Investigation on the pest status of the dusky cotton bug *Oxycarenus laetus* kirby (Lygaeidae: Heteroptera) on cotton[1]

Resumen. La chinche gris del algodón se alimenta de los embriones de semillas germinando, así como de los cotiledones causando una disminución en el porcentaje de germinación. Para evitar el daño causado por hongos del suelo, en particular de los géneros *Aspergillus*, *Fusarium* y *Penicillium* que penetran por las heridas causadas por la chinche las semillas se trataron.

Al aumentar el grado de infestación con la chinche decrecieron el porcentaje de germinación (A = –0.909), la altura de la planta (r = 0.890), y la pera en húmedo (r = –0.740) y en seco (r = –0989). El análisis del índice de vigor indica que esta varió en plantas infectadas entre 2325.6 y 1512.0 mientras que en las plantas sanas el índice de rigor fue de 2604 0.

The dusky cotton bug, *Oxycarenus laetus* Kirby has been reported to infest cotton in all the cotton growing regions of India (5) and known to reduce the yield of seed cotton by more than 20% under severe infestation (6) It is also reported to feed on several species of Malvales (9). The nymphs and adults of the dusky cotton bug feed on the ripening seeds, reducing the weight of the seed (10), yet no information is available on the nature of damage caused to the seeds and subsequent effect on the germination of the seed. Hence the present investigation was made to assess the effect of seed feeding of this bug on the germination rate and vigour of the seedling.

Materials and methods

Freshly burst bolls of Suvin [*Gossypium barbadense* (L.)] from healthy plants without previous infestation by any other pest were selected and known numbers of *O. laetus* nymphs and adults in the ratio of 3:1 were confined on the plants by covering a polyethylene bag for 15 days. Infestation grades of 25, 50 and 100 bugs per boll were maintained along with check. The different infestation grades including the check were replicated four times. Two thirds of the seeds obtained from the experiment were treated with Bavistin, fungicide (2 – Methoxy – (Carbaryl) – benzimidazole) at the rate of 0.5 gm/100 gm seeds to prevent infestation due to soil borne fungi and/or any other pathogens.

The fungicide treated seeds were tested for germination rate in the germination chamber. The germination rate was assessed on the tenth day after sowing. Measurement of seedling growth has been suggested as a reliable index of seed vigour (11) and hence the seedlings were carefully removed without any damage for recording the height and wet and dry weights. The non-germinated seeds were dissected under binocular microscope to identify the nature of damage and causes for non-germination. Similarly, the fungicide treated and untreated seeds were sown in the field for observing the germination rate. Seedling vigour index was calculated by the method of Abdul Bhaki and Anderson (1).

The per cent of germination ranged from 51 to 96, therefore arc sine transformation was done for statistical scrutiny of the data (7). Analysis of variance was used to test the significance between the three different treatments viz. (a) fungicide treated seeds tested in the germination chamber and (b) field and (c) untreated seeds tested in the field. Simple correlation was worked out for studying the relationship between the different infestation grades and the germination rate, plant height, wet and dry weights of the seedlings germinated in the germination chamber. A linear regression line was fitted to the observed values by the method of 'Least squares' (4).

Results and discussion

Lygaeids are generally known as seed bugs (8) since they feed mostly on the seeds of various cultivated and uncultivated monocots and dicots. Eyles (3) reported *Drymus sylvaticus* (Fab.) to completely suck out the embryo of sorrel seed; indicating the preference for the embryo of the seed, while the common milkweed bug *Oncopeltus fasciatus* (Dallas) does not feed on the embryo (2). The damage caused by the dusky cotton bug often resembled that of the *O. fasciatus* and the embryo is damaged only occasionally, the developing seeds suffer heavy damage of the embryo while the ripened seeds are not damaged, hence the seed maturity is an important factor in the level of damage caused to the embryo of the seed. Also intensive feeding results in damage to the embryo. Thus one of the important causes for non-germination of seeds appears to be the extensive damage to the radicle and cotyledons as observed on the seeds from heavy infestation grades (50 and 100 bugs/boll), the radicle in such seeds was partially damaged and decaying. Non germinated seeds from the field showed secondary infestation of fungi, particularly the seed without fungicide treatment. The black mould (*Aspergillus* spp.) developed on the cotyledons, the other important fungi developing on the decaying seeds were *Fusarium* sp. and *Penicilium* sp. The fungi entered from the soil through the feeding punctures on the seed coat, the damage was extensively noticed on the cotyledons, while the radicle and plumule were decaying and shrunken. Few of the cotyledonary leaves of the seedlings from 100 bugs/boll had punctures of 1.00 mm to 5.00 mm wide and the tissue surrounding these punctures had burnt-up appearance.

Germination rate of seeds untreated with fungicide was considerably lower than the treated seeds, among the fungicide treated seeds, those sown in the field exhibited a lower germination rate than the seeds tested in the germination chamber and seeds of heavier infestation grades (50 and 100 bugs/boll) registered a lower germination rate than seeds from the check and 25 bugs/boll (Table 1). The differences between the different treatments as well as various grades of infestation are highly significant, while the interaction between treatments is significant at 5% level (Table 2). The same trend was observed in the other characters of the seedling viz, plant height, wet and dry weights, though the difference was not as much significant as the germination rate. Regression analysis showed a linear relationship between the degree of infestation and the quality of the seedling (Fig. 1). With greater infestation the germination rate decreased (r = –0909**), plant height reduced (r = –0.890**) and wet and dry weights lowered (r = –0.740** and –0.989** respectively). The reduced plant height and decreased wet and dry weights of the seedlings from infested seeds might be due to the various level of injury to the endosperm and cotyledonary leaves as evidenced by the feeding punctures. The seeds heavily infested by the dusky

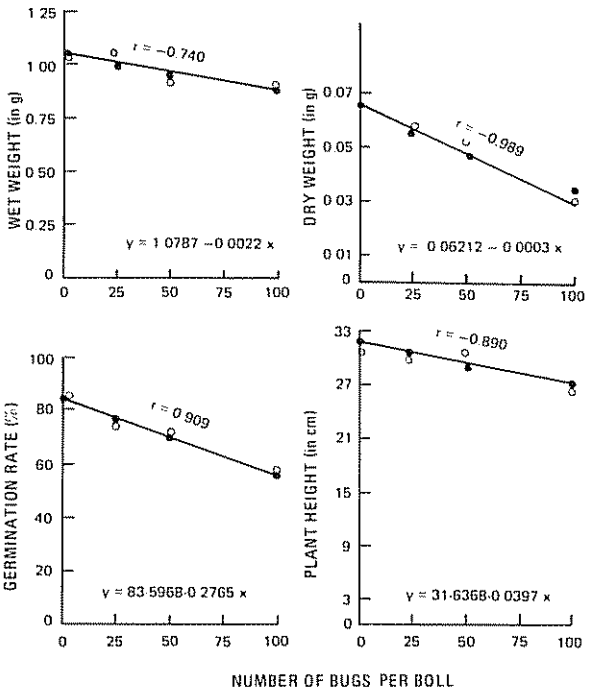

Fig 1. Linean regression analysis between the degree of infestation and the quality of the seedlings.

Table 1. Transformed mean value of germination rate.

Number of bugs/boll	Fungicide treated seeds		Untreated seeds tested	Mean of treatments
	Tested in germn. chamber	Tested in field	in field	
0	9.172	8.942	8.424	8.846
25	8.714	8.268	7.932	8.305
50	8.385	7.820	7.602	7.936
100	7.484	6.852	5.924	6.753
Mean of infestation grades	8.439	7.971	7.471	

Table 2. Anova table.

Source	D.F.	S.S.	M.S.S.	S.E.	F
Replications	4	0.15	0.031	–	< 1.0
Treatments Infestation	2	9.25	4.620	0.0985	47.54**
Grades	3	35.41	11.803	0.1139	121.34**
Interaction	6	1.43	0.238	0.1973	2.45*
Error	44	4.28	0.097		

* Significant at 5% level
** Significant at 1% level.

Table 3. Vigour index.

Number of bugs/boll	Fungicide treated seeds		Untreated seeds tested in field
	Tested in germination chamber	Tested in field	
0	2 604.0	2 416.0	2 130.0
25	2 325.6	2 042.4	1 738.8
50	2 170.0	1 616.5	1 479.0
100	1 512.0	1 128.0	840.0

cotton bugs produced weaker seedlings as they yielded very less dry matter (0.03 g/plant) when compared to uninfested seeds (0.058 g/plant). Of the four characters of the seedlings investigated for the effect of dusky cotton bug feeding on the cotton seeds, dry matter ($r = -0.989^{**}$) and germination rate ($r = -0.909^{**}$) were more affected than the plant height and wet weight. Thus it is evident from these results that heavy infestation by the dusky cotton bug reduces germination rate of seeds and subsequent vigour of the plant. The vigour index (Table 3) also indicates that the uninfested seeds are definitely superior to infested seeds and that vigour of the seedling steadily decreases as the infestation rate increases.

The basic and cheap input for realizing high yield is the quality seeds, hence the quality of the seed for superior performance under optimum environmental condition should be given prior importance, therefore the cotton crop should be protected against the ravage of the dusky cotton bug, particularly when the crop is for the purpose of seed multiplication.

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Summary

The dusky cotton bug feeds on the embryo of the developing seeds and also the cotyledon and thereby reduces the germinability of the seed. The soil borne fungi, especially the species of the following genera viz. *Aspergillus, Fusarium* and *Penicillium* enter through the feeding hole and cause further damage to the seed, however, fungicide treated seeds were protected from such damage. With increased infestation of the dusky cotton bug, the germination rate decreaded ($r = -0.909$), plant height reduced ($r = 0.890$), wet and dry weights lowered ($r = -0.740$ and $r = -0.989$ respectively). Analysis of vigour index indicates that the plant vigour of the infested seedlings ranged from 2325.6 to 1512.0 while the healthy seeds showed a vigour index of 2604.0.

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The frequency of occurrence and geographical distribution of plant parasitic nematodes associated with *Theobrama cacao* in Nigeria.

Resumen. En este estudio se informa sobre la frecuencia de aparición y la distribución geográfica de nematodos asociados al cultivo del cacao en Nigeria. Se examinaron 1 500 muestras colectadas en 72 fincas en las cuales se encontró 25 especies pertenecientes a 17 géneros. Por primera vez fueron encontradas en cacao *Xiphinema basiliense*, *Paralongidorus* sp., *Longidorus* sp. y *Euthylenchus africanus*. Los géneros más comunes fueron *Helicotylenchus*, *Xiphinema*, *Scutellonema*, *Meloidogyne* y *Hemicycliophora*.

The earliest report of cocoa nematodes was that of Ritzema Bos (12) who found root-knot nematode, *Heterodera radicicola* (= *Meloidogyne* sp.) on cocoa in 1900. He, however, did not indicate the locality.

In 1921, Ghesquire (8) reported the occurrence and close association of *Meloidogyne* sp. with the die-back disease of cocoa in Belgian Congo. Many other reports of the occurrence of nematodes on cocoa have since been published (3, 10, 14, 15, 19). Forty-seven species of nematodes belonging to twenty-seven genera have been reported in the literature to be associated with *Theobroma cacao* roots (18).

This survey was undertaken in order to find out the frequency, the distribution of each species and to document any new records of the plant-parasitic nematodes associated with cocoa in Nigeria.

Materials and methods

Soil samples were taken within a 50 cm radius from the base of cocoa trees as the largest number of nematodes were recovered from that region. Samples were taken with augers of 2.5 cm diameter to a depth of 24 cm. The samples were stored in polythene bags and transfered to the laboratory for nematode extraction.

Soil samples were washed through Cobb sieves (5) of 500 and 53 micron pore sizes respectively before extracting nematodes for 18 hours from the resulting suspension by the Whitehead and Hemming (20) tray method. This combination was found to be effective for the recovery of Longidorid nematodes.

Nematode suspensions were concentrated to a 20 – 25 ml sample using the settling-siphon method of Caveness (4). The samples were examined under the dissecting and compound microscopes immediately or preserved in TAF solution (6).

Sampling was done during the wet season in all cases over a period of 24 months. The six cocoa-growing states in Nigeria – Bendel, Benue, Cross River, Ogun, Ondo and Oyo were covered in the survey. A total of 1 500 samples covering 72 farms were investigated. Depending on size 10 – 20 soil samples were taken from each farm.

Tomato indicator plants were also employed to detect the presence of *Meloidogyne* spp. in farms where cocoa establishment had been difficult or impossible at the Gambari Experimental Station of the Cocoa Research Institute of Nigeria (CRIN).

Results and discussion

Table 1 shows the nematodes encountered in the six states covered. Twenty-five species belonging to 17 genera were identified. The frequency of their occurrence is expressed as a percentage of the total