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SEASONAL DISTRIBUTION OF COMMON BEAN (*Phaseolus vulgaris* L.) BRUCHID SPECIES IN SELECTED AREAS IN TANZANIA

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INTRODUCTION

Bruchids are the major problem affecting bean (*Phaseolus vulgaris* L.) seed and grain in storage. Two species of bruchids are major pests of stored beans, the common bean weevil *Acanthoscelides obtectus* (Say) and the Mexican bean weevil *Zabrotes subfasciatus* (Boh). *Acanthoscelides obtectus* start to infest beans in the field and continue to infest in beans storage while *Z. subfasciatus* infest beans only in storage (Howe and Currie, 1964). Bruchid damage reduces the weight, quality and viability of bean seed. The degree of loss due to bruchid damage is quite variable and depends on the storage period and storage conditions. In Tanzania, for example, bean losses of up to 40% due to bean bruchids have been reported (Kiula and Karel, 1985). Beans that have been damaged by bruchids are undesirable on the market and cause economic losses to the producer and quality losses to the consumer mainly because damaged seeds are usually covered with eggs and perforations (Schoonhoven and Cardona, 1986).

The risk of bean damage by bruchids in East African traditional small farm storage facilities is possibly the single major reason why farmers do not wish to grow large quantities of beans. Farmers fear that stored beans will be attacked by bruchids so they sell most of their beans soon after harvesting to avoid large storage losses. Various methods used to control bruchids include cultural and chemical controls and breeding for resistance. High levels of resistance against *Z. subfasciatus* have been identified from wild beans in Mexico and is attributed to the presence of arcelin which is a protein found in the wild beans (Gallepo, 1988).

In Mexico it was noted that at altitudes above 1500 m.a.s.l. *A. obtectus* tended to dominate, while below 1500 m.a.s.l. *Z. subfasciatus* was predominant (Biedmont and Bonet, 1981). Surveys in Uganda showed that both species were well established and wide-spread (Slim, 1990). Another study by Masolwa and Nchimbi (1991) in Morogoro, Dodoma and Arusha regions in Tanzania showed that both species were present with *Z. subfasciatus* being predominant. However, in a survey conducted by Giga *et al*. (1992) in some parts of Tanzania, it was observed that there was very little presence of *Z. subfasciatus*. The infestation of *Z. subfasciatus* was observed in the Babati area (1500 m.a.s.l.) while *A. obtectus* was found to occur in areas ranging in altitude of 600 – 1600 m.a.s.l. and was the most prevalent species observed in the areas surveyed. These findings were in agreement with the observations by Misangu and Nchimbi (in press) from 10 regions in Tanzania which showed that *A. obtectus* was more prevalent in most regions. These findings lead to the suggestion that perhaps there is seasonal variation of bruchid species related to changes in weather. This paper presents the results of a survey conducted over a three-year period in eight regions of Tanzania to determine whether there is seasonal variation in bruchid distribution.

Materials and Methods

Over a three year period, from August 1997 to December 1999, eight bean growing regions in Tanzania (Bukoba, Mwanza, Morogoro, Arusha, Kilimanjaro, Tanga, Mbeya and Ruvuma) were surveyed for bean bruchids (Figure 1). A summary of the weather patterns for these eight regions is presented in Table 1.

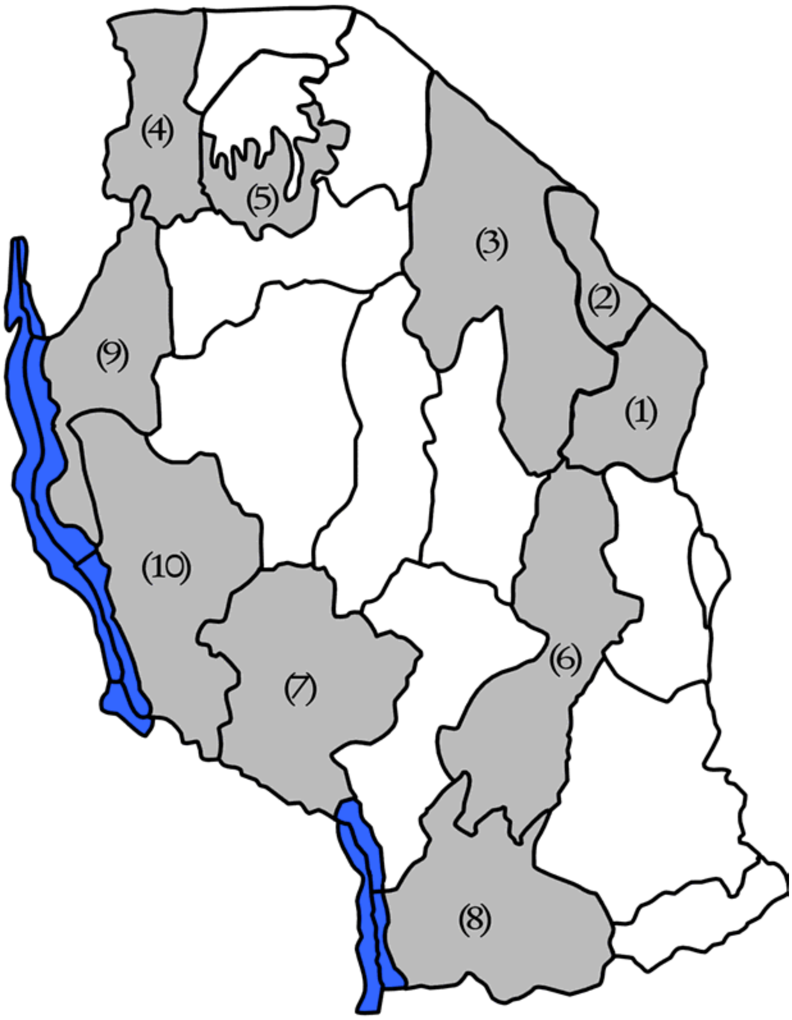

Figure 1. Bean growing regions in Tanzania, Bukoba, Mwanza, Morogoro, Arusha, Kilimanjaro, Tanga, Mbeya and Ruvuma, where bean bruchids were surveyed from August 1997 to December 1999.

Table 1. Weather patterns in eight regions in Tanzania surveyed for bean weevils.

Regions	Main Rains	Dry and Cool	Dry and Warm
Mwanza, Bukoba, Ruvuma, Mbeya	November to March or early-April	May to mid-August	Mid-August to November
Arusha, Moshi	March to May	May to July	August to February
Morogoro, Tanga	March to May **Short Rains** October to January	May to July	August to September

Beans in all regions are planted during the mid main rainfall period and harvested at the mid dry-cool period. Beans are always planted at the mid rainfall period and not at the beginning of rainfall to avoid bean flowering during heavy rainfall period as this will result in dropping of flowers.

Bean samples were collected at four-month intervals, resulting in three collection periods a year for three years. The first collection period was from January to April, the second was from May to August, and the third was from September to December. In each of the eight regions 10-15 bean samples were collected each year. Bean samples weighing 300-500 grams were collected from individual farmers in the villages and sometimes from the local markets in the villages. During sample collection, emphasis was placed on collecting samples grown and marketed in those areas and beans that were brought in from other areas were avoided. The bean samples were collected in small plastic bags and sealed using rubber bands. Each bag was labeled with collection location, date of collection and variety name. Samples were brought to the Department of Crop Science and Production at SUA for analysis. In the laboratory, from each collected sample, a 300 gram sub-sample was used. Bruchids were separated from the sub-sample by sieving beans through a 3 mm mesh screen into a tray placed in ice cubes. Under the ice cold conditions, the bruchids were temporarily immobilized to facilitate handling, counting and identification. Bruchid species identification was based on the key by Haines (1991).

RESULTS AND DISCUSSION

The results of the bruchid survey are presented in Table 2. In Mbeya, Morogoro, Mwanza and Bukoba regions there was no seasonal variation of the two bruchid species and *Acanthoscelides obtectus* was the most prevalent bruchid species in all three collection periods. In Mwanza and Bukoba regions, samples were collected only in the second and third collection periods mainly due to traveling problems in those areas in the first period.

In the remaining four regions, observations indicate there was seasonal variation in the distribution of bruchid species. In Tanga and Ruvuma regions, *Z. subfasciatus* was more prevalent in the first collection period while *A. obtectus* was more prevalent in the second and third collection periods. In the Arusha region, Z*. subfaciatus* was more prevalent in the first and third collection periods while *A. obtectus* was more prevalent in the second collection period. In Kilimanjaro, *A. obtectus* was more prevalent in the first and second collection periods while Z*. subfaciatus* was more prevalent in the third collection period.

Acanthoscelides obtectus start to infest beans in the field and continue to infest in storage, while *Z. subfasciatus* infest beans only in storage. In general, *Z. subfasciatus* was present in higher numbers in the first collection period and *A. obtectus* was present in higher numbers in the second and third collection periods. High infestation levels of *A. obtectus* in the second and third collection periods are likely due to its high levels of in-field infestation in May–June, before the beans are harvested and brought into storage. In the first period, beans are in storage in these regions therefore higher numbers of *Z. subfasciatus* may be expected during this period.

Table 2. Percent distribution (actual counts) of bruchid species (*Acanthoscelides obtectus* and *Zabrotes subfaciatus*) in major bean (*Phaseolus vulgaris* L.) growing areas in Tanzania in three collection periods from 1997 to 1999.

Region	Collection Periods					
	January – April		May - August		Sept. – December	
	A[x]	Z[y]	A	Z	A	Z
Mbeya	92.7 (908)	7.3 (71)	99.6 (510)	0.4 (2)	97.6 (280)	2.4 (7)
Morogoro	98.2 (805)	1.8 (15)	96.4 (928)	3.6 (35)	72.9 (625)	27.1 (232)
Mwanza/Bukoba	na [z]	na	25.4 (1614)	74.6 (4751)	11.6 (212)	88.4 (1610)
Tanga	10.4 (101)	89.6 (873)	54.0 (594)	46.0 (506)	85.0 (604)	15.0 (107)
Ruvuma	20.1 (160)	79.9 (638)	83.3 (679)	16.7 (136)	99.6 (926)	0.4 (4)
Arusha	8.8 (547)	91.2 (5701)	62.0 (744)	38.0 (456)	7.2 (173)	92.8 (2246)
Kilimanjaro	51.2 (3419)	48.8 (3254)	93.0 (837)	7.0 (63)	39.3 (916)	60.7 (1414)
Mean	**46.9**	**64.1**	**73.4**	**26.6**	**59.0**	**41.0**

[x]A = *Acanthoscelides obtectus*
[y]Z = *Zabrotes subfasciatus*
[z] na = data not available

CONCLUSIONS

This seasonal distribution pattern of bruchid species in the observed areas indicates that *A. obtectus* is an important bruchid species in Tanzania. Therefore, there is a need to look for sources of resistance to *A. obtectus* in the bean breeding programme. A *Phaseolus acuitifolius* line G 40199 evaluated at SUA showed high resistance to *A. obtectus*. These observations also imply that the arc 1 gene for *Z. subfasciatus* resistance may be effective for long term bean storage in Tanzania. Interspecific hybridization between *P. acuitifolius* and lines with arc 1 may be a good approach for incorporating resistance for the two bruchid species into one genotype.

REFERENCES

Biemonth, J.C. and A. Bonet. 1981. The bean weevil populations from the *Acanthoscelides obtectus* (Say) group living on wild subspontameous *Phaseolus vulgaris* L. cultivated in the Tepoztlan region of the sites of Mexico. pp 23-41. *In* V. Libeyre (ed.) The Ecology of Bruchids Attacking Legumes (Pulse). W. Junk Publisher, London.

Gallepo, G.. 1988. Novel seed protein in beans kills weevil enemies. Science Report, Research Division College of Agriculture and Life Sciences, University of Wisconsin, Madison, p.1-3.

Giga, D.P., J.K.O. Ampofo, S. Nahdy, F. Nagesi, M. Nahimana and S. Nchimbi-Msolla. 1992. On-farm storage losses due to bean bruchids and farmers' control strategies. *Report on Travelling Workshop in Eastern and Southern Africa 16 September – October, 1992,* CIAT Occasional Publication Series No. 8.

Haines, C.P. 1991. Insect and Arachnids of Tropical stored product. Their biology and identification. Training Manual, Second Edition. p 90-92.

Howe, R.W. and J.E. Currie, 1964. Some laboratory observations on rates development and oviposition of several species of bruchidae breeding in stored pulses. *Bulletin of Entomological Research* 55: 437-477.

Kiula, B.A. and A.K. Karel. 1985. Effectiveness of vegetable oils in protecting beans against bean weevil (*Zabrotes subfasciatus* [Boh]). *Bean Improvement Cooperative Annual Report No. 28*, p.3-5.

Masolwa, P.E. and S. Nchimbi. 1991. Distribution Patterns of Bean Bruchids *Zabrotes subfasciatus* (Boh.) and *Acanthoscelides obtectus* (Say) in some parts of Tanzania In: Mabagala, R.B. and N Mollel. *Bean Research Vo. 6,* pg. 68-71.

Misangu, R.N. and S. Nchimbi-Msolla. 2002. The distribution of bean bruchid species in major bean growing areas in Tanzania. *Tanzania Journal of Agricultural Sciences (In press).*

Schoonhoven, A.V. and C. Cardona. 1986. Main insect pests of stored beans and their control. Study guide. Centre International de Agriculture Tropical.

Slim, M.N.. 1990. Distribution patterns of 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 Regional Africa Workshop Series No. 7.

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