Research Note on the Distribution and Relative Importance of Bean Bruchid Species *Acanthoscelides obtectus* (Say.) and *Zabrotes subfasciatus* (Boh.) in Tanzania

Misangu*, R.N., S. Nchimbi-Msolla and S.O.W. M. Reuben
Department of Crop Science, Sokoine University of Agriculture P.O.Box 3005, Morogoro, Tanzania

Abstract

*Two bean bruchid species **Acanthoscelides obtectus** (Say.) and **Zabrotes subfasciatus** (Boh.) are known to destroy beans in storage. However, the distribution and relative importance of these species have not been established in Tanzania. In this study, a bean bruchid survey was carried out to find out if the two bean bruchid species occurred in the country. The survey was conducted in 1993 and it was observed that both bean bruchid species were present in all regions surveyed. However, the species **A. obtectus** was more dominant in all regions except in Ruvuma and therefore appeared to be relatively more important than **Z. subfasciatus**. The occurrence of the two species in all surveyed regions indicates that both species are of economic importance in the country. There was no indication that the two species occur in well defined ecological zones.*

Keywords: Distribution, bean bruchids, relative importance

Introduction

The bean bruchid species *Acanthoscelides obtectus* (Say.) and *Zabrotes subfasciatus* (Boh.) are major storage pests of beans (*Phaseolus vulgaris* L) in Tanzania and are a major constraint to small-holder bean producers. During storage bruchid damage can be very detrimental and reduces the weight, quality and viability of beans. Weight losses of up to 40% are common in Tanzania (Kiula and Karel, 1985). However, the general observation is that the degree of loss depends on the storage period. The longer the storage period the greater the loss and may reach up to 100%.

The distribution of bruchid species in Tanzania is not well established. Studies by Schoonhoven and Cardona (1986) conducted in South America indicated that *A. obtectus* is adapted and restricted to higher altitudes. On the contrary, *Z. subfasciatus* is more adapted and confined to low altitude areas. In South America therefore, the two bean bruchid species appear to differ very clearly in their ecological adaptation. However, a bruchid survey in Uganda showed that both species were well established and widely spread in the country (Slim, 1990). Another bean bruchid survey conducted by Masolwa and Chimbi(1991) covering Arusha, Morogoro and Dodoma districts in Tanzania showed that both species were present but *Z. subfasciatus* was more predominant. A similar survey conducted by Giga *et al.* (1992) in Uganda, Tanzania and Zimbabwe indicated that *Z. subfasciatus* was absent in most areas except for a few isolated cases in Uganda. *A. obtectus* occurred in areas ranging in altitude from 600 to 1600 metres above sea level (m.a.s.l.), and was the most prevalent species. This indicated that *A. obtectus* was also well established in the medium altitude areas. In Tanzania, *Z. subfasciatus* was observed only in Babati district at an altitude of 1500 m.a.s.l., indicating that the species also occurred in cooler environments. In Zimbabwe, only *A. obtectus* was

*Corresponding author

observed. It was therefore concluded that the two species of bean bruchids in Africa are adapted to a wide range of ecological zones and not only to well defined ecological zones.

In view of the contradicting results on the adaptation of the two bean bruchids species, a survey of all major bean growing regions in Tanzania was conducted to investigate whether both bruchid species occurred in all bean growing areas and if they were associated with climatic or physical factors.

Materials and Methods

The bean bruchid survey was conducted between August and September 1993 in 10 regions of Tanzania (Table 1). During the survey, bean samples weighing 200–300 g were collected from local markets and from individual households in villages alongside highways. The purpose of collecting bean samples from local markets and individual households was to minimize chances of collecting bean samples brought from outside regions. Each bean sample was placed in a separate polythelene bag which was sealed with rubber bands. Each bag was provided with a label indicating the source, date of collection and variety. Twenty one to 31 samples were collected per region depending on the availability of bruchid infested beans.

The bruchids were separated from each sample in the laboratory by sieving through a 3 mm mesh into ice cold trays. This was accomplished by having the base re-acceptance tray in contact with a larger tray containing ice. This was to chill and temporarily immobilize the bruchids for easy handling, counting and identification. The bruchid identification was based on the key proposed by Haines (1991). The total number of each bruchid species from each sample was carefully recorded. The results were analysed using the T-test.

Results and Discussion

Both bruchid species were present in all the ten surveyed regions(Table 1). Of the 4234 bruchids collected from the samples, 73% belonged to *A.obtectus* and 27% to *Z. subfasciatus species.* In general, *A.obtectus* was more prevalent than *Z. subfasciatus.* The exception was in Ruvuma region where *A.obtectus* accounted for 45% of the total bruchid collected from that region (Fig.1).

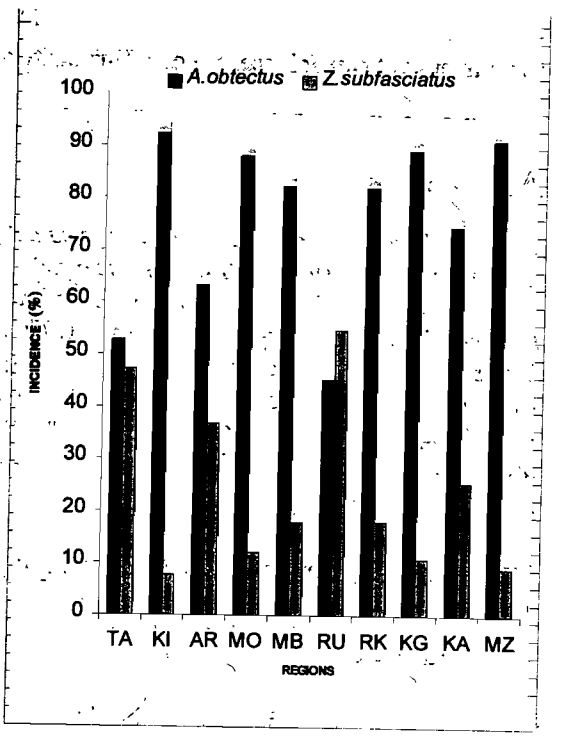

Figure 1: Incidence of *A. obtectus* and *Z.subfasciatus* in the selected bean growing regions of Tanzania

In the regions of Kilimanjaro, Morogoro, Mbeya, Rukwa, Kigoma and Mwanza, *A. obtectus* accounted for more than 80% and *Z. subfasciatus* was less than 20% of the total bruchid number (Table 1). In Arusha and Kagera, *A. obtectus* was 63.3 and 74.6% of the total counts while *Z. subfasciatus* was 36.7 and 25.4%, respectively. However, in Tanga region, differences between the two species were narrow.

The ANOVA (Table 2) indicates that regions did not differ significantly ($P = <0.001$) on the distribution of bruchid species. However the species differed significantly in their relative occurrence whereby *A. obtectus* was found in larger numbers than *Z. subfasciatus.* This shows that *A. obtectus* is more important than *Z. Subfasciatus.*

Table 1: The relative occurrence of *Acanthoscelides obtectus* (Say.) and *Zabrotes Subfasicatus*(Boh.) in the major bean growing regions of Tanzania

Region	Number of. A. Obtectus	Number of. Z. Subfasciatus	Totals
Tanga	374	336	710
Kilimanjaro	294	25	319
Arusha	544	315	859
Morogoro	298	41	339
Mbeya	251	54	305
Ruvuma	147	178	325
Rukwa	237	52	289
Kigoma	362	44	409
Karega	188	64	252
Mwanza	391	39	430
Total	3086	1148	4234
%	72.9	27.1	100

Table 2: ANOVA for the bean bruchid species distribution among regions in Tanzania

SV	Df	SS	MS	F
Region	9	180,699.2	20,077.7	2.8 NS
Bruchid species	1	187,792.2	187,792.2	25.8***
Error	9	65,554.8	7,283.9	
Total	19	434,046.2		

*** (P = < 0.001)

The results did not show a clear indication that the pattern of bean bruchid species distribution was associated with climatic or physical factors contrary to observation by Schoonhoven and Cardona (1986).

The results from this study are similar to those of Masolwa and Nchimbi (1991) who observed the presence of both bruchid species in the districts they surveyed. However, these workers recorded a higher prevalence of *Z. subfasciatus* than *A obtectus*. Our results also agree with the findings of Giga *et al.* (1992 who observed a predominance of *A. obtectus* but differ in that they observed *Z. subfasciatus* in only one district.

It is likely that the occurrence and dominance of the two species in Tanzania is influenced by the changes in weather. The survey by Masolwa and Nchimbi (1991) was conducted between March and August and that by Giga *et al.*(1992) between September and October, while the current survey was undertaken from August to October. In the surveyed regions the dry cool months are May to October a period which is probably favourable to the occurrence of *A.obtectus*. On the contrary, the hot, humid and rainy season is between October to April which covered the period in which Masolwa and Nchimbi conducted their survey. It is possible that during this period the incidence of *Z. subfasciatus* was higher than *A. obtectus*. During the survey conducted by Giga *et al.* (1992), *A. obtectus* was the only bruchid species observed and *Z. subfasciatus* was observed only in isolated cases. The findings of this study contradict with those of Giga *et al.* (1992), although they were conducted during the same months. This may be attributed to the limited number of districts covered and small number of bean samples collected during their survey. However, it may also possibly be that *A. obtectus* is adapted to a wide range of environments than *Z. Subfasciatus*.

Conclusion

The present investigation indicates that both bruchid species occur in all major bean growing regions of Tanzania where both species are of economic importance. The species *A.obtectus* occurred in significantly ($P = < 0.001$) larger numbers than *Z. subfasciatus* in most regions.

This shows that *A. obtectus* is relatively more successful than *Z. subfasciatus*. However, since both species are economically important, effective control measures including breeding beans for bruchid resistance are required.

Acknowledgement

The authors wish to acknowledge the financial support provided by the Bean/Cowpea Collaborative Research Support Programme (CRSP) for this study.

References

Giga, D.P., J.K.O. Ampofo, S. Nahdy, F. Negesi, M. Nahimana and S.Nchimbi (1992). On-farm storage losses due to bean bruchids and farmers' control strategies: A Report on Travelling Workshop in Eastern and Southern Africa 16 September – 10 October 1992. pp. 35.

Haines, C.P. (1991). Insects and Arachnids of Tropical Stored Products: Their Biology and Identification. A Training Manual, Second Edition pp.90 – 92.

Kiula, B. A. and Karel, A. K. (1985). Effectiveness of vegetable oils in protecting beans against bean weevil (*Zabrotes subfasciatus* Bohman). Bean Improvement Cooperative Annual ReportNo.28,p. 3-5.

Masolwa.P.E. and s. Nchimbi (1991). Distribution patterns of Bean Bruchids: *Zabrotes subfasciatus* (Boh.)and *Acanthoscelides obtectus* (Say.): Bruchidae: Coleoptera) in some parts of Tanzania. Undergraduate Special Project. Unpublished.

Schoonhoven, A.V. and C. Cardona (1986). Main insect pests of stored beans and their control : Study guide. Central International de Agricultura Tropical. Pp. 5 – 25.

Slim, M.N. (1990). Distribution patterns of the bean bruchids: *Zabrotes subfasciatus* (Boh.) and *Acanthoscelides obtectus* (Say.) in Uganda. In Smithson, J.B. (Ed.). Proceedings of the second workshop on Bean Research in Eastern Africa, Nairobi, Kenya, 5 – 8 March, 1990. CIAT African Workshop Series No.7 Regional Programme on Beans. Eastern Africa Debre-Zeit, Ethiopia pp. 22.