

Survey of insect pests on pigeonpea in Nigeria

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Abstract

Survey of pigeonpea growing areas in Nigeria comprising Imo, Abia, Enugu, Anambra, Delta, Kogi and Benue states was carried out in February 2007 and repeated in February 2008 basically to establish pest incidence and level of damage caused by insect pests in farmers' fields. Questionnaires and discussions with agriculturists from state agricultural extension agencies, universities, staff of Ministries of Agriculture and farmers were carried out. From 103 sample sites, 100 pigeonpea pods were selected at random and analyzed for percentage pod damage by pod borers and pod sucking bugs. The cropping systems in which pigeonpea was growing were noted and percentage seed losses due to pests from each system were analyzed and recorded. From the results, major insect pests encountered during the field visits were: foliage beetles, ants, termites, flower pests [thrips (*Megalurothrips usitatus*) and blister beetle (*Mylabris pustulata*)], pod borers (*Helicoverpa armigera*, *Maruca testulalis*, *Etiella zinckenella*), pod sucking bugs (*Anoplocnemis curvipes*, *Riptortus dentipes*, *Clavigralla tomentosicollis*, *Nezara viridula*), aphids (*Aphis craccivora*), and leaf damaging weevils (*Myllocerus undecimpustulatus*). Results also revealed that mean damage by pod sucking bugs was highest in Imo (78%), Kogi (73%) and Benue states (71%) and least in Enugu state (44%) than the damage by pod borers in all the states visited. Among the cropping systems observed in the areas, pigeonpea/maize intercrop recorded greater damage by pod borers than pod sucking bugs while pigeonpea/rice intercrop had the least damage by pod borers and pod sucking bugs followed by pigeonpea/cocoyam intercrop.

Introduction

Pigeonpea (*Cajanus cajan*) is usually described as a perennial legume (Purseglove 1974, Smartt 1976) but widely grown as an annual crop. India is the world's largest producer of pigeonpea. In India, where the crop originated, there are several survey reports of quantitative estimates of losses caused by insect pests on pigeonpea from various parts of the country. Thus, surveys of pigeonpea in India conducted by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in 1975 and 1981 indicated a mean pod damage of 13% in 359 fields surveyed in North India (Lateef and Reed 1983). Results from this survey revealed that lepidopteran borers, mainly *Helicoverpa armigera*, caused severe damage to pigeonpea in Northeast, Central and South India. After India, Kenya is the second largest producer of pigeonpea.

The mineral content of pigeonpea indicates that it is an excellent source of calcium, potassium, copper, iron, phosphorus, magnesium and zinc, and is low in sodium (Duke 1981). Deshpande and Damodaran (1990) reported that the low sodium content, ability to lower serum cholesterol in humans, high fiber content, low fat content, long shelf life, high protein content and high complex carbohydrates make pigeonpea an excellent food source of both protein and energy for hypertensive people.

As a consequence of outrageous increase in local prices of food (especially the price of meat, fish and eggs), grain legumes such as cowpea (*Vigna unguiculata*), pigeonpea, chickpea (*Cicer arietinum*), soybean (*Glycine max*) and other pulses are enjoying resurgence in interest and enhanced level of consumption. There is no temporary or seasonal resurgence because of food shortage and high prices in Africa.

Despite the importance of pigeonpea in African diet and health needs, it is underutilized as little seems to be known about the biotic constraints and utilization of the crop. In Nigeria, survey information about pigeonpea is lacking. Therefore, to provide data base for further scientific research and to make pigeonpea popular among farmers and consumers in Nigeria, a team of scientists carried out a survey of pigeonpea growing areas in the country. Hence, the primary objective of this research is to establish pest incidence in pigeonpea growing areas in Nigeria and the level of damage caused by insect pests in farmers' fields.

Materials and methods

In February 2007, scientists from Federal University of Technology, Owerri and University of Nigeria, Nsukka carried out a field visit to some pigeonpea growing areas in Nigeria. In 2008, another visit was made during the same period as in 2007. Scientists comprised entomologists, pathologists, nematologist, breeders, agronomists, extensionists and economist. Questionnaires were used to obtain necessary information from farmers. Other sources of information during the visit include discussions from state extension agencies, universities, staff of Ministries of Agriculture and individuals familiar with the crop.

The places visited include the pigeonpea growing areas from towns in Local Government Areas of Imo, Abia, Enugu, Anambra, Delta, Kogi and Benue states. Some plants from farmers' fields were carefully examined and records were made on the incidence of insect pests. From 103 sampling sites, 100 pods each were selected at random, weighed in the laboratory with top loading balance and analyzed for percentage pod damage by insect pests. Insect pests were also collected and preserved in a specimen bottle containing 98% ethyl alcohol. These specimens were identified in the laboratory and later taken to insect museum at Almadu Bello University, Zaria for confirmation. Infected plants were also collected and examined for disease incidence at the laboratory in University of Nigeria, Nsukka.

Results

Geographical locations of surveyed states in Nigeria and their staple crops. Imo state is bordered by Abia state on the east, by the River-Niger and Delta state on the west, by Anambra state to the north and Rivers state to the south.

Abia state is bounded on the north and northeast by the states of Anambra, Enugu and Ebonyi. To the west of Abia is Imo state, the east and southeast are Cross River and Akwa Ibom states and to the south is Rivers state.

The southern part of the state lies within the riverine part of Nigeria. In Imo and Abia states, which occupy the rain forest zone of Southeastern Nigeria, pigeonpea was seen during the survey in scattered stands. In the two states, particularly in villages like Ehime-Mbano, pigeonpea was planted as hedges and also used for farm boundary demarcation. Farmers in most of the villages visited, complained that pigeonpea odor is irritating and the long cooking period is a problem. Hence they are reluctant to adopt the crop as a major crop in their farming systems. The two states with adequate seasonal rainfall and much arable land produce yam, maize (*Zea mays*), potato (*Solanum tuberosum*), cassava (*Manihot esculenta*), rice (*Oryza sativa*), plantain (*Musa sp*) and cashew (*Anacardium occidentale*).

Enugu is one of the states in the Southeastern part of Nigeria. The state shares borders with Abia and Imo states to the south, Ebonyi state to the east, Benue state to the northeast, Kogi state to the northwest and Anambra state to the west. It lies within the derived savannah zone of Southeastern Nigeria.

Anambra State is in Southeastern part of Nigeria and the boundaries are formed by Delta state to the West, Imo state to the South, Enugu state to the East and Kogi state to the North. In Nigeria, farming systems vary in their objectives, complexity, degree of sophistication and the degree of practices and operations.

In Enugu and Anambra states, some farm families are now appreciating the importance of pigeonpea in their traditional farming systems, and the profitability of pigeonpea crop. In a typical compound farm, it is not uncommon to see more than two crops of different species on the same piece of land. In several farms in Southeastern Nigeria, yam, cassava, maize, okra, pepper, melon, black beans and pigeonpea are the major staple crops. These crops in mixed stands exhibit different characteristics maturing at different times and adaptation to different ecological and cultural practices. The local landraces of pigeonpea often planted stay longer in the field than other crops. They grow and reach maturity between January and February which happens to be the peak of harmattan (dry season).

Delta state borders Edo state, Ondo state, Imo state, Rivers state, Anambra state and Bayelsa state and lies within the tropical rain forest zone of South and Southeastern Nigeria and is characterized by short day season between January and February. In this area, pigeonpea plants were also found in the bush in scattered portions and often in mixed stands with yam, cassava and maize, mostly in some areas at Okpanam. However, pigeonpea is not known as a major staple crop in these areas and does not thrive well in some other localities within the region as a result of waterlogging.

However, going towards the Benue and Kogi states located in the north central part of Nigeria, mixed cropping decreases in intensity. In these areas, there has sprung up a good number of large-scale farms for the production of local pigeonpea in sole stands. Pigeonpea is among the major staple crops in addition to beans, soybean and bambara groundnut. Bush fallowing is the common practice with fallow periods of four to seven or more years probably because their population density is low with large land mass. Compound farms are also common in all areas. The farms are cultivated with crops such as pepper, rice, melon, groundnut, maize, pumpkin, yam, cassava, sweet potato, guinea corn, flax, beniseed, and often with or without pigeonpea. In Kogi state, cash crops such as coffee, cocoa, oil palm and cashew are grown in addition to arable crops.

Major insect pests observed in farmers' fields.

Farmers' fields in all the areas visited had long-duration local pigeonpea cultivars with different heights and canopy development. Farmers plant pigeonpea in May and often harvest the pods from December through February. The insects encountered were foliage beetles (*Oothea mutabilis*), whitefly (*Bemisia tabaci*), leafhoppers (*Empoasca kraemeri*, *E. fascialis*), scale insects (*Ceroplastodes cajani*), termites (*Odontotermes* sp), aphids (*Aphis craccivora*), leaf damaging weevils (*Myllocerus undecimpustulatus*), lepidopteran borers such as pod borers (*Helicoverpa armigera*, *Etiella zinckenella*, *Maruca testulalis*), flower pests [thrips (*Megalurothrips usitatus*) and blister beetle (*Mylabris pustulata*)], pod sucking bugs (*Anoplocnemis curvipes*, *Riptortus dentipes*, *Clavigralla tomentosicollis*, *Nezara viridula*) and blue butterfly (*Lampides boeticus*).

Though farmers did not indicate significant losses due to insect damage, all stages of pod sucking bugs especially, *Clavigralla* spp and *Riptortus dentipes* were observed on the pods. There were eggs of *H. armigera* in all the flowers examined. *Mylabris* spp were observed on flowers in almost all the areas visited, but pod damage was most prominent on pigeonpea caused by pod sucking bugs particularly, *Clavigralla* spp and *Riptortus* spp. There is variation from state to state and village to village with respect to pigeonpea pod damage by pod borers (*H. armigera*) and pod sucking bugs (*R. dentipes* and *C. tomentosicollis*). Major diseases identified include fusarium wilt (*Fusarium udum*), root rot (*Sclerotium rolfsii*) and angular leafspot (*Phaeisariopsis griseola*).

Table 1 reveals that pod borer caused greater average damage of 15.15% to pigeonpea pods at Mbidi in Oru-West Local Government Area of Imo state compared to other villages. At village level, pod sucking bugs comprising *C. tomentosicollis* and *R. dentipes* recorded the highest damage of 93.10% to pigeonpea pods at

Ihiagwa in Owerri-West Local Government Area. On average, from the two years field visits pod sucking bugs caused 78.29% damage to pigeonpea pods in Imo State which is greater when compared to all other states visited, while pod borers caused 6.28% pod damage.

Table 2 shows that in Abia state, pod borer (*H. armigera*) with highest pod damage of 6.47% occurred in Umuokpara while pod sucking bugs (mostly *C. tomentosicollis* and *R. dentipes*) caused 78.61% to pigeonpea pods at Ndume in Ikwu-Ano Local Government Area. Field visits in 2007 and 2008 in Abia state showed that on average pod sucking bugs caused 67.93% damage to pigeonpea pods while pod borers caused 5.85% pod damage.

Table 3 shows that on average *H. armigera* caused 23.04% pod damage in Okpanam while pod sucking bugs with highest pod damage of 62.26% also occurred at Okpanam all in Oshimilli South Local Government Area. However, the average pod damage in Delta state was 15.17% by pod borers and 50.26% by pod sucking bugs.

Table 4 reveals that in Anambra state *H. armigera* caused the highest damage of 36.06% to pigeonpea pods at Ebenebe while the highest damage of 78.59% by pod sucking bugs was observed at Amukwu. On average of the two years field visits, pod borers caused 18.61% damage and pod sucking bugs caused 78.59% damage in the state.

Table 5 shows that in Enugu state *H. armigera* caused more damage to pigeonpea pods at Orba (30.80%) and Ogurugu (25.90%) while on average the damage by pod sucking bugs was high in Obollo-Afor (78.34%) and Nike (78.27%) towns in Isi-Uzo and Enugu North Local Government Areas respectively. During 2007 and 2008 field visits the mean pod damage by pod borers was 17.44% while it was 43.69% by pod sucking bugs.

Table 6 shows that at Ukpaba in Kogi state, *H. armigera* caused highest damage of 46.63% to pigeonpea pods while pod sucking bugs caused the highest damage at Zariaji (95.69%) in Kabba Local Government Area. Pod sucking bugs caused mean damage of 73.19% during 2007 and 2008 while pod borers caused 17.51% damage.

Table 7 shows that in Benue state, highest pod damage (20.15%) by pod borers occurred at Tse-Korleke village in Gwer West Local Government Area while the highest pod damage of 80.85% by pod sucking bugs occurred at Aondona in Gwer East Local Government Area, followed by 78.95% pod damage at Yandev in Gboko Local Government Area. The mean pod damage in Benue state was 12.63% by pod borers and 70.77% by pod sucking bugs.

Table 8 reveals that pigeonpea intercropped with maize is most susceptible to pod borers (53.12% damage) and pod sucking bugs (25.99% damage). Also pod damage in sole pigeonpea and pigeonpea/sorghum intercrop was higher when compared to that in pigeonpea

Table 1. Insect pests damage to pigeonpea pods in Imo state, Nigeria, 2007 and 2008.

Local Government Area	Village	Pod borer damage (%)			Pod sucking bug damage (%)		
		2007	2008	Mean	2007	2008	Mean
Owerri Zone							
Owerri-North	Ebgu	4.00	5.10	4.60	89.30	93.60	91.45
Owerri-North	Emekuku	7.50	5.00	6.30	75.30	77.90	76.60
Owerri-North	Uratta	5.80	4.09	4.95	73.50	80.70	77.10
Owerri-West	Ihiagwa	4.50	3.80	4.15	89.90	98.20	93.10
Ngo-Okpala	Ohoha	2.80	3.00	3.30	66.30	70.60	68.50
Ngo-Okpala	Umureke	3.90	4.20	4.10	70.80	81.90	76.35
Ngo-Okpala	Ihitte	6.60	7.90	7.30	75.00	90.80	82.90
Mbaitoli	Orodo	2.90	4.70	3.80	88.00	79.80	83.90
Mbaitoli	Ifakala	5.20	6.00	5.60	69.90	87.80	78.85
Mbaitoli	Mbieri	4.30	5.60	5.00	77.40	83.60	80.50
Ezinihite-Mbaise	Itu	5.10	3.90	4.50	67.80	83.50	75.65
Ezinihite-Mbaise	Eziudo	5.30	3.94	4.62	73.20	77.10	75.20
Ezinihite-Mbaise	Akpodium	1.87	3.96	2.92	80.36	78.52	79.44
Ezinihite-Mbaise	Umudim	3.50	4.49	4.00	86.55	77.32	81.94
Olu Zone							
Olu	Nkwere	12.82	15.31	14.07	84.17	92.54	88.36
Ideato-North	Akokwa	13.22	14.67	13.95	79.60	86.95	83.28
Ideato-North	Obina	10.80	8.28	9.54	88.36	75.72	82.04
Oru-West	Mbidi	14.39	15.90	15.15	69.48	78.90	74.19
Oru-West	Awonmanma	12.67	16.17	14.42	73.41	80.33	76.87
Ngwuta	Izumba	11.46	9.53	10.50	88.73	81.62	85.18
Okigwe Zone							
Okigwe	Amuro	2.99	4.78	3.89	79.81	83.20	81.51
Okigwe	Adizuogu	6.97	3.75	5.36	78.60	79.48	79.04
Okigwe	Arondizogu	7.74	5.12	6.43	90.84	78.92	84.88
Ihete-Uboma	Abuoke	4.24	4.70	4.47	68.53	84.21	76.34
Ihete-Uboma	Ikperere	6.32	3.95	5.14	90.60	78.51	84.55
Ihete-Uboma	Amainyi	3.30	4.79	4.05	86.42	89.50	87.96
Ihete-Uboma	Lowa	4.83	3.85	4.34	78.90	77.68	78.29
Ihete-Uboma	Umuihi	5.04	2.75	3.90	73.79	91.60	82.70
Ehime-Mbano	Nsu	6.00	4.05	5.03	87.90	79.52	83.71
Ehime-Mbano	Ehime	4.91	5.83	5.37	84.87	68.94	76.91
Ehime-Mbano	Umu-Akagwu	2.78	5.27	4.03	79.61	87.69	83.65
Mean pod damage (%)		6.25	6.27	6.28	79.58	82.40	78.29

Table 2. Insect pests damage to pigeonpea pods in Abia state, Nigeria, 2007 and 2008.

Local Government Area	Village	Pod borer damage (%)			Pod sucking bug damage (%)		
		2007	2008	Mean	2007	2008	Mean
Ikwu-Ano	Ibeku	5.20	6.48	5.84	68.59	62.73	65.66
Ikwu-Ano	Ohokobe	6.18	4.34	5.26	65.96	72.70	69.33
Ikwu-Ano	Ndume	5.60	7.20	5.20	76.40	80.82	78.61
Umuahia	Umuokpara	6.27	6.66	6.47	71.64	68.21	69.93
Umuahia	Isingwu	5.58	6.50	6.04	69.38	63.54	66.51
Isiukwu-Ato	Nunya	3.98	6.80	5.39	59.64	62.31	60.98
Isiukwu-Ato	Eluama	4.45	6.86	5.66	69.80	54.32	62.06
Abia-Nortn	Abayi	6.30	5.88	6.09	77.80	69.00	73.40
Abia-North	Umuagosi	7.20	5.30	6.30	66.90	73.80	70.40
Abia-North	Umule	7.40	5.00	6.20	55.90	68.80	62.40
Mean pod damage (%)		5.82	6.10	5.85	65.24	67.61	67.93

Table 3. Insect pests damage to pigeonpea pods in Delta state, Nigeria, 2007 and 2008.

Local Government Area	Village	Pod borer damage (%)			Pod sucking bug damage (%)		
		2007	2008	Mean	2007	2008	Mean
Oshimili South							
Asaba	Okpanam I	15.00	6.11	15.56	54.00	56.00	55.00
Asaba	Okpanam II	21.00	25.08	23.04	66.00	59.51	62.26
Asaba	Asaba	15.70	20.80	18.15	56.75	63.03	59.89
Isoko North	Uzoro	14.05	10.92	12.49	46.91	52.16	49.54
Isoko North	Okpe	12.26	13.06	12.66	58.18	48.08	52.13
Isoko North	Ellu	18.32	14.75	16.54	33.88	49.60	41.74
Isoko North	Oyede	10.66	16.44	13.55	51.27	49.33	50.30
Isoko South	Uzere	9.29	15.60	12.45	47.08	38.66	42.87
Isoko South	Oleh	13.51	10.14	11.83	39.90	50.15	42.03
Isoko South	Emede	16.18	19.21	17.70	40.28	49.12	44.70
Isoko South	Iyede	17.00	10.14	13.57	48.00	56.70	52.35
Mean pod damage (%)		14.82	14.70	15.17	49.30	52.03	50.26

Table 4. Insect pests damage to pigeonpea pods in Anambra state, Nigeria, 2007 and 2008.

Local Government Area	Village	Pod borer damage (%)			Pod sucking bug damage (%)		
		2007	2008	Mean	2007	2008	Mean
Awka N.	Ugbenu	17.65	19.44	18.55	45.88	38.70	42.29
Orumba	Umunze	13.00	11.70	12.35	50.26	61.24	55.75
Orumba	Ajali	8.80	10.10	9.45	78.43	66.82	72.63
Aguata	Uga	14.10	12.00	13.05	52.00	63.55	57.78
Aguata	Ezinifite	19.58	16.00	17.79	70.10	62.51	66.31
Aniocha	Agulu	20.43	19.60	20.02	59.15	52.46	55.81
Anyamelu	Amukwu	18.36	15.70	17.03	76.58	80.60	78.59
Anambra	Umuleri	27.00	28.13	27.57	66.00	73.10	69.55
Awka North	Amansea	7.60	19.20	10.40	62.00	68.00	65.00
Awka North	Ebenebe	31.90	40.21	36.06	56.90	69.04	62.97
Awka North	Okpuno	15.70	12.67	14.19	46.50	39.78	43.14
Mean pod damage (%)		17.65	18.61	17.86	60.38	61.44	60.89

intercropped with yam, cassava, rice and cocoyam. Pod damage was minimum in pigeonpea/rice intercrop followed by pigeonpea/cocoyam intercrop.

Discussion

In all the states visited, pod sucking bugs caused greater damage to pigeonpea pods particularly in Imo, Kogi, Benue and Abia states. In Kogi and Benue states large areas of pigeonpea are grown, often as monocrop while in Imo and Abia states pigeonpeas are planted in scattered plots and mostly as hedges in farmlands. The high damage by pod sucking bugs (*C. tomentosicollis*) was predominant in Kogi and Benue states and *R. dentipes* was important in Imo and Abia states. This is to be

expected as the pests experienced free movement due to sole pigeonpea crop, which favored feeding and oviposition. Survey carried out in pigeonpea growing areas in India in September 1989, where 26 farmers constituted the sample, revealed that insect pests particularly pod sucking bugs (*Clavigralla gibbosa*) are the major pigeonpea yield reducers (Omanga et al. 1989).

In all these states, pod borers (particularly *H. armigera*) are considered to be low compared to pod sucking bugs. Rainfall and harsh harmattan weather probably enhanced the mortality of growth stages of *H. armigera*.

On the other hand the mean percentage pod damage by *R. dentipes*, *C. tomentosicollis* and *H. armigera* were generally considered to be low as in Enugu, Anambra and

Table 5. Insect pests damage to pigeonpea pods in Enugu State, Nigeria, 2007 and 2008.

Local Government Area	Village	Pod borer damage (%)			Pod sucking bug damage (%)		
		2007	2008	Mean	2007	2008	Mean
Nsukka	Ede-Oballa	15.87	19.50	17.69	65.08	70.10	67.59
Isi-Uzo	Orba	29.50	32.10	30.80	47.54	35.00	41.27
Isi-Uzo	Milike-Uno	18.64	23.64	21.14	59.32	45.30	52.31
Isi-Uzo	Obollo-Afor	21.70	19.83	20.77	73.50	83.18	78.34
Igbo-Etiti	Aku	12.77	15.00	13.89	34.04	40.11	37.08
Igbo Etiti	Ukehe	16.20	18.00	17.10	26.30	31.20	28.80
Igbo-Etiti	Ozalla	18.40	17.70	18.05	28.60	33.30	31.00
Igbo-Etiti	Onyohor	10.30	12.60	11.45	29.00	26.50	27.80
Igbo-Eze	Iheaka	3.45	11.15	7.30	60.40	55.50	57.95
Igbo-Eze	Ibagwa-Aka	14.40	11.80	13.10	30.00	33.55	31.78
Igbo-Eze	Ibagwa-Ani	14.58	16.32	15.45	26.80	29.00	26.90
Igbo-Eze	Ovoko	18.20	17.66	17.93	33.00	36.20	34.60
Uzo-Uwani	Ogurugu	23.60	28.20	25.90	26.40	17.16	21.78
Uzo-Uwani	Opanda	19.30	23.10	21.20	39.60	45.31	42.46
Uzo-Uwani	Nimbo	16.80	20.40	18.60	40.80	38.60	39.70
Enugu North	Nike	15.63	10.19	12.91	70.31	86.23	78.27
Oji-River	Oji-River	25.90	20.90	23.40	10.00	25.60	17.80
Udi	Udi	13.33	15.18	14.26	50.00	49.90	49.95
Udi	Mokwe	8.70	12.09	10.40	65.22	68.19	66.71
Mean pod damage (%)		16.01	17.12	17.44	42.94	44.73	43.69

Table 6. Insect pests damage to pigeonpea pods in Kogi state, Nigeria, 2007 and 2008.

Local Government Area	Village	Pod borer damage (%)			Pod sucking bug damage (%)		
		2007	2008	Mean	2007	2008	Mean
Anpka	Ukpaba	43.06	50.26	46.63	48.61	50.90	49.76
Ayamgba	Ayamgba	3.00	11.80	7.40	92.00	96.30	94.15
Okene	Okene	27.59	35.33	31.46	67.24	73.25	70.25
Kogi	Karara	7.69	14.70	11.20	61.45	54.30	57.92
Okehi	Osara	4.12	3.08	3.60	83.51	94.67	89.09
Okene	Ogaminana	11.00	9.60	10.30	78.00	86.43	82.22
Olabeboro	Agbadum-Okpo	20.62	16.68	18.65	44.33	35.85	40.64
Lokoja	Lokoja	16.67	20.22	18.45	73.08	84.21	78.65
Kabba	Zariaji	7.32	9.15	8.24	92.68	98.70	95.69
Okene	Achola	8.47	5.72	7.10	71.20	87.12	76.16
Kabba	Kabba	29.00	26.09	32.55	66.00	75.20	70.60
Mean pod damage (%)		16.23	19.33	17.51	70.74	76.08	73.19

Delta states as in most places pigeonpea was seen in mixed stand with yam, cocoyam, cassava, rice, pineapple and maize. Thus the intercrops provided impediments for survival and feeding potential of pod sucking bugs and pod borers in the farming systems of the region. This finding was supported by Oyenga-Latigo et al. (1992), who observed that *Aphis fabae* incidence was low in beans intercropped with densely populated maize.

With respect to intercropping systems observed, maize shares some pests with pigeonpea, particularly the lepidopterous feeders and blister beetles and therefore, is likely to provide additional sites for pests in the mixture; hence the greater damage observed in pigeonpea/maize than in other intercrops. Lower pod damage obtained from pigeonpea/rice intercrop followed by cocoyam intercrop may be ascribed to diluting effect of non-host plants on the dispersal of insects.

Table 7. Insect pests damage to pigeonpea pods in Benue state, Nigeria, 2007 and 2008.

Local Government Area	Village	Pod borer damage (%)			Pod sucking bug damage (%)		
		2007	2008	Mean	2007	2008	Mean
Udokpoloko	Udokpoloko	16.00	17.10	16.55	74.00	76.15	75.08
Gwer East	Taraku	19.60	16.85	17.95	56.52	62.90	59.71
Gwer East	Aondona	8.11	9.00	8.56	83.80	77.89	80.85
Gwer West	Tse-Kough	6.52	11.20	8.86	59.80	66.42	63.11
Gwer West	Tse-Korlere	20.50	19.80	20.15	63.50	58.77	61.14
Apa	Adoka	7.92	11.09	9.51	72.60	69.81	66.76
Ogbokolo	Ogbokolo	8.21	15.00	11.61	76.20	85.25	80.73
Katsina-Ala	Katsina-Ala	10.00	11.18	10.59	60.11	77.08	68.60
Tarka	Wannune	9.60	13.33	11.47	75.00	70.50	72.75
Gboko	Yandev	12.11	10.06	11.09	80.90	77.00	78.95
Mean pod damage (%)		11.86	13.46	12.63	70.44	72.18	70.77

Table 8. Insect pests damage to pigeonpea pods in different cropping systems in Nigeria, 2007 and 2008.

Cropping systems	Pod borer damage (%)			Pod sucking bug damage (%)		
	2007	2008	Mean	2007	2008	Mean
Pigeonpea (sole)	35.44	43.70	39.57	18.62	22.00	20.31
Pigeonpea/Maize	45.00	61.23	53.12	22.93	29.05	25.99
Pigeonpea/Sorghum	26.38	33.82	30.10	21.34	26.19	23.77
Pigeonpea/Cassava	19.76	25.90	22.83	18.00	21.68	19.84
Pigeonpea/Yam	14.00	16.12	15.06	16.00	19.17	17.59
Pigeonpea/Rice	11.50	12.44	11.97	12.50	8.80	10.65
Pigeonpea/Cocoyam	12.16	13.60	12.88	13.00	10.91	11.96

Yam and cassava intercrops may have been influenced by some factors related to the inability of the insects to locate their host easily in a diversified ecosystem, as a kind of pseudo-resistance as described by Painter (1985) and Norris and Kogan (1980).

Conclusion and recommendation

There was incidence of different species of insect pests in pigeonpea growing areas surveyed in Nigeria, with the highest percentage of pod damage being observed in Imo, Kogi and Benue states. These states grow sole crops of pigeonpea and so farmers in these areas should adopt the system of planting pigeonpea in mixture with other crops, particularly rice and cocoyam, to help minimize the incidence of pod sucking bugs and pod borers in pigeonpea pods. Efforts should be made to encourage researchers in Nigeria to examine the biotic/abiotic

constraints of producing short-duration pigeonpea in Nigeria and develop breeding strategies considering the desirable qualities required by farmers and consumers. In this way, short-duration pigeonpea cultivars will gradually become popular in the farming systems of most of the farmers in different states of Nigeria.

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