Academic Journal of Entomology 13 (3): 61-66, 2020
ISSN 1995-8994

DOI: 10.5829/idosi.aje.2020.61.66

Population Density of Main Pests Infesting Okra Plants and Their Associated Predators at Dakahlia Governorate

Hala E. El-Mewafy

Vegetable Pests and Medicinal and Aromatic Plants Research Department,
Plant Protection Research Institute, ARC, Dokki- Giza, Egypt

Abstract: Okra plant is one of the most important vegetable crops that contain much vitamins and protein benefits the human body. In the current study, field experiments were conducted at Dakahlia Governorate during two successive seasons 2017/2018 and 2018/2019 to study the population density of main pests infesting okra plantations and their associated predators affecting on these pests and management of the most serious pest on this plant. The results obtained showed that, main pests during the two seasons were *Aphis gossypii* (Glover) and *Phenacoccus solenopsis* (Tinsley). However the associated predators were *Exochomus nigromaculatus* Goeze and *Chrysoperla carnea* (Steph.). Also, the results proved the effectiveness of ginger oil on management of *P. solenopsis*.

Key words: Okra pests and predators · Ginger oil · *P. solenopsis*

INTRODUCTION

Okra (*Abelmoschus esculentus* L.) is one of the most common vegetable in Egypt [1]. It considered as African tropical vegetable, many countries are cultivating okra crop in the world [2]. Okra seeds are good source of protein, vegetable oil and rich in vitamin A and B, phosphorus and iodine, which play viral role in human diet [3]. Okra is a powerhouse of valuable nutrients, soluble and insoluble fiber, which helps to lower serum cholesterol, risk of heart disease, keeps the intestinal tract healthy and decrease colorectal cancer [4]. Okra crop is suffering from number of biotic and a biotic factors, including insect pests and diseases [5]. It is attacked by a number of phytophagous insects, diseases and mites during different growth stages [6]. It is affected by number of insect pest from sowing to harvesting such as aphid, jassid, whitefly, thrips, spotted bollworms and mites. whitefly, *Bemisia tabaci* (Genn.) is the most important insect pest of okra crop. These pests are damaging crop by sucking the sap directly and by transmitting a large number of viral diseases indirectly [7]. Jassid found a very damaging sucking insect pest of many crops in the majority areas of the growing countries of the world and has been found damaging many crops in the world. It has been observed that, both adults and nymphs cause damage while sucking sap of plants. Due to sucking the color becomes grayish or by injecting toxic saliva into the plant tissues of okra crops and fall down (Crinkling) which is the characteristic feature of jassid attack [8]. The species of Aphididae, Coccidae and Pseudococcidae families such as *A. gossypii*, *C. ceriferus* and *P. solenopsis* cause damage to crops by various ways attacking on leaves, steams, fruits and roots [9]. Predators are effective as controlling agent and suggested for controlling jassids [10]. The effective method at present for the control of these pests is, however, by the use of synthetic insecticides that are widely used since a long time, but recent investigations have proved that the use of synthetic pesticides cause hazardous to human health and have long residual effects. Beside these, the chemicals create harmful effects over the population of predatory spiders, ants and lady bird beetles [11]. The natural bio-pesticides in commercial agriculture and horticulture is being practiced since long to circumvent the problems associated with indiscriminate use of pesticides and are earning reputation among the researchers and growers [12]. Hence, botanical insecticides and their essential oils, are among the most efficient botanicals [13]. This study concerned mainly with studying population density of main pests and associated predators of okra plants.

Corresponding Author: Hala E. El-Mewafy, Vegetable Pests and Medicinal and Aromatic Plants Research Department, Plant Protection Research Institute, ARC, Dokki- Giza, Egypt

MATERIALS AND METHODS

Field Experiments: The experiment were carried out in a farm at Aga, Dakahlia Governorate during two successive seasons 2017/2018 and 2018/ 2019. An area (about half feddan), divided to nine replicates, was planted with okra (Balady variety), on 1st July at the two seasons, respectively. Every one week randomly samples of 10 leaves from 10 plants from each replicate were collected and put in paper bags and taken to the laboratory, where carefully examined by the aid of a stereoscopic-microscope for counting the pests and the predators. The whole area was free from any pesticides treatment.

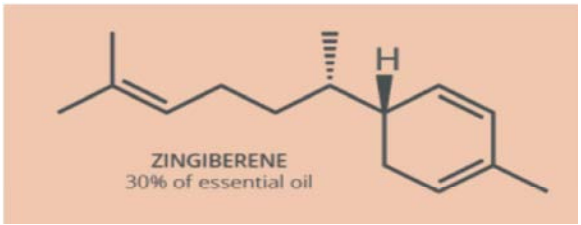
The classification of the pests and predators were made by the aid of Department of Taxonomy in Plant Protection Research Institute.

Data were analyzed by using one way ANOVA followed by least significant difference (LSD) at probability level of 0.05. All analysis was performed using [14]

Laboratory Experiment: *Phenacoccus solenopsis* was managed, in laboratory, by ginger oil.

Laboratory Insect Rearing: Cotton mealy bug, *Phenacoccus solenopsis* (Tinsley) (Hemiptera: Pseudococcidae) was collected from the okra plant that was transferred to the laboratory.Sprouting potato tubers were used as a host plant for laboratory rearing and gravid females of *P. solenopsis* were inserted in sprouting potatoes and observed daily [15]. The newly hatched crawlers were placed on sprouted potato before being confined in a carton cylindrical box of 8 cm long and 12 cm diameter that were kept at 30°C and 60±5 % R.H. [15].

The Tested Plant Oils: Ginger oil was bought from Essential oil Extracts Center, National Research Center. It was extracted from fresh ginger roots, primarily consisting of zingiberene [16].



(An *et al.*, 2016)

Preparing the Stock Solution the Tested Plant Extracts: The stock concentrations of ginger oil were prepared on basis of the tested plant weight and the volume of the distilled water (w/v) in the presence of tween 80(0.1%) as emulsifier and were kept in glass stoppered bottles and stored under refrigeration. Four diluted concentrations for were used to draw the LC-P line. Three replicates were used for each concentration.

Toxicity Test: Toxicity of ginger oil was evaluated against adult of *P. solenopsis*. Thirty newly emerged adults, 10 individuals in each replicate, were placed on okra leaves in each Petri dish. Four concentrations (1000, 5000, 7500 and 10000 ppm) were sprayed on the individuals. Mortality was recorded for 7 days after treatment. Mortality percentage was estimated and corrected according to Abbott [17]. $12LC_{50}$ value was determined using probit analysis statistical method of Finney [18].

RESULTS AND DISCUSSION

Field Experiments

Main Pests Attacking Okra Plants During 2017/ 2018 and 2018/ 2019 Seasons: Data presented in Table (1) showed that, *P. selonpsis* populations had the highest population that was 1727 individuals;

A. gossypii populations recorded 1323 individuals the population of *E. discipiens* was 776. However, the population of *B. tabaci*, *T. urticae*, *S. littoralis* and *M. persicae* were lower which recorded 172, 113, 56 and 51, respectively. From Table (1) and Fig. (1) it can be noticed that, the peaks of populations of *P. selonpsis*, *A. gossypii* and *E. discipiens* were concentrated during 26/ 7/ 2017 to 6/9/2018. *Aphis gossypii* had two peaks, these peaks were recorded at in the 3rd week of july meanwhile, the second peak in the end of August. While, *E. discipiens* had two peaks the first in the beginning of August meanwhile, the second peak was at the 1st of September. The highest average number (500 individual) to *P. selonpsis* was opteined in the last weak of August. Data obtained in Table (2) and illustrated in Fig. (2) showed that the second season during 2018, the highest populations also were *P. selonpsis*, *A. gossypii* and *E. discipiens*, Aphis gossypii had two peaks at the second year of study in the beginning of August while, the second peak was in 2nd of August. Also *E. discipiens* had two peaks the first at the 1st of August meanwhile, the second at 3rd week of September. While, *P. selonpsis* had two peaks also the first peak at the beginning of August. while, the second at the last week of August. The total populations recorded lower than in the 1st season and the population of *A. gossypii* was the highest with total 2059 then *P. selonpsis* population was 1586 and *E. discipiens* was 574 individuals, Zakir *et al.* [19] proved

Table 1: Population density of the main pests infesting okra during 2017/ 2018 season

Sampling date	*A. gossypii*	*M. persicae*	*E. discipiens*	*B. tabaci*	*S. littoralis*	*T. urticae*	*P. solenopsis*
19/7/2017	0	0	0	0	0	0	0
26/7/2017	243	26	28	58	17	21	145
2/8/2017	147	25	48	64	10	22	155
9/8/ 2017	129	0	35	25	13	32	160
16/8/ 2017	135	0	84	14	9	22	400
23/8/ 2017	214	0	166	7	5	16	500
30/8/ 2017	287	0	200	4	2	0	245
6/9/ 2017	141	0	211	0	0	0	75
13/9/ 2017	11	0	3	0	0	0	33
20/9/ 2017	16	0	1	0	0	0	14
27/9/ 2017	0	0	0	0	0	0	0
Total	1323	51	776	172	56	113	1727
Average	120.3± 30.9	4.6± 3.1	70.5± 24.9	15.6± 7.1	5.1± 1.9	10.3± 3.7	157± 50.1

Table 2: Population density of the main pests infesting okra during 2018/ 2019 season

Sampling date	*A. gossypii*	*M. persicae*	*E. discipiens*	*B. tabaci*	*S. littoralis*	*T. urticae*	*P. solenopsis*
11/7/2018	0	0	0	0	0	0	0
18/7/2018	89	11	48	11	0	0	19
25/7/ 2018	193	12	30	14	16	8	175
1/8/ 2018	303	5	37	18	19	9	181
8/8/ 2018	225	0	61	27	12	25	176
15/8/ 2018	327	0	35	18	10	26	222
22/8/ 2018	312	0	48	15	9	14	339
29/8/ 2018	262	0	50	25	14	11	300
5/9/ 2018	222	0	33	15	16	12	138
12/9/ 2018	85	0	45	17	13	8	20
19/ 9/ 2018	41	0	187	16	12	36	16
Total	2059	28	574	176	121	149	1586
Average	187.2± 34.8	2.5± 1.4	52.2± 14.3	16± 2.1	11± 1.8	13.5± 3.4	144.2± 35.7

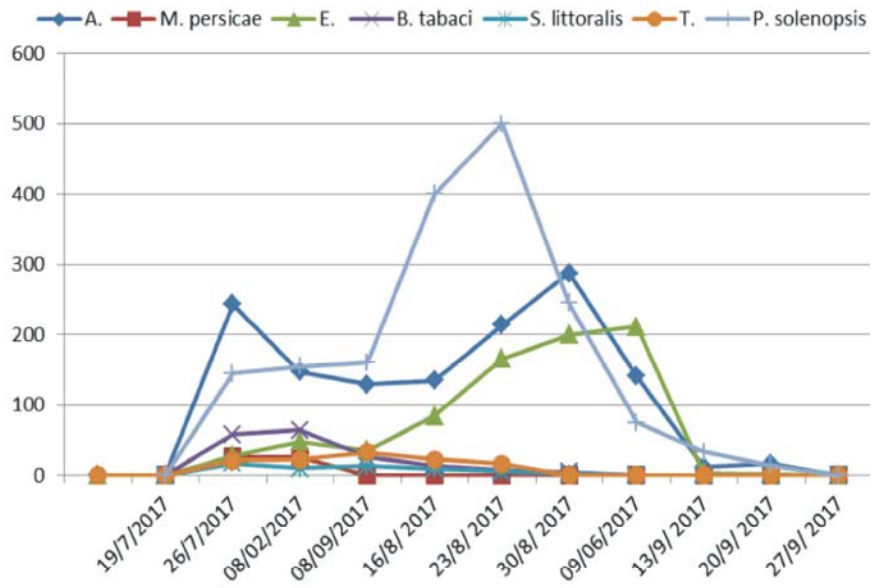


Fig. 1: Population density of pests of okra plant during 2017/2018

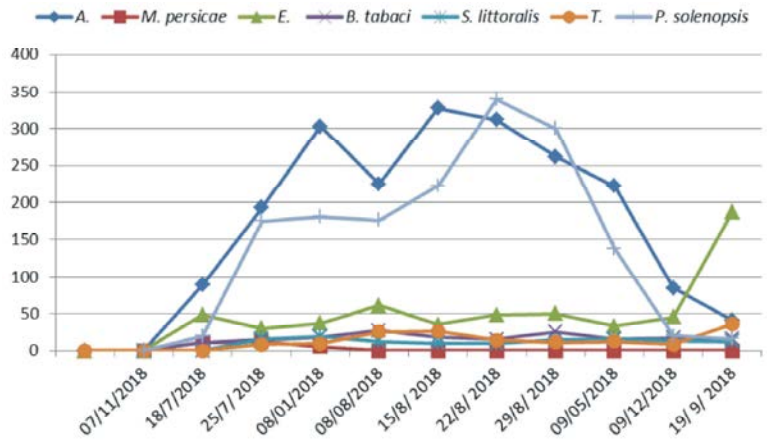


Fig. 2: Population density of pests of okra plant during 2018/2019

Table 3: Population density of the predators infesting okra plant during 2017/ 2018 and 2018/2019 season

	2017/ 2018			2018/ 2019	
Sampling date	*E. nigromaculatus*	*C. carnea*	Sampling date	*E. nigromaculatus*	*C. carnea*
19/7/2017	0	0	11/7/2018	0	0
26/7/2017	0	0	18/7/2018	0	0
2/8/2017	0	1	25/7/2018	0	0
9/8/2017	0	2	1/8/2018	0	2
16/8/2017	0	3	8/8/2018	1	1
23/8/2017	5	9	15/8/2018	3	3
30/8/2017	6	6	22/8/2018	5	6
6/9/2017	6	11	29/8/2018	6	7
13/9/2017	2	2	5/9/2018	4	6
20/9/2017	4	1	12/9/2018	2	4
27/9/2017	6	3	19/9/2018	3	4
Total	29	38	Total	24	33
Average	2.6± 0.8	3.5± 1.1	Average	2.2± 0.6	3± 0.7

Table 4: Efficiency of ginger oil against *P. selonpsis*

Treatment	Conc. (ppm)	Total Corrected mortality%	LC_{50}	LC_{90}	Slope± S.D.	LC_{90}/ LC_{50}	R	P
Ginger oil	1000	26.67	2975.41	22938.04	1.44± 0.18	7.71	0.973	0.146
	5000	56.57						
	7500	70						
	10000	83.33						

R: Regression P: Propability

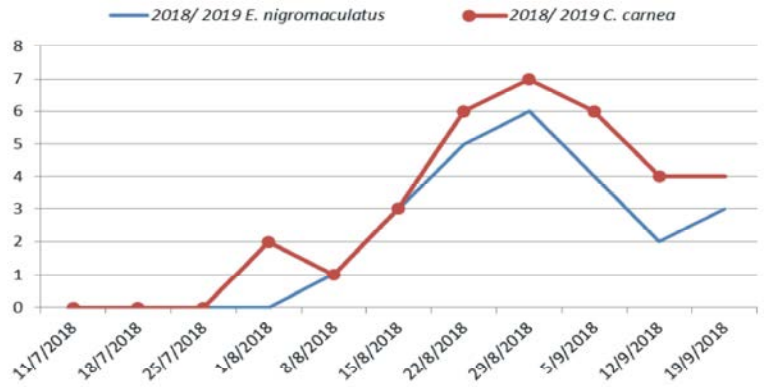


Fig. 3: Population density of associated predators inhabiting okra plant, during 2017/2018

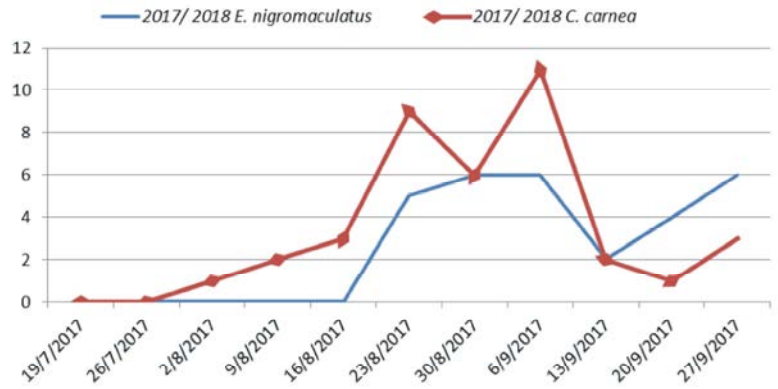


Fig. 4: Population density of associated predators inhabiting okra plant, during 2018/2019

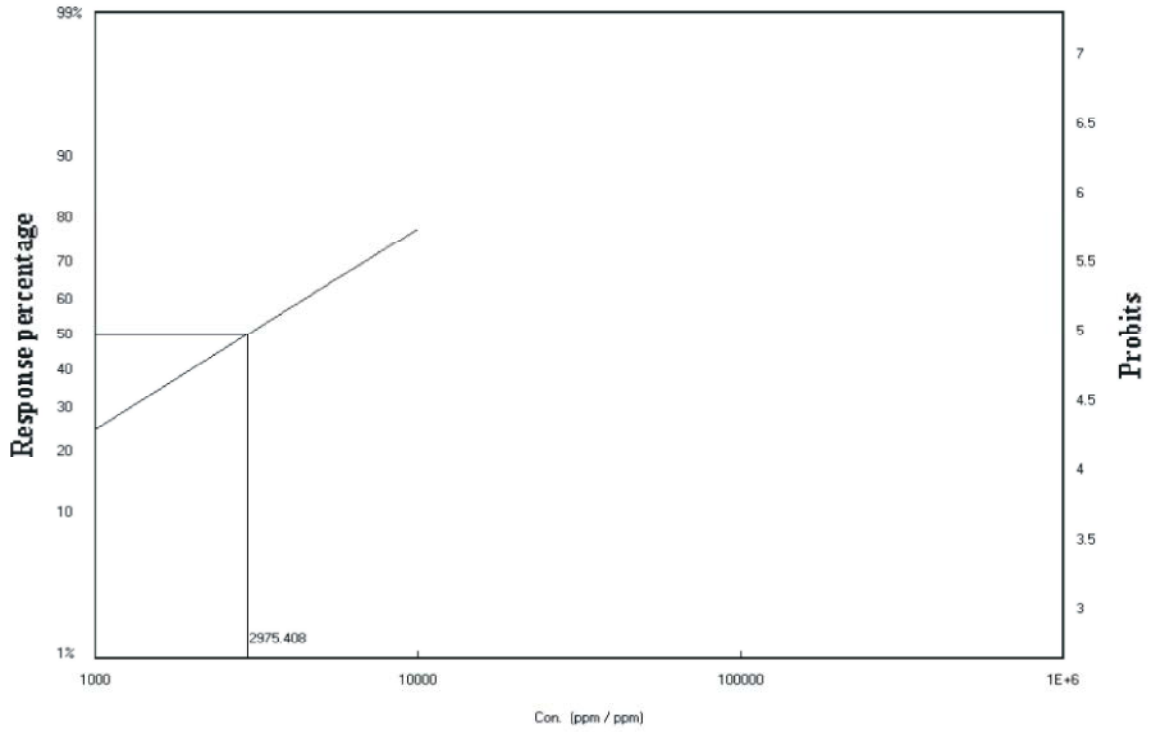


Fig. 5: LC-P line for ginger oil of *P. selonpsis*

similar results who recorded high populations of jassid, white fly, aphid and cotton mealy bug on okra plants. Nath *et al*. [20] found that the best in reduction of both white fly and jassid population to 2.08 and 3.98 per cent after three weeks of appearance of the initial pest population as compared to the control. The treatment also recorded the highest yield of okra (92 q/ha).

The data presented in Table (3) and illustrated in Figs. (3 and 4) revealed that, the presence of some predators that were *E. nigromaculatus* and *C. carnea* during the two seasons, 2017/2018 and 2018/2019. Despite of the population of the two predators were low, but the population of *C. carnea* was higher than the population of *E. nigromaculatus.* Zakir *et al.* [19] proved similar results in their study on okra plant.

Laboratory Experiment: Data arranged in Table (4) and illustrated in Fig. (5) assured that the effectiveness of ginger oil on adults of *P. selonpsis*, LC50 was 2975.41 ppm Meanwhile, LC90 was 22938.04 ppm. The probability was 0.146. On the other side, the result showed a varied of the mortality percentages for the different concentrations. It was noticed that the high concentrations of ginger oil were most effective on the target insect compared

with the low concentrations. Prishanthini and Vinobaba [21] proved the effectiveness of botanical extracts on *P. selonpsis*. Isirima *et al.* [22] proved also the great effect of ginger oil on cowpea pests.

REFERENCES

1. Aved, H., A. Aziz and R. Leghari, 2009. Resistance in different okra (*Abelmoschus esculentus* L.) cultivars against American bollworm (*Helicover paarmigera* Hub.). J Agric. Res., 47: 433-438.
2. Sinnadurai, S., 1992. Vegetable cultivation Asempa Publishers Accra, pp: 208.
3. Khushk, A.M., U. Shar and M.A. Memon, 2003. The cultivation of okra in Sindh and its economic view, PARC. Technology Transfer Institute, Tandojam. Publication in Sindh Zarat, 136: 17-18.
4. Broek, R.V., G.D. Iacovino, A.L. Paradela and M.A. Galli, 2007. Alternative control of *Erysipheci choearun* on okra crop. Ecossistema., 27: 23-26.
5. Jiskani, M.M., 2006. Okra diseases and IPDM English allabout horticulture okra diseases and ipdm. Shtm., 44: 313-317.
6. Gulati, R., 2004. Incidence of *Tetranychus cinnabarinus* infestation in different varieties of *Abelmoschus esculentus*. Ann. Pl. Protect. Sci., 10: 239-242.
7. Basu, A.N., 1995. *Bemisia tabaci* (Genn.) crop pest and principal whitefly vector of plant viruses. West View Press, Boulteters San Fransisco, Oxford, 1995, pp: 183.
8. Lohar, M.K., 2001. Applied Entomology, Second Edition. Biological Control Published by Dr. Kashir Raza under Kashif Publication, Hyderabad, pp: 147-167.
9. Vinobaba, M.L. and M. Prishanthini, 2009. A new invasive species of mealy bug from the east Department of Zoology, Eastern University, Vantharumoolai, Chenkalady, Sri Lanka, esn. Zoolg mealy %20 bug%20 web %20 article.
10. Kuhro, R., A. Ghafoor, A. Mahmood, M.S. Khan, S. Andleeb and M. Bukhari, 2012. Assessment potential of predatory spiders in controlling the cotton jassid (*Amrascadevastans*) under laboratory and field conditions. J. Animal & Plant Sci., 22(3): 635-638.
11. Solangi, B.K. and M.K. Lohar, 2007. Effect of some insecticides on the population of insect pests and predators on okra. Asian J. Plant Sci., 6(6): 620-926.
12. Kumar, S. and S.B. Kalidhar, 2003. A review of the chemistry and biological activity of Pongamiapinnata. J. Medicinal and Aromatic Plant Sci., 25: 441-465.
13. Regnault, R., 1997. The potential of botanical essential oils for insect pest control. Integrated Pest Management Reviews, 2: 25-34.
14. Co Hort, Software, 2004. CoStat.www.cohort.com Biological control with C*hrysoperla lucasina* Montery, California, USA.
15. Attia, A.R. and A.M. Ebrahim, 2015. Biological studies on the predator Dicrodipl osismanihoti Harris (Diptera, Cecidomyiidae) on the mealy bug *Phenacoccuss olenopsis* Tinsley (Hemiptera, Pseudococcidae). Egyp. J. Biol. Pest Control, 25(3): 565-568.
16. An, K., D. Zhao and Z. Wang, 2016. "Comparison of different drying methods on Chinese ginger (*Zingiber officinale* Roscoe): Changes in volatiles, chemical profile, antioxidant properties and microstructure". Food Chem., 197(Part B): 300-1292.
17. Abbott, W.S., 1925. A method of computing the effectiveness of an insecticide. J. Econ. Entomol., 18: 265-267.
18. Finney, D.J., 1971. Probitanalysis. Cambridgeuniv., London, pp: 333.
19. Zakir, A.B., H.M. Fida, A.S. Abid, A.C. Maqsood, A.C. Naveed, H.L. Shahid, M. Sanaullah and A.J. Ashfaque, 2017. Integrated pest management of Okra insect pests. Inter. J. Fauna. Biolog. Stud., 4(3): 39-42.
20. Nath, R.K., K.H. Begum and P. Ahmed, 2020. Integrated Pest Management of Okra (*Abelmoschus esculentus* L.) Int. J. Curr. Microbiol. App. Sci., 9(1): 1725-1729.
21. Prishanthini, M. and M. Vinobaba, 2014. Efficacy of some selected botanical extracts against the Cotton mealybug *Phenacoccuss olenopsis* (Tinsley) (Hemiptera: Pseudococcidae). Intern. J. Sci. and Res., 1: 50-53.
22. Isirima, C., U. Ndubuisi and B. Maxwell, 2010. World rural observations comparative studies on effects of garlic (*Allium sativum*) and ginger (*Zingiber officinale*) Extracts on Cowpea Insects Pest Attack, 2(2).