



## PRELIMINARY ASSESSMENT OF INSECT PEST OF SUNFLOWER (*HELIANTHUS ANNUUS* L.) IN OWERRI RAIN FOREST ZONE OF SOUTH-EASTERN, NIGERIA

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### ABSTRACT

This research was carried out at the Department of Crop Science and Technology, Postgraduate Teaching and Research Farm, Federal University of Technology, Owerri, South-eastern Nigeria in May 2013. Different cultivars of sunflower were screened for insect pest associated with the plant in Owerri Agro-Ecological zone. The design of the experiment used was a Randomized Complete Block Design laid out in five replications. The result showed that IARS 1 was susceptible to wide range of insect pest leading to poor seed yield (kg/ha) while IARS 2 (1.50 kg/ha) and IARS 3 (3.14 kg/ha) were found to be resistant to pest infestations resulting to high seed yield potential compared to IARS 1 and IARS 4 that recorded very poor and minimum seed yield respectively. The variety IARS 3 has exhibited good seed yield in the face of pest load and weather stress and therefore could be adopted into the integrated pest management of sunflower crop in Imo State, Nigeria.

**KEYWORDS:** sunflower, screening, insect counts, yield.

### INTRODUCTION

Sunflower (*Helianthus annuus* L.) is an ornamental crop that is cultivated widely throughout the world, and it belongs to the family Asteraceae (Groove and Summer, 2005). It was probably a "camp follower" of several of the Western native American tribes who domesticated the crop (possibly 1000BC) and then carried it Eastward and Southward of North America in association with human migration in prehistoric times (Robinson, 1973; Hicks, 1990). The first Europeans observed sunflower cultivated in many places from Southern Canada to Mexico (Noetzel, 1970). The sunflower is an annual plant in the family Asteraceae, Genus - *Helianthus* L. with a large flower head (capitulum). The stem of the flower can grow up to 3 meters tall, with a flower head that can be 30 cm wide. Other types of sunflowers include the California Royal Sunflower, which has a burgundy (red+ purple) flower head (Robinson, 1973; Robinson *et al.*, 1979). The Sunflower (*Helianthus annuus* L.) is one of the most important oil crops globally and is grown on over 22 million hectares worldwide, with a production of 26 million tones, Skoric *et al.*, 2007). The current world area under sunflower cultivation is 22.3 million hectare while seed production and average yield stands at 27.71 million tons and 1.2 ton/ha respectively (FAO, 2004). Commercially available sunflower varieties contain from 39 to 49% oil in the seed. In 1985-86, sunflower seed was the third largest source of vegetable oil worldwide, following soybean and palm (Schlute, 1990). The growth of sunflower as an oilseed crop has rivalled that of soybean, with both increasing production over 6-fold since

the 1930s. Sunflower accounts for about 14% of the world production of seed oils (6.9 million metric tons in 1985-86) and about 7% of the oilcake and meal produced from oilseeds (FAOSTAT, 2001). Europe and the USSR produce over 60% of the world's sunflowers (FAOSTAT, 2001).

Sunflower oil is rich in antioxidants and substances that act as antioxidants. Vitamin E, which has a group of compounds known as tocopherols, is a powerful antioxidant that can eliminate free radicals before they can mutate healthy cells into cancerous cells (John, 2019 (<https://www.organicfacts.net/health-benefits/oils/sunflower-oil.html>)) The antioxidant properties of sunflower oil help in preventing premature signs of aging, as it helps protect the skin from exposure to sunlight. The vitamin E in sunflower seed oil can help protect the collagen and elastin in the skin and reduce the appearance of fine lines and wrinkles in your face (John, 2019 (<https://www.organicfacts.net/health-benefits/oils/sunflower-oil.html>))

The oil accounts for 80% of the value of the sunflower crop, as contrasted with soybean which derives most of its value from the meal. Sunflower oil is generally considered a premium oil because of its light color, high level of unsaturated fatty acids and lack of linolenic acid, bland flavor and high smoke points. The primary fatty acids in the oil are oleic and linoleic (typically 90% unsaturated fatty acids), with the remainder consisting of palmitic and stearic saturated fatty acids. The primary use is as a salad and cooking oil or in margarine. In the USA, sunflower oils account for 8% or less of these markets, but in many sunflower-producing countries, sunflower is the preferred

and the most commonly used oil (Brewer and Schmidt, 1995). Protein percentage of sunflower meal ranges from 28% for non-dehulled seeds to 42% for completely dehulled seeds (McGraw Hill, 1989). The color of the meal ranges from grey to black, depending upon extraction processes and degree of dehulling (Robbelen *et al.*, 1989). By comparison, phytopharmaceuticals are drugs whose active constituents are exclusively plant-based (containing plant parts, extracts, plant juices or distillates) and are used in rational phytotherapy, offering high advantages as they come with safety profiles. From skin care to medical therapeutics, sunflower seed oil subjected increasingly research papers in dermatology as well as patent products for two major reasons, respectively (1) an effective, low-cost, and natural alternative, and (2) contains lipids similar in composition to stratum corneum lipids which has been shown to increase the epidermal ceramide and cholesterol synthesis, and to activate peroxisome proliferative-activated receptor alpha (Eichenfield *et al.*, 2009). Human evidences on antioxidant property of tocopherols- abundant in sunflower seeds and known as the most common form of vitamin E - are also referring to cosmeceutical photo-protection in dermal applications (Mishra *et al.*, 2011), especially in the form of natural unesterified tocopherols as demonstrated by in vitro human skin cell (keratinocytes) test using simulated solar UV radiation (Alander *et al.*, 2006). Archaeologists have uncovered evidence which suggests Native Americans used sunflowers to remove warts and to treat those who suffered from sunstroke (Van der vossen *et al.*, 2001). Sunflower seeds is a great snack, it detoxify the liver. It can also get rid of harmful toxins floating around in the body. In addition it prevents cholesterol from building up and causing body damage (Fitnea report, 2012).

Over 150 phytophagous insect species have been reported from cultivated and wild sunflower, but only a few of these insects have adapted to environment and have become economic pests (Rogers *et al.*, 1983, Rogers, 1992). These insect pests attack the leaves, stems, flower heads as well as the seeds and cause economic loss in sunflower production and which is related in reduced seed yield and quality, as well as oil extracted from the seeds. Sunflower acts as host of several insects which ravage the crop both in the field as well as the storage and inflict severe losses (Irum, 2009). Some of the pests ravaging the crop include: the green sting bug (*Nezera viridula* Linnaeus), cut worm (*Agrotis* spp.), American bollworm *Helicoverpa Heliothis*, cotton aphid (*Aphis gossypii* Glov) and potato aphids (*Lacrosiphum euphorbiae* Tho), others include (*Zygogramma exclamatio*) sunflower beetle, (*Melanagromyza* Spp. stem girdler, *Empoasca* Spp., (*Suleima heliathana*) sunflower bud moth, (*Helicoverpa* spp.) bullworm, (*Homoeosoma electrum*) sunflower moth, Sunflower stem weevil (*Cylindrocopturus adspersus* Leconte, white fly (*Bemisia tabaci*) and grasshopper (Aslam *et al.*, 2000; Ashfaq. and Aslam, 2001, Sattar, *et al.*, 1984). Adults of insect pests of other crops (such as corn rootworm beetle and blister beetle) can be found as pollen feeders on sunflower heads, but usually cause little injury (Vick *et al.*, 2002).

Insect pests have become major potential yield-reducing factors in sunflower production in the northern Midwest (Brewer, 1997). Insects specific to sunflower that feed on

the heads include the larvae of three months, sunflower moth, banded sunflower moth and sunflower bud moth (Charlet *et al.*, 1999). Sunflower midge has caused widespread damage in some years. Sunflower head clipping weevil, sunflower beetle, sunflower maggot, wireworm, grasshopper, cutworm, sugar beet webworm, ragweed plant bug, woolly bear and painted lady caterpillar have caused occasional damage to sunflower (Brewer and Schmidt, 1995). Basic information on the pest status of Sunflower in Nigerian with particular reference to humid environment is scarce and hence calls for an investigation on pest status of sunflower and yield potential in Owerri representing the humid environment in South-eastern, Nigeria.

## MATERIALS AND METHODS

### Experimental site

The study was carried out at the Department of Crop Science and Technology Undergraduate Teaching and Research Farm, Federal University of Technology Owerri on soil classified as uitsol (Eshett, 1993) from May to August, 2013. The mean rainfall during the cropping system is between 114mm -130mm and an average temperature of 29°C - 32°C. The site is geographically located between latitude 05 - 26N and longitude 07 - 02E at an elevation of 91M above sea level.

### Source of planting materials

The sunflower cultivars (IAR Foundation Seed Samsung 1-4) as stated below, used for this study was obtained from Seed unit of Industrial Agricultural Research, Samaru. Ahmad Bello University Zaria, these are: Samsung 1- designated as IARS 1, Samsung 2- designated as IARS 2, Samsung 3- designated as IARS 3, Samsung 4- designated as IARS 4.

### Land preparation

An area of land measuring 14×19m (266.0 m<sup>2</sup>) was cleared using cutlass, shovel and picker. Mapping was marked using measuring tape, ranging poles and pegs. Minimum tillage was done and the land area divided into five (5) replications with each replication having four (4) plots which measured 2.7 ×2.7 m (7.29 m<sup>2</sup>) per plot. There were 1.0 m between plots and 1.0 m between replications

### Experimental design, treatment allocation and planting

The treatment comprised of four cultivars which were assigned at random to each plot and replicated 5 times giving a total of 20 treatment combinations. The experiment was laid in the field using Randomized Complete Block Design (RCBD) with five replications. Sunflower seeds were sown at a depth of 2-3cm and a distance of 45cm apart on row and 45cm within rows, and later thinned down two weeks after planting to one plant per stand. There were six (6) rows per plot and each row contained six (6) sunflower plants which gave a total of 36 plants per plot and a plant population of 49,383 plants per hectare.

### Insect pest sampling

Insect pests were collected at different stages of growth using sweep net. The samples were collected from early morning between 6.30-8.00 am at weekly intervals and preserved in a vial containing 95% ethyl ethanol. The Specimens were later taken to the Department of Crop Science and Technology Laboratory, Federal University of Technology Owerri, for identification using the preserved

insect samples. Insect pests collected were separated into their categories.

#### Cultural practices

Weeding was done manually with hoe at 3 weeks after planting and subsequently carried out every 2 weeks. A uniform quantity of poultry manure from battery cage system (2.5 kg) measured with weighing balance was applied to each plot and mixed thoroughly with soil before planting to help increase the fertility of the area

#### Data collection

The following data were collected during the investigation: Physio-chemical properties of the soil, Germination percentage, Insect count at vegetative, and flowering/maturity stage, Days to flowering, Days to seed maturity, Plant height at harvest, and Yield (kg/ha).

#### Data analysis

Data for insect count were subjected to square root transformation before analysis of variance was carried out. All data collected subjected to analysis of variance (ANOVA). Differences between means were separated using Fishes least significant difference (F-LSD) at 5% probability level according to the procedure by Steel and Torrie (1980).

### RESULTS AND DISCUSSION

Table 1 show that the amount of rainfall during the month of may (114mm) increase progressively to 155 mm during the month of July. Thereafter, the rainfall decreased to 130 mm during the sunflower harvest period in August. Temperature was recorded at (29.5-32.5°C) during the growth period of the crop. Generally there was high temperature (29.5-32.5°C) during the growth period of the crop. Sunflower is unsuitable for humid climates, temperature for optimum growth are 23-27°C (Faghayide, 1995). The unfavourable temperature (32°C) coupled with rainfall impacted negatively on the performance of the crop which invariably influenced the level of pest found on the different cultivars. .

The result of the population of major insect pests at vegetative and flowering/maturity phases of the sunflower cultivars were presented in table 2. The result revealed that at vegetative phase (plates 1 a, b), significant ( $p < 0.05$ ) population of the variegated grasshoppers (plates 2a, b) while the migratory grasshoppers (plates 3 a,b) were non-significant in their population. There were significant variations of some insect pest both at vegetative and flowering phase of sunflower cultivars. The slight rainfall during the vegetative stage of growth invariably influenced the level of pest found on the crop. Likewise a significant difference ( $p < 0.05$ ) was recorded in the infestation level of insect pest during the flowering phase of sunflower cultivars. The cultivar IARS 1 experienced high level of Blister beetle (*Mylabris pustulata*) (plate 12) infestation followed by IARS 4, while other cultivars such as IARS 3, IARS 2, IARS 1 also recorded high level of *Dolicirisi indicus* (plate 4 a,b), Cotton stainer- *Dysdercus cingulatus* Fab (plate 6) and *Xylocopa olivacea* (pollinator bee) infestation. However, variety IARS 3 recorded the least population of pests while the highest population was

recorded on IARS 1. The result was in line with Dialoke (2013) who recorded high level of *Zonocerus variegatus* (nymphs) on pigeonpea vegetation during the month of April planting period at Owerri, Imo State. At flowering, there were significant ( $p < 0.05$ ) population of blister beetles, stink bug and cotton stainer with low population recorded on IARS 3 compared with other cultivars. Also the results of the population of flower blister beetles and flower bugs were in concomitant with the works of Dialoke *et al.* (2014a) on blister beetles and Dialoke *et al.* (2014b) on insect pests associated with early maturing pigeonpea in Owerri. The population of bees were not significant ( $p > 0.05$ ). Other pests observed on the sunflower from the field were presented in plates 7-16.

Table 3, showed the result of percentage germination, days to flowering and 100% seed maturity, plant height (cm), and seed yield (kg/ha). The varieties (IARS 2 –50.20%) and IARS 3--- 52.20%) had low percentage germination compared with IARS 1-60.10%) and IARS 4---56.90%). Sunflower cultivars showed significant difference ( $P < 0.05$ ) in the germination percentage. However, there was a low germination recorded and this was probably due to low rainfall, relative humidity and high temperature within the period, (114-130mm). There were non-significant ( $p > 0.05$ ) effect of the days to flowering The cultivar IARS3 flowered earlier (35.8 days) while IARS 1, IARS 2 and IARS 4 followed suit respectively after 37.4 days . Flowering of sunflower takes 30 - 35 days from day of planting to first floral initiation (Fick *et al.*, 1989). This longer date recorded could be as attributed to the meteorological condition of the area since temperature stress during reproductive development negatively impact on pollen viability and fertilization of floral bud development (Prasad *et al.*, 2002) .

Similarly in the number of days to seed maturity .The cultivar IARS 4 exhibited early seed maturity (63.8 days ) followed by IARS 1 (64.4 days), IARS 3 (65.8 days) and lastly IARS 2 (66 days). Sunflower seeds from planting take 55 - 60 days to maturation after flowering (Fick *et al.*, 1989). There were significant effect ( $p < 0.05$ ) of the days to 100% maturity, plant height and seed yield (kg/ha). There was a generally reduced yield as compared to 350 – 815 kg/ha recorded by Faghayide (1995) in Ibadan. This poor yield could be as result of temperature stress (32°C), and high rainfall which occurred during the peak period of flowering in June and July. Fick *et al.* (1989) earlier reported that extreme temperature and rainfall could cause flower abortion which may result in lowering of yield potential due to a shorter amount of flower available for seed filling. Also high rainfall caused rotting of sunflower heads which must have affected the seed filling. High infestation of nymphs of variegated grass hopper (*Zonoceros vaiegatus* L.) during seedling emergence might have also invariably led to the loss of some stands of the sunflower cultivars. The voracious feeding of the leaves of some of the survived stands by grasshoppers might have further reduced the photosynthetic abilities of the cultivars, thus affecting the yield potentials of the crop.



Plates 1 (a) (b)

FIGURE: Sunflower plants in the farm

Some major Orthopteran pests on sunflower



PLATE 2 (a) *Zonocerus variegatus* (nymphs) (b) Adult *Z. variegatus* feeding on leaves



(a) (b)

PLATE 3. Migratory grasshopper (*Melanoplus sanguinipes* Fabricius)

Complex of some podsucking bugs on Sunflower cultivars



PLATE 4 (a). Adult Stink bug (*Dolicoris indicus*) (b) *Dolicoris Indicus* mating



**PLATE 5.** Pod sucking bugs (*Riptortus dentipes*)



**PLATE 6.** Cotton stainer (*Dysdercus cingulatus Fab*)

**Major lepidopteran species on sunflower**



**PLATE 7.** Capitulum borer (Head borer): *Helicoverp armigera*

**Some major Coleopteran pests on Sunflower**



**PLATE 8.** Flower beetle (*Aulacophora vinula*)

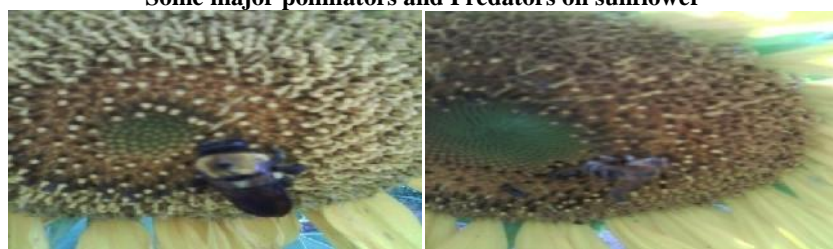


**PLATE 9.** *Apion occidentale*



**PLATE 10.** Blister beetle (*Mylabris pustulata Thunberg*)

**Some major pollinators and Predators on sunflower**



**PLATE 11.** *Xylocopa olivacea* on older

**PLATE 12.** *Belonogaster junceus* flower head

**Sunflower Plant vectors**



**PLATE 13.** *Xylocopa Olivacea* on fresh *Sphodromantis sp* Flower head

**PLATE 14.** Praying mantis (Nymph)



**PLATE 15.** Spider

**PLATE 16.** Leaf hopper (jassids): *Amrasca biguttula biguttula*

**TABLE I.** Meterological data from Owerri, Agricultural Development

**Programme for the period of 2013**

Months	Amount of Rainfall		Temperature oC		Relative humidity (%)	Dew Point (%)	Vapour Pressure (mb)
	Rainfall	Rain days	Max.	Min.			
January	0	0	32.5	29.0	78.5	23.7	25.6
February	120	3	32.2	29.5	78.3	24.6	24.0
March	68	6	32.4	29.0	80.0	24.5	25.5
April	102	8	31.5	29.7	80.5	25.0	25.0
May	114	12	32.0	29.0	79.6	24.5	26.4
June	145	14	32.5	29.3	79.8	24.7	25.3
July	155	16	31.8	29.5	78.5	24.5	24.7
August	130	10	31.0	29.0	78.3	24.2	24.5
Sept.	136	12	31.5	29.5	78.8	24.5	24.3
Oct	132	10	31.6	29.4	78.5	24.2	24.8

**TABLE 2.** Mean number of major Insect pests on sunflower in Owerri

Varieties of Sunflower	Vegetative pests		Flowering/Fruiting pests			
	Mean no. of variegated grasshoppers	Mean no. of migratory grasshoppers	Mean. No. of Blister beetles	Mean no. of stink bug	Mean no. of cotton stainer	Mean no. of <i>Xylocopa olivacea</i>
IARS 1	0.75	0.45	0.75	3.80	4.20	2.05
IARS 2	0.30	0.55	0.30	0.50	5.50	1.19
IARS 3	1.20	0.70	0.82	4.80	6.70	1.79
IARS 4	0.40	0.65	0.35	3.80	5.00	1.98
LSD (0.05)	0.4	N.S	0.3	1.0	2.2	N.S

**TABLE 3.** Mean values of number of percentage germination (%), No. of days to flowering and 100 % seed maturity, mean plant height (cm), and seed yield (kg/ha)

Varieties of Sunflower	Percentage germination	Days to flowering	Days to 100% seed maturity	plant height at maturity	seed yield (kg/ha)
IARS 1	60.1	37.4	64.4	0.98	274.35
IARS 2	50.2	37.4	66	1	644.72
IARS 3	52.2	35.8	65.8	1.9	795.61
IARS 4	56.9	37.4	63.8	0.94	493.83
LSD (0.05)	2.4	N.S.	3.6	0.4	28.7

### CONCLUSION AND RECOMMENDATION

The cultivars, IARS 2 and IARS 3 that had low percentage germination but matured earlier than other cultivars. There was generally very low yield and high pests' loads in Owerri representing the rain forest Zone of South-eastern, Nigeria. From this preliminary research work, IARS 3 showed the highest level of resistance to pest infestation in Imo State environment based on its ability to yield higher than other cultivars despite the heavy pest load and environmental stress on the variety and therefore should be recommended for farmers planting in the environment of Imo State, Nigeria. However, there is research need to investigate on the appropriate Integrated Pest Management (IPM) strategy that can encourage the seed yield by minimizing pest loads on the plant e.g. use of plant spacing, planting dates, biopesticides, parasites and parasitoids etc.

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