Effect of Some Environmental Factors on the Seasonal Occurrence of the Cocoa Shield Bug, *Bathycoelia thalassina* (Herrich-Schaeffer) (Hemiptera: Pentatomidae) in Nigeria[1]

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ABSTRACT

The seasonal occurrence of the cocoa shield bug, *Bathycoelia thalassina* (H-S), was monitored on cocoa between 1979 and 1982 to determine the relationship between its abundance and some environmental factors. The insect population has two frequency peaks, in February–May and August-November. There was no difference between the percentage mature pods and cherelles (immature pods) attacked by the insect, and the indication was that there was probably no feeding preference for either the mature pods or cherelles. The relationships between the abundance of the insect pest and pods, cherelles, mean monthly rainfall, relative humidity and temperature were erratic and not significant. It is suggested that the numbers of the pest may be significantly affected only by the severity of the factors.

COMPENDIO

La presencia del chinche de escudo *Bathycoelia thalassina* (H-S), sujeta a las variaciones estacionales en el año, fue observada en plantas de cacao, en el período 1979 a 1982 con el propósito de determinar la relación que pueda existir entre su nivel de población y algunos factores ambientales. La población insectil tiene dos picos de frecuencia: febrero-mayo y agosto-noviembre. No se encontró diferencia entre el porcentaje de mazorcas maduras y de "chereles" (mazorcas inmaduras) que fueron atacadas por el insecto, lo cual puede ser indicación de que posiblemente no hubo preferencia alimentaria por ninguno de los dos tipos de mazorca. Las relaciones entre abundancia del insecto y número de chereles, media mensual de lluvia, humedad relativa y temperatura fueron erráticas y no significativas. Se sugiere que las poblaciones insectiles pueden ser significativamente afectadas solamente por la severidad con que se presenten los factores ambientales.

INTRODUCTION

The cocoa shield bug, *Bathycoelia thalassina* (Herrich-Schaeffer) (Hemiptera: Pentatomidae), is fast becoming a pest of economic importance to Amazon and hybrid cocoa now widely cultivated in Nigeria. It occurs across central and western tropical Africa (1, 10), particularly in Ghana (4, 15), Nigeria and the Cameroons (3, 7) Its occurrence and distribution on cocoa have been observed to follow the cropping seasons of cocoa (13) and the type of cocoa varieties (5, 6, 8, 9) in Ghana, while in Nigeria the distribution anpears to be related to topography, altitudes (3) and host plants (12) The pest causes premature ripening, distortion of pods and development of empty cocoa beans (5, 8, 11). Resultant crop losses of up to 18% and 10% have been reported in Ghana (14) and in Nigeria (3, 11), respectively

This paper attempts to examine the relationships between the insect population in the field and the prevailing environmental factors such as available cocoa pods and cherelles, rainfall, relative humidity and temperature in Nigeria.

MATERIALS AND METHODS

Weekly counts of the nymphs and adult *B. thalassina* (H-S), numbers of pods and cherelles were carried out in two Amazon cocoa plots, S2/7 and E5/1, at the Cocoa Research Institute's Headquarters, Onigambari, Ibadan, Nigeria, between 1978 and 1982. The cocoa was planted at 3.05 m x 3.05 m spacing On each sampling date, 100 trees selected randomly were thoroughly examined up to hand height (a maximum of 2 m above the ground) by a team of three men. The number of nymphs and adults of *B. thalassina* was recorded without removing them. Meteorological data –temperature, relative humidity and rainfall– were extracted from records collected with standard meteorological instruments in the Stevenson's screen situated at the Institute's meteorological station located at about 1.5 km from the plots on the estate. Counts of cherelles and pod production on the 100 randomly sampled cocoa trees were also carried out. The numbers of cherelles and mature pods attacked by *B. thalassina* were recorded and expressed as percentages of the total cherelles and pods counted. Correlation coefficients were calculated for the numbers of *B. thalassina* and pods, cherelles, the mean temperature, relative humidity and rainfall respectively.

RESULTS AND DISCUSSION

Seasonal abundance of *B. thalassina* at the two sites

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S2/7 and E5/1, both planted to Amazon cocoa, are presented in Fig. 1. The bug occurred on cocoa throughout the year with peaks occurring in February, May and August, and November, during the peak of the minor and main cocoa seasons respectively. Eguagie (2, 3) observed similar population peaks of the insect in the field in Nigeria. An analysis of variance (ANOVA) carried out on the numbers of the bug (Table 1) shows significant differences in the level of abundance between years ($P < 0.001$) and months ($P < 0.01$).

Damages caused by *B. thalassina* feeding on cocoa pods and cherelles were observed in the field throughout the seasons (Fig. 2). The feeding intensity as well as the number of pods attacked also fluctuated within the season, but did not particularly reflect the level of abundance of the bug on the crop and were not directly affected by prevailing physical factors. As shown by the result of the comparative "t"-test values (Table 2), the mean number of pods and cherelles with feeding lesions did not show that the bug exhibited any feeding preference for either the pods or cherelles on the cocoa trees.

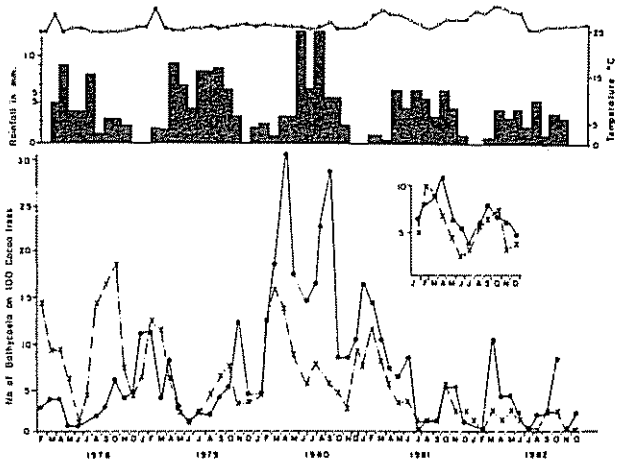

Fig. 1. Trends in population of *B. thalassina* in two sites S2/7 and E5/1 Amazon plots at the Cocoa Research Institute of Nigeria (CRIN) headquarters (x —·— x —·— x S2/7; •—•—• E5/1); Inset is the Mean for 5 years (1978–1982).

A correlation analysis between the number of *B thalassina* and the available pods, cherelles, mean values of the prevailing rainfall, relative humidity and temperature (Table 3) shows that the number of pods or cherelles available on cocoa trees did not result in the occurrence of equally high numbers of *B thalassina*. The numbers of the bug also did not correlate with the percentage of pods or cherelles attacked. As reflected in Fig. 1, the population trend was high whenever there was low and moderate rainfall. The correlation coefficients between bug numbers and rainfall were insignificantly negative,

Table 2. Comparative "t" test analysis between pods and cherrelles with feeding lesions inflicted by *B. thalassina* (mean of two plots S2/7 and E5/1).

Year	"t" test value
1978	2.32*
1979	1.06 NS
1980	0.89 NS
1981	0.103 NS
1982	1.97 NS

* Significant $P < 0.05$
NS Not significant

Table 1. F-values for the occurrence of *B. thalassina* at two sites, S2/7 and E.5/1, at CRIN Headquarters (1978-1982).

Source of variation	Sum of squares	Degree of freedom	Mean square	Variance ratio and significance level (*)
S2/7				
Years	431 567	4	107 892	10 3825***
Months	353 933	11	32 1757	3 0963**
E5/1				
Years	1 087 47	4	271 858	8 83853***
Months	234 05	11	21 2773	0.69176 NS

* Significant $P < 0.05$.
** Significant $P < 0.01$
*** Significant $P < 0.001$.
NS Not significant at $P < 0.05$.

which suggests that the *Bathycoelia* population could be reduced by rainfall Earlier studies by Owusu-Manu (13, 16) in Ghana had suggested that rainfall was an important factor capable of regulating the abundance of the pest in the field. The number of *Bathycoelia* correlated negatively with the relative humidity, but positively with temperature; the correlation was significant in 1980. The mean temperature fluctuation graph shown in Fig 1 did not vary much from month to month during the seasons, and thus temperature seems to exert a generally moderate effect on the insect's population.

The general picture in the correlation matrix (Table 4) shows that there is closer interrelationship between physical factors and crop response The observed inconsistent relationships between the numbers of *B. thalassina* and the factors suggest that only the severity of these factors may be capable of significantly affecting the insect occurrence in the field

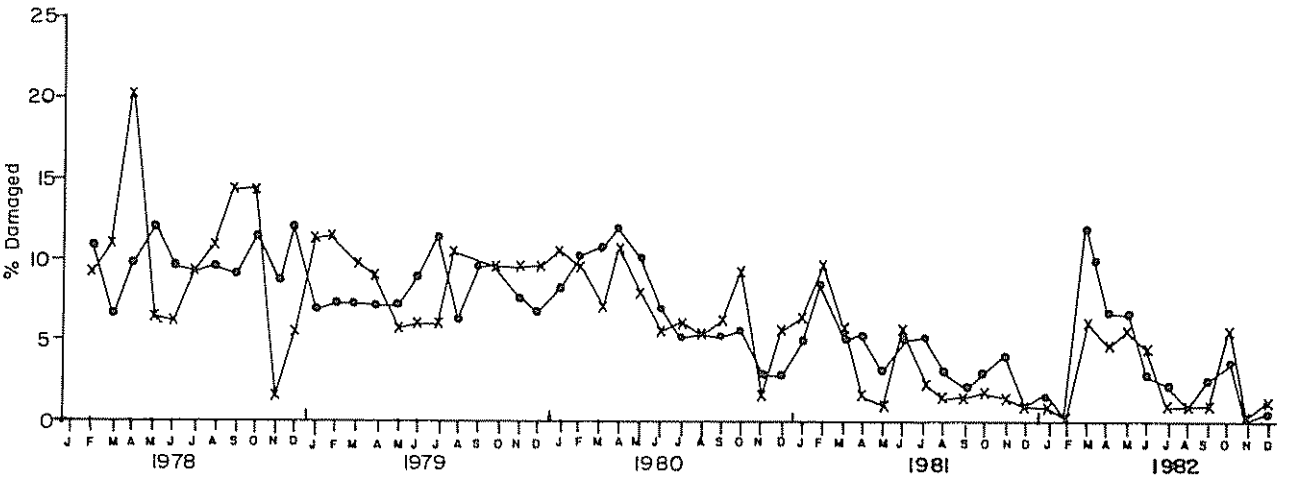

Fig 2 Level of damage caused by *B. thalassina* on Cocoa pods (•—•) and cherrelles (x——x) at C.R.I.N headquarters.

Table 3. Correlation between *Bathycoelia* numbers and pods, cherrelles, rainfall, relative humidity and temperature.

Factors	1978	1979	1980	1981	1982
Pods	+ 0 572371	– 0 387068	– 0.694012	– 0.227852	+ 0.420332
Cherrelles	– 0.191933	+ 0 0445452	+ 0.403197	– 0.165824	+ 0 0742918
Rainfall	– 0.257548	– 0 545222	+ 0.659616	– 0.393261	+ 0.390951
R.H.	+ 0 282207	– 0 575835	– 0.790836**	– 0 630393	– 0.209118
T^{o}	+ 0 191354	+ 0.499855	+ 0 70818 **	+ 0.506649	+ 0.402545

** Significant $P < 0.05$.
NS Not significant

Table 4. Correlation matrix of the relations between *B. thalassina* and the environmental factors on the field in 1980.

	Insect 1	Pods 2	Cherrelles 3	Rainfall 4	Relative humidity 5	Temperature 6
1	–	–	–	–	–	–
2	– 0.69401*	–	–	–	–	–
3	+ 0.40319	+ 0.43353	–	–	–	–
4	+ 0.65962	– 0.76663**	+ 0.84578**	–	–	–
5	– 0.79084**	+ 0.96821**	– 0.48287	– 0.77388**	–	–
6	+ 0.70818**	– 0.98147**	+ 0.49777	+ 0.82427**	– 0.973224**	–

* Significant $P < 0.05$

** Significant $P < 0.01$

*** Significant $P < 0.001$

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