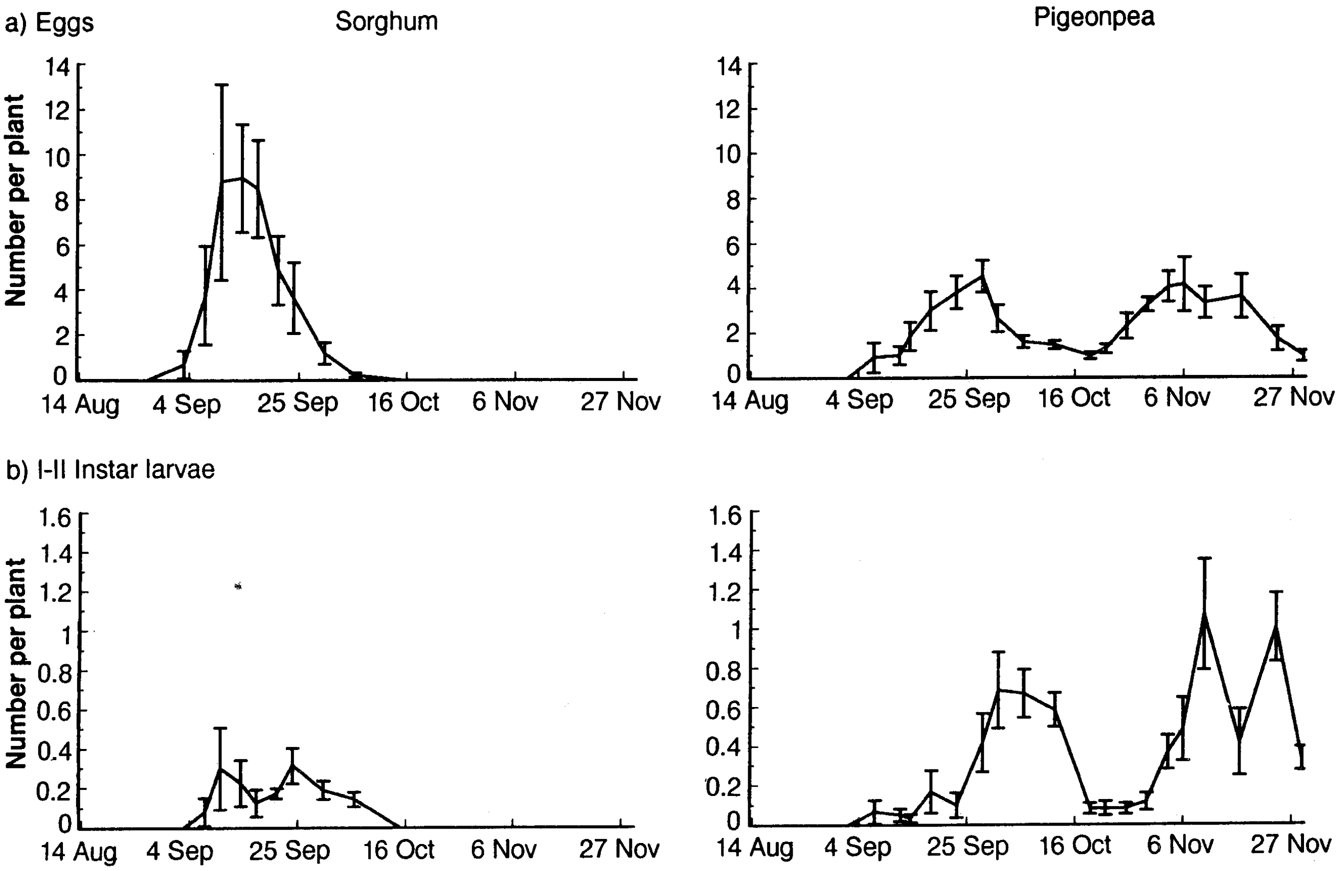

Figure 2. Seasonal abundance of a) *Helicoverpa armigera* eggs, and b) I-II instar larvae on sorghum and short-duration pigeonpea.

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Observations on Insect Damage to Pigeonpea in Nigeria

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Though more than 200 species of insects are recorded as pests of pigeonpea (Lateef and Reed 1980), there are relatively few published accounts of insect damage to this crop in Africa. Materu (1970) reported that more than 50% of pigeonpea seeds were damaged by pod bug in Tanzania, while in Uganda, Kohler and Rarochie (1971) recorded 5% seed damage due to *Helicoverpa armigera*. In Kenya, Okeyo-Owuor (1978) reported seed loss by lepidopteran borers (13%), and podfly, *Melanagromyza* sp (11%). In this note we report observations on insect pest damage to pigeonpea in Nigeria, collected during surveys to assess pigeonpea production and utilization (see Tabo et al., this issue).

Observations on pest incidence were recorded in 50 to 200 plants at each sample site. In addition, pigeonpea seed samples were collected from markets in Ankpa and Nsukka (see map in Tabo et al., this issue), and kept in our laboratory at Kano for further observation. Each seed sample was kept in a 1 L Kilner jar covered with a fine wire mesh gauze. Insects which emerged from these samples were identified by M. Chori at the insect museum of the Institute for Agricultural Research (IAR), Zaria, Nigeria. In 1993, 117 samples consisting of 10 pods each were taken from farms and examined in the laboratory. Parasitoids were identified by T. Huddleston at the British Museum of Natural History, London.

The majority of crops sampled during survey in 1993 were still in the vegetative stage. The insects observed were thrips, leaf hoppers, leaf feeding caterpillars (*Spodoptera exempta*), pod sucking bugs (*Clavigralla tomentoscicollis*), flower beetles, pod borers (*Maruca testulalis*), ants and spittle bugs. Some hymenopterous natural enemies were reared from the pod borers and were identified as *Habrobracon hebetor*. Seed samples collected from the market were infested by the bruchid *Callosobruchus maculatus*, a serious storage pest of cowpea in Nigeria. Natural enemies emerging from these bruchids were identified as *Dinarmus vagabundus*.

Many reported pigeonpea pests were observed, though farmers did not report significant losses. All stages of *C. tomentoscicollis* were observed on pigeonpea pods. Eggs of *H. armigera* were seen on floral parts and damage caused by the larvae was observed on developing pods. Varying populations of thrips were seen on the flowers. Blister beetles (*Mylabris* spp) were observed on flowers at the experimental plots of the Taraba Agriculture Development Project (TADP). In general, damage by *C. tomentoscicollis* was most prominent.

In the 1993 survey, pod and seed damage varied among states (Table 1). Pod damage was greatest in Delta (40%) and least in Niger (5%) while seed damage was highest in Delta (27%) and lowest in Plateau (5%). Most of the damage had been caused by lepidopteran pod borers which were no longer present as the crops had matured and been harvested in most places.

The cropping systems in which pigeonpea was grown appeared to have an effect on the amount of insect damage to the crop (Table 2). Ratoon crops suffered the most severe damage, followed by pigeonpea intercropped with maize and sorghum. Samples obtained from the market had the least insect damage, followed by those intercropped with rice, isolated stands, and lone stands.

These results are not surprising; ratoon crops were at least one year old and were thus likely to support higher numbers of the insect pests due to a build-up. Maize and sorghum share some pests with pigeonpea, particularly some lepidoptera and blister beetles, and therefore are likely to provide additional sites for pests in the mixtures. The very low level of damage in market samples is a reflection of the processing and sorting that occurs prior to selling. Pigeonpea intercropped with rice was seen at only one location and this field may have escaped insect damage because of low pest populations, but this needs further investigation. Lone and isolated stands may likewise have escaped pest damage due to the inability of the insects to locate the host in a diversified ecosystem.

Table 1. Insect damage to pigeonpea pods and seeds, Nigeria, Feb 1993.

State	No. of samples[1]	No. of pods	No. of seeds	% of Pods damaged	% Seeds damaged
Delta	2	20	71	40	27
Kaduna	10	100	228	26	11
Kogi	19	190	624	19	9
Anambra	4	40	152	18	7
Enugu	25	250	814	12	15
Edo	2	20	74	10	22
Benue	2	20	76	10	8
Plateau	4	40	179	8	5
Niger	6	60	261	5	17
Not stated	43	430	1686	12	5
Total/Mean	117	1170	4165	16.00	12.60

1. One sample consisted of 10 pods taken at random from different plants in a field.

Table 2. Insect damage to pigeonpea pods and seeds in relation to cropping system (sole or intercrop), Nigeria, Feb 1993.

Cropping system	% Borer damage (a)	% Shrivelled pods (b)	% Seed damage (c)	Overall Ranking (mean of a+b+c)
Ratoon	42.2 (2)*	34.85 (1)	43.42 (1)	(1)
Maize intercrop	45.00 (1)	22.93 (2)	27.63 (2)	(2)
Sorghum intercrop	26.38 (4)	21.34 (3)	16.37 (3)	(3)
Monocrop	35.44 (3)	18.62 (4)	25.59 (4)	(4)
Cassava intercrop	19.76 (6)	18.00 (5)	16.16 (5)	(5)
Hedge	23.39 (5)	15.80 (7)	15.36 (7)	(6)
Isolated stands	18.30 (7)	14.65 (8)	15.61 (6)	(7)
Lone stands	14.13 (8)	13.07 (9)	13.17 (8)	(8)
Yam intercrop	14.00 (9)	16.00 (6)	12.00 (9)	(8)
Rice intercrop	11.50 (10)	12.50 (10)	8.50 (10)	(10)
Market sample	-	-	3.00 (11)	(11)
Mean	25.01	18.78	17.89	

* = Figures in parentheses represent the ranking of damage where 1 is the highest and 11 is the lowest damage.

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Biotechnology

Isozyme Variation in In Vitro Propagated Calluses of Pigeonpea

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Spontaneously arising changes in somatic tissues during in vitro culture have been suggested as an additional source of genetic variability in any crop species. But progress in this area required development of suitable in vitro culture techniques which generate maximum variability, and efficient screening techniques to detect the variants. Isozymes, being nearly direct gene products (proteins), hold tremendous promise both as tools to gain insight into the cause of genetic instability, and as markers to monitor variation (Lassner and Orton 1983). To explore the possibility of creating genetic variability using tissue culture, we have studied the isozyme pattern of acid phosphatase and esterase in in vitro propagated calluses of pigeonpea.

Thirty-days-old calluses obtained from four genotypes, H 87-1, H 82-2, ICP 7182, and ICP 6974, cultured on Murashige and Skoog's (1962) medium supplemented with 2,4-D (2.0 mg L^{-1}), using germinating seeds without seed coat as explants were subjected to isozyme analysis