COMPETITION BETWEEN POPULATIONS OF BEAN WEEVILS *Zabrotes subfasciatus* BOHEMANN, 1833 AND *Acanthoscelides obtectus* SAY, 1831 FEEDING ON THE SAME FOOD SOURCE (COL., BRUCHIDAE)

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ABSTRACT

Population densities of two bean weevil species *Zabrotes subfasciatus* Bohemann, 1833 and *Acanthoscelides obtectus* Say, 1831 (Col., Bruchidae), commonly injuring stored beans (*Phaseolus vulgaris* L.) in Brazil, occurring together in eleven bean cultivars stored at Linhares Experimental Station, in the State of Espírito Santo, were studied.

Bean cultivars named 'Costa Rica', 'Linhagem Venezuela 350','Mulatinho Paulista', 'Preto 120', 'Preto 141', 'Preto 143', 'Preto 147', 'Preto 192', 'Rico 23', 'Seleção Cuva' and 'Venezuela 350' were used as food source by the weevils.

Statistical analysis of data recorded on population density of each especies at the 12th month of storage showed, firstly, e non preference by species through cultivars and, secondly a markedly interspecific competition in favour of *Z. subfasciatus*.

INTRODUCTION

Beans are the second major agriculture product in Brazilian diet served together with rice, the major product.

Brazilian agriculture has bean up to now unable to provide enough beans for internal consumers. Several measures habe been taken to increase Brazilian bean productivity but it is still faraway from a good and enough yield. And, still what succeed to be produced, takes the risk of being injured at the storage by bean weevils.

Stored beans in Brazil are commonly injured by two main bean weevil species, *Zabrotes subfasciatus* Bohemann, 1833 and *Acanthoscelides obtectus* Say, 1831 (Col., Bruchidae). Although both species are wellknown bean pestes, there is a lack of numerical evidence about their behaviour when they occur together in the same food source and the ecological implications of that behaviour.

Recebido em 18/09/78.

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of that behaviour.

Biology of both species was studied by BONDAR (1936) as follow.

A. obtectus was spread from America all-over the world. It can injury grains still in the field as the female ovipposites inside the pods. The egg requires about five days to eclode in the summer and up to 20 days in the winter. Larvae attains its complete development from 11 to 42 days according to the season; nymphal stage lasts from five to 18 days, which gives a life cycle from 21 to 80 days. Adult lives about two months.

Z. subfasciatus is a South-American species, but is already known in Central America, Africa, Asia and Europe. Usually this species only injuries stored beans. The eggs are laid on the seeds, superficially. Eclosion occurs between three to 11 days (at 28^0C) and about 48 days (at 19^0C). Larval stage lasts from 17 days in the summer and 150 days in the winter (data commonly observed in Europa). Life cycle may take from 36 to 240 days. Adult stage lasts from 12 to 40 days. It is assumed that an average of six or eigth generations occurs in Brazil, in tropical areas.

A work carried out by OLIVEIRA *et alii* (1979) showed that the main cultivar planted in the States of Espírito Santo and Rio de Janeiro, 'Rico 23', under conventional storage conditions was injured, in six months, in 61 % of its grains. In 12 months, all the grains were injured and the seeds dead. Other cultivars such 'Costa Rica', 'Linhagem Venezuela 350', 'Mulatinho Paulista', 'Preto 120', 'Preto 141', 'Preto 143', 'Preto 147', 'Preto 192', 'Seleção Cuva' and 'Venezuela 350' had an avarage of 15% of the grains injured at the 6^{th} month of storage but were completly injured at the 12^{th} month. The authors pointed out the economic importance and the needs to control the bean weevil species present: *Z. subfasciatus* and *A. obtectus*.

RAMALHO *et alii* (1977) found that among the cultivars 'Pintado', 'Guatemala', Paraná', 'Carioca', 'Enxofre', 'Pardo Rico', 'Rico 23', and 'Vermelho Rajado 1162' in the State of Minas Gerais, Brazil, there was no colour preference by *A. obtectus*. Testing for olfaction preference, there was no difference among 'Paraná', 'Mulatinho Paulista', 'Rico 23', 'Manteiga Fosco', 'VI -10-10', 'Rico Pardo', 'Rico Baio', '37 R. 890', 'Lavras', 'Carioca', 'Jalo' and 'Guatemala' cultivars.

Studies of competition between two insect species occuring together in stored products were conducted by PARK (1948) with flour beetles, *Tribolium castaneum* Herbst, 1797 and *T. confusum* Duval, 1868 (Col. Tenebrionidae). When these species were raised together, one of the two became extinct after about a year and the other species assumed the population density it would usually have reached alone. PARK (1954) found that the experimental conditions were important in determining which of the two species would replace the other. At temperatures above 29^0C *T. castaneum* was favoured, but below 29^0C *T. confusum* was usually the successful species.

VARLEY *et alii* (1973) in their useful book about insect population ecology pointed out that field observations would normally show only the final result of competition and closely allied species which exploit the same resources often seemed to co-exist in a stable way.

The present work intended to give numerical evidence on some aspects of the relationship between the two bean weevil species when they occurred together injuring stored beans at the conventional conditions of storage at a farmer level. We belive that if control of these pests is to be put on a sound cientific basis, the biological system with which we wish to interfere must be well enough understood for us to make right decisions on pest control.

The work was carried out at Linhares Experiment Station in the State of Espírito Santo from March 1972 to March 1973.

MATERIALS AND METHODS

Eleven bean cultivars (*Phaseolus vulgaris* L.) named 'Costa Rica', 'Linhagem Venezuela 350', 'Mulatinho Paulista', 'Preto 120', 'Preto 141', 'Preto 143', 'Preto 147', 'Preto 192', 'Rico 23', 'Seleção Cuva' and 'Venezuela 350', in small juta bags of 2 kg of seeds plot were distribuited in a fully randomized desing, under conventional conditions of storage bricks-made.

Four replicates (1 + 3) were used.

The seeds came from the same field and had been stored under controlled conditions of temperature and humidity at Vitoria Seed Laboratory in the State of Espírito Santo until the experiment was performed. Grain humidity was around 8% and no bean weevils or injured grains were detected in all cultivars at the beginning of the experiment.

Twelve months later, record on population density of bean weevil species was made for each plot according to the following procedure:

1) each plot had the grains separated by sieving from dead or alive weevils;

2) grain brought in polyethylene bags to the Laboratory of Entomology at the State of Rio de Janeiro, were distributed in Petri dishes covered by nylon net to allow air entrance and prevent weevils to escape;

3) after two weeks, the bean weevil population ecloded in each plot was counted and separated by species.

Data were transformed into $y = \log x + 1$, the best transformation when dealing with insect numbers to emphasizes rational comparisons between successive values in treatment (MURDIE, 1972) and analysed.

RESULTS AND DISCUSSION

Results from the experiment were rank according to *Z. subfasciatus* population density in the eleven bean cultivars and showed in Table 1.

TABLE 1 - Mean number of bean weevil species occurring together in eleven bean cultivars.

Cultivar	Bean weevil population density +			
	Z. subfasciatus		*A. obtectus*	
	Original numbers	Log x + 1	Original numbers	Log x + 1
Preto 147	859	2.91	22	1.32
Preto 192	796	2.77	46	1.55
Preto 120	657	2.76	77	1.76
Venez. 350	612	2.60	138	2.02
Costa Rica	591	2.70	80	1.83
L.V. 350	562	2.70	100	1.89
Mul. Paulista	559	2.71	117	1.72
Preto 141	512	2.65	65	1.57
Rico 23	420	2.50	82	1.76
S. Cuva	364	2.53	137	2.08
Preto 143	184	2.25	125	1.73

+ Mean of 4 replicates
C.V. = 18%

Statistical analysis showed that there was no preference either by *Z. subfasciatus* neither by *A. obtectus* for a particular bean cultivar tested, but population density of the two species was significant different at the level of 1% in favour of *Z. subfasciatus*.

Z. subfasciatus population density was always greater than *A. obtectus* population density in all cultivars studied.

Based on previous data (BONDAR, 1936) of biology of both species, *A. obtectus* has shorter life cycle than *Z. subfasciatus* and depends less upon high temperatures so they had better conditions to develop under the conditions of the experiment than *Z. subfasciatus*. But this did not occur. Then, factors influencing a great development of *Z. subfasciatus* populations in detriment of development of *A. obtectus* population must be related with interspecific competition when these species occur together in the same food source. This hypothesis has bean confirmed in the present work since population density of *Z. subfasciatus* was always significant greater than *A. obtectus* population density in all cultivars tested.

Still at the ligth of data on biology of both species recorded by BONDAR (1936) *A. obtectus* may infest grains still in the field and *Z. subfasciatus* do not. It is preferently, a stored grain pest.

In the experiment, no initial infestation coming from grains in the field was present. Infestation by both species had started in the storage, and this is a fact in favour of *Z. subfasciatus*.

Eggs are laid within the grains by *A. obtectus* and on the grains by *Z. subfasciatus*. Mortality of *A. obtectus* at the beginning of life cycle must be greater than for *Z. subfasciatus* since the first species must do a mechanical work to come out of the grains and some individuals may do not secceed.

CONCLUSIONS

The experiment showed a numerical evidence of a significant difference in favour of *Z. subfasciatus* population density when it occurred together with *A. obtectus* in the same food source. An interspecific competition yet not well explained occurred.

ACKNOWLEDGEMENTS

The autors are deeply indebted to Dr. R.G. Coelho for revision of the manuscript.

Acknowledgements are due to Mr. A.F. da Silva Fº for statistical analysis and to Mrs. W.M. Medeiros and N.D. Pimenta for typping.

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RESUMO

Competição entre populações dos carunhos *Zabrotes subfasciatus* Bohemann, 1833 e *Acanthoscelides obtectus* Say, 1831 na mesma fonte de alimento.

Neste trabalho foi estudada a densidade populacional de duas espécies de carunchos *Zabrotes subfasciatus* Bohemann, 1833 e *Acanthoscelides obtectus* Say, 1831 (Col., Bruchidae) em 11 cultivares de feijão (*Phaseolus vulgaris* L.) armazenados em condições naturais de armazém na Estação Experimental de Linhares no Estado do Espírito Santo.

Foram usadas as cultivares: 'Costa Rica', 'Linhagem Venezuela 350', 'Mulatinho Paulista', 'Preto 120', 'Preto 141', 'Preto 143', 'Preto 147', 'Preto 192', 'Rico 23', 'Seleção Cuva' e 'Venezuela 350'.

A infestação se processou naturalmente no armazém.

No final de 12 meses de armazenagem foi feita uma amostragem de cada parcela onde foi contada a população de caruncho existente pertencente a cada uma das duas espécies.

A análise estatística dos dados de densidade populacional mostrou, primeiro, a não preferência de espécies em relação as 11 cultivares e, segundo, evidência numérica para uma competição interespecífica em favor da espécie *Z. subfasciatus*.