Gouana Boure Oueye, Soil Scientist, DRTA, and Mr Emmanuel Owoleke, our Driver and General Assistant. We also thank Dr MC Dike of the Institute for Agricultural Research, Samaru, Zaria, Nigeria for identifying the insects.

References

Djonnewa, A., and Dangi, O.P. 1988. Improvement of transplanted sorghum. Pages 48-52 *in* Proceedings of the Third Regional Sorghum Workshop, 20-23 Sep 1988, Maroua, Cameroon.

Tabo, R., Olabanji, O.G., Ajayi, O., Flower, D.J., and Kaigama, B.K. 1993. Performance of dry season sorghum at varying plant densities in northeastern Nigeria. Agronomy Abstracts 1993: 147.

Versteeg, M.N. 1995. Rapport de l' atelier de formation sur un sondage diagnostic rural participatif et rapide du Canton de Madiagho, Republique du Tchad. 66 pp.

Survival of Overwintering Sorghum Midge in Relation to Crop Residue Destruction

D A Mott and G L Teetes (Department of Entomology, Texas A & M University, College Station, Texas 77843-2475, USA)

Survival of overwintering sorghum midge, *Stenodiplosis sorghicola* (Coquillett) was assessed during 1994/95 in a