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Varietal Differences in Rice (*Oryza sativa* L.) Resistance to the Shield Bug, *Aspavia armigera* (Fabricius) (Hemiptera: Pentatomidae)

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Abstract

Sixty rice accessions were assessed in the field for resistance to *Aspavia armigera* F. attack under natural and artificial infestations. Out of these, 30 were lowland and 19 upland varieties derived from the International Institute for Tropical Agriculture (IITA) breeding programmes, while the others were obtained from other local and international organizations. From the upland varieties, the highest population density of *A. armigera* was recorded on CAN 4143 ($p < 0.05$), while the highest percentages of unfilled grains were obtained on ITA 132 (33.1%) and CAN 4143 (32%), and were both rated the most susceptible to *A. armigera*. CAN 6656, on which the lowest value for unfilled grains (4.7%) was found was rated resistant. Among the lowland varieties, TOX 3118-2-E2-2-1-2, on which was recorded the highest population density of *A. armigera* and highest percentage of unfilled grains ($p < 0.05$) was considered susceptible, while ITA 230, ITA 308, ITA 123, TOX 3100-32-2-1-3-5, TOX 3107-39-1-2-1-3, TOX 3027-43-1-E3-1-1, TOX 3441-7-1-1-1, TOX 3226-5-2-2-2, TOX 3716-15-1-1 and TOX 3561-56-2-3-2 were considered resistant. However, no-choice tests revealed that five from each of ten upland and lowland varieties initially rated as resistant were severely damaged. The other five upland ITA 315, IRAT 169, ITA 321, FAROX 41 and M 55 with consistent expression of resistance which also had low number of stylet sheath: 11, 17, 23, 24.3, and 29.3, respectively, were therefore rated resistant. Similarly, lowland ITA 230, TOX 3561-56-2-3-2, TOX 3100-2-1-3-5, TOX 3226-5-2-2-2 and TOX 3107-39-1-2-1-3 with low number of stylet sheath were rated resistant as well.

Keywords: *Aspavia armigera*, rice, resistance, damage, pod-sucking bugs, variety, pentatomid

1. Introduction

Rice (*Oryza sativa* L.) is one of the major food crops cultivated by farmers in all agro-ecological zones of Nigeria. It is an important cereal crop and food item, not only widely consumed by a large proportion of the population in Nigeria, but all around the world in various forms (Ibiam et al., 2006; Shehu et al., 2013). The global rice production is estimated at 454.6 million tonnes annually which has an average yield of 4.25 tonnes per hectare (Fazlollah et al., 2011). Land under rice cultivation in Nigeria has increased from 1,609,890 ha in 2005/2006 to 2,012,740 ha in 2009/2010, while production has also moved from 3,286,500 kg/ha in 2005/2006 to 4,080,940 kg/ha in 2009/2010 (Ibrahim, 2013).

Among the constraints to rice production in Nigeria are pests which include weeds, pathogens, insects, rodents and birds. Insect pests are serious enemies to rice production which must be protected and increased to foster human health. Over 800 insect pests attack standing and stored rice (Grist & Lever, 1969). According to Pathak and Dhaliwal (1981), these insect pests account for rice losses of 24%, while Cramer (1967) reports 35%.

Aspavia armigera is one of the insect pest complex attacking rice in Nigeria. The insect is abundant in both upland and low land ecosystems of the humid forest and Guinea savanna zones, but is more abundant in the latter (Ewete & Olagbaju, 1990). The grain-sucking bug has a wide host range. In Nigeria, the bug is a major pest of rice as well as soybean and cowpea (Ewete & Olagbaju, 1990; Pitan et al., 2007). The feeding of both the adult and nymphs of *Aspavia* species especially *A. armigera* at the dough stage results in partially filled grains of low quality. Unprocessed panicles (paddy) usually have diffused brown spots indicating areas of attack on the grains by the bugs. However, infested grains turn dirty brown to black during parboiling thus affecting their aesthetic value.

Production practices such as varietal selection impact insect populations and damage because some rice varieties are more tolerant to biotic stresses than others (Long et al., 2001). In fact, one of the ideal methods of minimizing insect damage on rice is to cultivate resistant varieties (Akinsola, 1985). However, thousands of unscreened rice lines collected from all over the world are available at the gene banks in Africa, for instance at IITA, Ibadan, and the West African Rice Development Association, WARDA (Now the African Rice Center), Ibadan, Nigeria (Ng et al., 1983). Varietal screening, therefore, is a continuous activity to increase the chances of discovering resistant qualities as few rice varieties have resistance traits (Akinsola, 1984).

Reports on rice varietal screening have been on other insects such as *Manduca sexta* (William et al., 1980), *Sitophilus graminum* (Starks & Buxton, 1977) and *Heliothis zea* (Wiseman, 1985). In Nigeria, breeding for resistance to insect pests had been on rice stem borers especially *Chilo* sp. and *Maliarpha* sp. (Akinsola, 1987; Alam, 1990; Ukwungwu & Odebiyi, 1985), and Africa Rice Gall Midge, *Orseolia oryzivora* H&G (Ukwungwu, 1985; Ukwungwu et al., 1990) but little attention was given to other insects. No doubt, there is paucity of information on rice resistance to the grain-suckers most especially, *Aspavia* sp. in Nigeria. In this study therefore, 60 lowland and upland rice varieties were evaluated for resistance to *A. armigera* on the field under natural and artificial infestation conditions. This was to select varieties as donor in the breeding programme for the integrated control of this bug.

2. Materials and Methods

2.1 Sources of Seeds

Sixty rice accessions with days to flowering ranging from 93 – 100 comprising 30 each of upland and lowland accessions were used for the study. All the lowland accessions were International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria accessions: ITA 121, ITA 230, ITA 222, ITA 308, ITA 312, ITA 123, ITA 328, ITA 306, ROX 3562-65-1-2-1, TOX 3107-39-1-2-2, TOX 3098-2-2-1-2-1, TOX 3100-32-2-1-3-5, TOX 3118-2-E2-2-1-2, TOX 3118-2-E2-2-1-2, TOX 3107-39-1-2-1-3, TOX 3052-46-E2-1, TOX 3402-6-3-2-2, TOX 3440-176-1-2-1, TOX 3440-52-3-3-3, TOX 3027-43-1-E3-1-1, TOX 3562-8-2-1-2, TOX 3399-108-3-2-2, TOX 3441-22-3-3-2, TOX 3441-7-1-1-1, TOX 3226-5-1-2-2, TOX 3716-15-1-1, TOX 3561-56-2-3-2, TOX 3226-5-2-2-2, TOX 3440-133-2-3-2, and TOX 3162-11-1-2-1-1. Nineteen of the upland accessions were IITA germplasms: ITA 132, ITA 337, ITA 162, ITA 321, ITA 317, ITA 325, ITA 333, ITA 301, ITA 305, ITA 307, ITA 235, ITA 315, ITA 186, ITA 185, ITA 118, ITA 338, ITA 116, ITA 187, and ITA 182. Other varieties, FARO 11, FARO 31, and FARO 41 were from the Federal Department of Agriculture, Nigeria, IDSA 6 and IDSA 62 (Institut des Savanes, Bouake, Cote d'Ivoire), CAN 6656 and CAN 4143 (Rice Experiment Station, Chainat, Thailand), CT 6261 (Bangladesh Rice Research Institute, Chittagong, Bangladesh), IRAT 169 and IRAT 104 (Institute des Gerdart, IRAT station, Bouake), and M 55 (Macros Agricultural Research Institute, Indonesia). The field screening experiment was carried out under natural infestation as well as artificial infestation in a field cage.

2.2 Preliminary Field Screening of 60 Rice Varieties for Resistance to Aspavia armigera

The experiment was carried out at the ES-17 and F-paddy fields at WARDA in IITA, Ibadan, Nigeria. Seeds were sown, one variety per line, at a spacing of 20 cm × 20 cm using a randomized complete block design with three replicates. Total plot size was 12 m × 6 m for upland or lowland variety, and each replicate occupied 3 m × 6 m with 1 m border row between them. Plots were hand-weeded twice, and NPK fertilizer was applied to the plots at the rate of 80-60-60 kg/ha in two splits - at planting and tillering. *A. armigera* number (nymphs and adults) was counted visually from 10 plants/panicles per treatment (variety) per replicate at weekly intervals starting from flowering to harvesting period between 7.00 – 9.00 hrs local time.

2.3 Field Screening of Twenty Rice Varieties for Resistance to Aspavia armigera under Artificial Infestation

The experiment consisted of (i) mass rearing of *A. armigera* (ii) field establishment of test rice varieties and (iii) caging of the insects with the test rice plants.

2.3.1 Mass Rearing of *A. armigera*

A. armigera mass rearing method was adapted from Nilakhem (1976), Bowling (1979a, 1979b) and Heinrichs et al. (1985). Thirteen cages which were constructed using water-resistant wood and aluminum wire mesh were placed in a trench of about 15 cm deep outside the Plant Biology Laboratory, Olabisi Onabanjo University, Ago-Iwoye, Nigeria. Carbofuran (1.0 kg a. i/ha) was applied to the trench while permethrin powder was applied round each cage to trap ants and other crawling insects. The 13 cages were shared into 3 sets - Oviposition cages (3), Culture Maintenance cages (3), and Test cages (7). Potted rice variety ITA 257 which served as food source for the insect was planted in 30 plastic pots (20 cm diameter) filled with sieved top soil. Granules of NPK were incorporated into the soil before planting, and six seeds were sown per pot each week before thinning to two plants per pot at two weeks after planting. The potted rice plants were watered everyday during the dry season and every other day during the rainy season.

Thirty adult *A. armigera* were collected from the field, sexed and placed (1M:1F) in one of the oviposition cages containing two potted milk-stage and six potted booting-stage ITA 257 plants. After 7 days, the potted plants at booting stage containing eggs were transferred to one of the Culture Maintenance cages. At the same time, another six potted plants were placed near the already egg-laden rice plants so that the newly hatched nymphs could easily transfer to the panicle of the new food plants. This arrangement was left for 1 week. The six potted plants (now with nymphs) were thereafter transferred into Test cages where they were reared to adults. Only the newly emerged adults were used in the screen cage experiment. Food was changed in the Test cages twice weekly on Mondays and Thursdays, and all contacts with the rearing cages were in the cool hours of the day (7.00 – 9.00 hrs and 16.30 – 18.00 hrs local time). These steps were repeated throughout the screening exercise.

2.3.2 Field Establishment of Test Rice Varieties

The varieties used in this study were those considered resistant to *A. armigera* in the previous preliminary screening exercise, These were: ten upland rice: IRAT 169; FAROX 41; ITA 321; ITA 315; M 55; IDSA 52; CAN 6656; IDSA 6; IRAT 104; and ITA 301, and ten lowland rice: ITA 230; ITA 123; TOX 3100-2-1-3-5; TOX 3107-39-1-2-1-3; TOX 3441-7-1-1-1 and TOX 3716-15-1-1. This experiment was sited at the F-4 and EH15 at IITA, Ibadan, Nigeria. The 20 upland or lowland rice varieties (treatments) were in the nursery for 28 days before transplanting into the field in a randomized complete block design (RCBD) with four replicates. The rice plants were spaced at 20 cm × 20 cm giving a total of 20 hills of each rice variety per replicate. The plot was hand-weeded twice and NPK fertilizer was applied at the rate of 80-60-60 kg/ha in two splits. There was also top-dressing of rice with urea at 50 kg/ha.

2.3.3 Caging of the Insects with the Test Rice Plants

Large removable field screening cages with each (14 × 5 × 1.5 m^3) covering an area of 70 m^2 were constructed with water-resistant wood and muslin cloth for confining *A. armigera* to rice plants (both lowland and upland) on the field. Each field cage was installed on 10 well-established lowland or upland rice varieties at EH15 and F4, IITA, Ibadan, when about one-fourth of the grains reached the milk stage. The muslin cloth enveloped the cage but maneuverable entrance for the introduction of insect was created at the corner of the cage. Adult male and female *A. armigera* were collected from the mass culture into a muslin cloth bag (30 cm × 15 cm) containing fresh soft rice panicle which served as food and were transported to the field. Adult *A. armigera* were introduced into the field cage at 15 bugs/m^2 (IRRI, 1988) from a corner close to the rice panicles. The cages were checked every other day to ascertain their integrity, and were left until the rice panicles were ripened for harvest.

2.4 Data Collection and Analysis

In both experiments, at maturity ten rice panicles were randomly harvested from each replicate, placed in separate paper bag, dried and labeled. These panicles were taken to the laboratory for the evaluation of bug feeding activity by the unfilled grain seed cleaner technique. The 10 panicles harvested from each replicate were oven-dried at 50 ^oC for 7 days and thereafter threshed in a panicle. The filled and unfilled grains were weighed before running it through a seed cleaner. Chaffy (unfilled grains) were brown-off. The weight of filled grains was taken. The percentage of unfilled grains was taken as:

$$\%\ \text{Unfilled grains} = \frac{X - Y}{X} = \frac{\text{Weight of the unfilled grains}}{\text{Total weight of filled + Unfilled grains}} \times 100$$

In the cage experiment, ten panicles per plot were harvested into a sleeve made of nylon mesh. This was immersed in the staining solution for one hour. After removal, they were rinsed in tap water, air-dried and later examined under a binocular dissecting microscope (Hamberg Brand) for stylet punctures to determine the percentage grain damage. Resistance was based on percentage of unfilled grains and *A. amigera* infestation level. In the cage experiment, resistance was confirmed using *A. armigera*-induced stylet grain damage.

Data on *A. armigera* population density were square root-transformed while those in percentages were arc sine-transformed before subjecting them to analysis of variance using SAS (2002). Significant means were thereafter, separated using Duncan's Multiple Range Test at 5% probability.

3. Results

Results showed that only 16.7% of the rice accessions tested was found to be resistant to *A. armigera*. Among the upland rice varieties, significantly higher population ($p < 0.05$) (5.0) of *A. armigera* was recorded on CAN 4143 compared to other varieties screened. The lowest bug population (2.0) was however, found on thirteen other varieties. The highest percentage of unfilled grains (33.1) was obtained on ITA 132, and 32% on CAN 4143, making them the most susceptible varieties to *A. armigera*. However, CAN 6656, on which the lowest value of unfilled grains (4.7) was found was considered resistant and selected for further screening (Table 1).

Table 1. Mean number of *Aspavia armigera* and percentage unfilled grains on thirty upland rice varieties under natural infestation

Variety	Mean number of *Aspavia sp*	Percentage unfilled grains	Decision
ITA 132	3.0b	33.1 ± 8.5a	S
ITA 337	2.3c	14.0 ± 3.0d	S
ITA 162	2.7b	19.6 ± 3.8d	S
ITA 321	2.0c	8.4 ± 2.7e	R
ITA 317	2.0c	17.8 ± 1.5d	S
ITA 325	2.3c	15.9 ± 8.2d	S
ITA 333	2.0c	16.6 ± 2.5d	S
ITA 310	2.3c	9.7 ± 2.1 e	R
ITA 305	2.0c	17.7 ± 4.5d	S
ITA 307	2.0c	21.8 ± 9.1c	S
ITA 235	3.0b	15.9 ± 8.6d	S
ITA 315	2.3c	5.5 ± 1.9e	R
ITA 118	2.7b	15.9 ± 8.2d	S
ITA 135	2.3c	16.2 ± 2.7d	S
ITA 118	2.3c	15.7 ± 1.1d	S
FAROX 41	2.0c	9.5 ± 1.7e	R
ITA 338	2.0c	20.8 ± 3.3c	S
IDSA 6	2.0c	9.0 ± 3.5e	R
CAN 4143	5.0a	32 ± 7.3a	S
IRAT 104	2.7b	7.5 ± 2.5e	R
M 55	2.0c	9.1 ± 0.7e	R
CT 6261	2.0c	12.8 ± 5.6d	S
IRAT 169	2.0c	9.9 ± 2.1d	R
IDSA 62	2.3c	9.8 ± 5.6d	R
CNA 6656	2.0c	4.7 ± 1.6e	R
ITA 116	2.3c	23.7 ± 4.4c	S
ITA 187	2.0c	21.9 ± 6.1c	S
ITA 182	2.7b	16 ± 2.1d	S
FARO 11(OS 6)	2.7b	14.4 ± 6.7d	S
FARO 31	2.3c	25.3 ± 5.3b	S

Note. Means followed by same letter in a column are not significantly different at 5% probability level; R = Resistant, S = Susceptible.

Similarly, among the lowland varieties, TOX 3118-2-E2-2-1-2 recorded the highest population density of *A. armigera* (4.7) which was not significantly different from values observed on ITA 121, ITA 222, TOX 3052-46-E2-1, TOX 3562-65-1-2-1; ITA 328 and TOX 3562-8-2-1-2. The lowest bug density (1.0) was however, obtained from eleven varieties. A significantly ($p < 0.05$) higher percentage of unfilled grains (21.8) was recorded on TOX 3118-2-E2-1-2, while 2.2% which was the lowest value was recorded on TOX 3716-15-1-1.

Therefore, 10 lowland varieties: ITA 230, ITA 308, ITA 123, TOX 3100-32-2-1-3-5, TOX 3107-39-1-2-1-3, TOX 3027-43-1-E3-1-1, TOX 3441-7-1-1-1, TOX 3226-5-2-2-2, TOX 3716-15-1-1 AND TOX 3561-56-2-3-2 were considered resistant and were selected for further no-choice tests (Table 2).

Table 2. Mean number of *Aspavia armigera* and percentage unfilled grains on thirty lowland rice varieties under natural infestation

Variety	Mean number of Aspavia sp	Percentage unfilled grains	Decision
ITA 121	3.7a	17.8 ±18.7b	S
ITA 230	1.0a	5.2 ± 2.3f	R
ITA 222	3.0a	16.6 ± 4.1b	S
ITA 308	1.0c	7.1 ± 1.6e	R
ITA 312	2.0b	21.0 ± 6.7a	S
ITA 123	1.0c	5.5 ± 2.7f	R
TOX 3107-39-1-2-1	10c	10.8 ± 1.9d	S
TOX 3098-39-1-2-1	2.0b	10.1 ± 1.6d	S
TOX 3100-32-2-1-3-5	1.0c	6.1 ±1.7e	R
TOX 3081-36-E1-4-3	2.0b	11.2 ± 3.1c	S
TOX 3118-2-E2-2-1-2	4.7a	21.8 ± 8.5a	S
TOX 3107-39-1-2-3	1.0c	8.4 ±2. 1e	R
TOX 3052-46-E2-1	3.0a	16.2 ± 6.2b	S
TOX 306	2.0b	20.2 ± 6.2a	S
TOX 3402-6-3-2-2	2.0b	10.0 ± 1.3d	S
TOX 3440-176-1-2-1	2.0b	12.2 ± 4.1c	S
TOX 3440-52-3-3-3	1.0c	10.7 ± 3.0d	S
TOX 3027-43-1-E3-1	1.0c	5.0 ± 0.6f	R
TOX 3562-8-2-1-2	3.0a	16.0 ± 2.7b	S
TOX 328	3.0a	13.8 ± 3.0c	S
TOX 3562-8-2-1-2	3.0a	10.0 ± 1.1d	S
TOX 3441-22-3-3-2	2.0b	13.1 ± 5.2c	S
TOX 3441-7-1-11	1.0c	7.0 ± 2.8e	R
TOX 3226-5-2-2-2	1.0c	6.5 ± 2.1e	R
TOX 3716-15-1-1	1.0c	2.2 ± 0.4g	R
TOX 3561-56-2-3-2	0.7a	3.0 ±04.7g	R
TOX 3440-133-2-3-2	1.3c	10.5 ± 1.2d	S
TOX 3226-5-3-2-2	1.3c	9.5 ± 2.4d	S
TOX 3399-108-3-2-2	2.3b	12.8 ± 3.6c	S
TOX 3162-11-1-2-1-1	2.0b	9.9 ± 1.8d	S

Note. Means followed by same letter in a column are not significantly different at 5% probability level; R = Resistant, S = Susceptible.

Table 3 shows the feeding activity of *A. armigera* on upland rice varieties screened under artificial infestation. Based on the number of stylet sheath recorded, the most susceptible variety was IRAT 104 which had 36.8 stylet sheaths statistically similar to that obtained for ITA 301. The most resistant variety was ITA 315 which had significantly lower number of stylet sheaths (11.0) compared to other upland varieties. Consequently, only five out of the ten initially considered resistant varieties from each of upland and lowland were consistent when further tested in the cage experiment. The upland varieties were: ITA 315, IRAT 169, ITA 321, FAROX 41 and M 55 with 11, 17, 23, 24.3, and 29.3 stylet sheaths, respectively. Similarly, the lowland rice varieties with significant low *A. armigera* feeding activity ($P < 0.05$) which were considered resistant were: ITA 230, TOX 3561-56-2-3-2, TOX 3100-2-1-3-5, TOX 3226-5-2-2-2 and TOX 3107-39-1-2-1-3 (Table 3).

4. Discussion

The preliminary field screening of 60 upland and lowland rice varieties based on the number of *A. armigera* and the percentage of unfilled grain recorded on each variety revealed that ten from each of upland and lowland varieties were resistant, while others were considered susceptible. The upland varieties: ITA 321, ITA 301, ITA 315, FAROX 41, IRAT 104, M 55, IRAT 169, IDSA 62, CAN 6656, and IRAT 6 were considered resistance based on higher unfilled grains and were selected for further screening, as screening under natural infestation is not enough for meaningful selection of resistant rice varieties (Akinsola, 1987). Similarly, ten lowland rice varieties: ITA 230, ITA 308, ITA 123, TOX 3100-32-1-3-5, TOX 3107-39-1-2-1-3, TOX 3027-43-1-E3-1-1, TOX 3441-7-1-1-1, TOX 3226-5-2-2-2, TOX 3176-15-1-1-1 and TOX 3561-56-2-3-2 were selected as resistant, based on the unfilled grains criterion, for further screening.

Out of these twenty upland and lowland varieties that were further screened in field cages, ten varieties: ITA 301, CAN 6656, IRAT 104, IDSA 6, IDSA 62, ITA 123, ITA 308, TOX 3716-15-1-1, TOX 3441-7-1-1-1 and 3027-43-1-E3-3-1-1, showed inconsistency in the expression of resistance and were rated susceptible after all. The expression of resistance to this bug in the remaining ten varieties were found to be reliable in the following order: upland-lowland.

Table 3. Feeding activity of adult *Aspavia armigera* on upland and lowland rice varieties under artificial infestation

Variety	Mean number of stylet	Rating
Upland		
ITA 301	36.0 ± 2.9a	S
CNA 6656	29.5 ± 2.9b	S
IRAT 104	36.8 ± 6.7a	S
ITA 321	13.3 ± 2.5c	R
IDSA 6	30.3 ± 4.6b	S
ITA 315	11.0 ± 2.1d	R
IRAT 169	7.0 ± 4.2d	R
IDSA 62	31.0 ± 5.5b	S
FAROX 41	4.3 ± 2.9e	R
M 55	9.3 ± 7.5d	R
Lowland		
ITA 230	8.3 ± 0.9c	R
ITA 123	21.8 ± 1.9a	S
ITA 308	17.8 ± 2.8b	S
TOX 3716-15-1-1	17.8 ± 2.3b	S
TOX 3561-56-2-3-2	7.8 ± 2.3d	R
TOX 3441-7-1-1-1	18.5 ± 1.5b	S
TOX 3100-32-2-1-3-5	6.8 ± 1.4d	R
TOX 3226-5-2-2-2	6.0 ± 1.2d	R
TOX 3107-39-1-2-1-3	4.3 ± 0.5e	R
TOX 3027-43-1-E3-1-1	16.3 ± 1.8b	S

Note. Means followed by same letter in column within a variety group are not significantly different at 5% probability level; ± s.e.; * Average of 1000 grains/variety; R = variety considered resistant; S = Susceptible.

FAROX 41 > ITA 321 > ITA 315 > M 55 > IRAT 169; lowland: TOX 3107-39-1-2-1-3 > TOX 3226-5-2-2-2 > TOX 3100-32-2-1-3-5 > TOX 3561-56-2-3-2 > ITA 230. This result showed that half of the 20 varieties selected from the first experiment succumbed to the feeding activity of the bug when confronted with a no-choice situation in the second experiment. This further underscores the importance of artificial bombardments of pest organisms in order to arrive at consistent resistance to pests in crops.

The mechanism by which insect resistance is conferred on crops is by non-preference, antibiosis or tolerance

(Painter, 1951; Kogan & Ortman, 1978). The choice to feed on a particular rice variety more than the other by a specific insect species may be classified as antixenosis or antibiosis modality of resistance, while tolerance has to do with the plant characteristics itself that withstand insect pest attack. Incidentally, all the rice varieties considered as resistant had fewer number of *A. armigera* on them and lower grain damage compared to others making them to exhibit either antixenosis or antibiosis type of resistance. Although previous works on rice resistance to *A. armigera* is scanty, Ewete and Olagbaju (1990) showed that ITA 257 was more susceptible to *A. armigera* than ITA 128 due to significantly higher damage and shorter developmental period recorded on the former.

That only 16.7% of the rice accessions tested was found to be resistant to *A. armigera* underscored the high level of rice susceptibility to *A. armigera* in Nigeria. It also shows that the grain-sucker is a serious economic pest of field-grown rice, which attack must be made a priority in crop improvement programmes. There is therefore, the need for continuous assessment of varieties resistant to the grain-sucker since there are large quantities of rice genotypes collected all over the world in many gene banks in Africa awaiting evaluation (Akinsola, 1984). The identified grain-sucker-resistant accessions should be made adaptable to the various rice cropping systems of the country, and be encouraged for cultivation.

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