Global Science Research Journals

ISSN: 2437-1866 Vol. 4 (1), pp. 176-181, July, 2016

http://www.globalscienceresearchjournals.org/

Global Journal of Crop, Soil Science and Plant Breeding

Full Length Research Paper

Influence of organic wastes on bacterial soft rot disease of cucumber (*Cucumis sativus*) in humid tropical Nigeria

***[1]Opara, E U. and [2]Ezenwa L.I.**

[1]Department of Plant Health Management, Michael Okpara University of Agriculture Umudike, Nigeria.
[2]Department of Environmental Management and Toxicology, Michael Okpara University of Agriculture.

Accepted 14 July, 2016

A field trial was conducted at Teaching and Research Farm of Michael Okpara University, Umudike Abia State, to determine the efficacy of local fruit- organic wastes in the control of soft rot disease of *Cucumis sativus* (cucumber) and to evaluate its yield response to organic wastes. From the results, it was observed that the treatments had significant effect (P<0.01) on all the growth parameters tested such as vine length, e.g. poultry droppings gave significant higher value (5.17cm) than the control (3.75cm). Regarding Stem Diameter, three of the organic wastes, poultry droppings (1.00cm), plantain peels (0.87cm) and palm bunch (0.95cm) all performed better when compared with the control at 1% significant level. Also in terms of number of flowers, had higher mean values than the untreated control there were significant differences (P<0.01). The effect of the wastes on yield was also considered, poultry droppings had best performance (4.67) and (886.67g) on number of flowers and fruit weight respectively followed by cassava peels with3.67 and 566.67g on respectively for flowers and fruit weight (P ≤ 0.01) these proved more superior than the control. Similarly, on seed weight all treatments did fare better than the untreated with poultry droppings taking the lead. In the same vane the severity of soft rot disease was significantly reduced by all the organic wastes with poultry droppings having higher control ability on disease severity (2.0) while the control showed the poorest. From the result therefore, it was found that all the treatments used were effective in controlling *Erwinia carotovora* of *Cucumis sativus* in the field and led to less disease incidence, severity and increased fruit weight when compared with the control.

Key words: Organic wastes, *Erwinia carotovora*, soft rot, disease severity, disease incidence.

INTRODUCTION

(*Cucumis sativus* L.) is a coarse, prostrate annual creeping vine that grows up trellises or other supporting frames, wrapping around with thin spiraling tendrils. The plant has large prickly, hairy triangular leaves that form a canopy over the fruit and yellow flowers which are mostly either male or female. The flowers are recognized by the swollen ovary at the base, which will become the edible fruit (Toit, 2012). Botanically, the fruit is a false berry,

*Corresponding Author: E-**mail**: euopara22@gmail.com

elongated and round in shape. Its size, shape and colour vary according to the cultivar in the immature fruit, chlorophyll in the cell under the epidermis causes the rind to be green but upon maturity, it turns yellow-white. The epidermal layer may have proliferated (warty) areas, each bearing a trichome (spiky hair). The fruit cavity contains soft tissue (placenta) in which the seeds are embedded (Buchanan, and David, 2012). Their thick, deep green skin has light green stripes and a rough surface with strong erichomes. The cucumber fruit, like that of other *cucurbitaceae,* is noted for its high water content which is around 95% of its fresh weight (Renner *et al*., 2007).

There are several constrains which limit the worldwide production of cucumbers. These include pre harvest and post-harvest losses from insects and other types of pests such as rodents, important insect's pests of cucumber include aphids, melon flies, leaf miners, caterpillars, slugs and diseases (CABI, 2008). Economic factors include storage cost, lack of processed products, transportation problems, high marketing cost and unstable demands and supplies. Environmental and edaphic factors such as soil fertility, temperature, flooding, soil structure and texture, as well as lack of improved cultivars and planting materials also pose constraints to cucumber production (Lerner and Dada, 2001).

Important diseases of cucumbers including

The objectives of this study are as follows:

- To evaluate the bactericidal effect of organic wastes on bacterial soft rot disease of *Cucumis sativus*.
- To investigate the effect of organic wastes on plant growth and fruit yield of *C. sativus*.

Diseases of Cucumber

Cucumber (*Cucumis sativus*) is susceptible to a number of diseases which are also common among other cucurbits. Considerable losses may occur during the rainy season as a result of various foliar diseases. Resistant or tolerant cultivars should be used wherever these diseases are likely to be a problem. (De lonny, 2001).

Bacterial Diseases

The entire range of crops referred to as cucurbits are affected by various foliar disease damage appears on leaves and stems but in several instance the fruit are directly infected or will develop poorly if foliar infection are severe (Zitter and Knipscheer, 2002).

Angular leafspot: This is a bacterial disease caused by the *Pseudomonas syringae* pv. *Lachrymans*. This disease is less common on cucumber because most of the cultivars are highly resistible (Anonymous, 2002).

Bacterial wilt: This is caused by the *Erwinia tracheiphila* a common and destructive disease of cucumbers. Losses from bacteria wilt vary from the premature death of occasional plants to as high as 75% of the crop. Expression of the disease symptoms varies with different cucumber cultivars. Bacterial wilt first appears on leaves of cucumbers as dull green patches that rapidly increase in size. Within a day or two the wilting symptoms spread to leaves up and down the runner (USDA, 2012). If a severely affected stem is cut across at the base and squeezed, creamy white bacterial ooze may exude from the cut adhere to a finger or knife blade and may be slowly pulled out into a delicate, shiny thread about ¼ inch long. This test is helpful in diagnosis of the disease (Thurston, 1998).

Bacterial Soft Rot: A soft rot of fruit can be caused by a composite bacterial pathogens including *Ewinia carotovora* pv. *carotovora*, which is the commonest, other bacterial species that cause soft rot include *Pseudomonas cichororii*, *P. marginalis*, and *P. viridiflavo*; and primary subspecies of *Erwinia carotovora* and *Erwinia chrysanthemum*, and are widespread and destructive disease of fleshy fruits, vegetables, and ornamental throughout the world (Anonymous, 1990). Soft rot losses may occur in the field, garden, greenhouse, or after harvest during transit, storage or marketing. The bacteria chiefly attack succulent, tender tissues or storage organs such as fleshy tubers, fruits, roots, bulbs, corms and rhizomes as well as bud, stem, petiole and leafstalk tissue. Bacterial soft rot is prevalent in overripe fruit damaged during harvest. In greenhouse produce, rotting is more prevalent in fruit that has flesh torn from the shoulder during picking or is marked by fingernails or sharp box edges, and shrink wrapped in plastic when wet fruit becomes wet in humid packing sheds when it is cooled fast, and the subsequent rot is accelerated by ethlylene gas given off by other ripening fruits, such as apples and tomatoes, in the same packing shed (Yan *et al*., 2012). Bacterial soft rots are often seen following other fruit rotting diseases, such stem blight, gray mold, and penicillium fruit rots. The causal organisms are common in most soils, particularly these frequently cropped with susceptible plants. Soft rot bacteria are a constant a threat because of their extensive host range and widespread distribution (Ronald *et al*., 2004). The symptoms of soft rot are similar on most plants. The disease starts on the leaves, stems and underground parts as small, water-soaked, translucent (lesions). These rapidly enlarge in both diameter and depth. The host tissues often become mushy or watery. Slimy masses of bacteria and cellular debris frequently ooze out from cracks and tissues (Bhat *et al*., 2010). Within 20 to 72 hours, the entire fleshy fruits, buds leaf stalks and leaves may rot and callapse sometimes leaving only the outer skin intact. Decaying tissue, which may be opaque, white, cream coloured gray, brown or black frequently give off a characteristically putrid odour. The odour is caused by secondary invading bacteria that are growing in the decomposing tissue. When the fleshy roots, rhizomes tubers, corms and crown of such plant as lily, carrot, cyclamen, iris parsnip and turnip are attacked in the field, garden or greenhouse, the foliage may turn yellow or wilt, later withering or collapsing. The soft rotting bacteria invade the plant at the ground and the slimy decay frequently extends deeply into the underground parts while the outer tissues remain firm and apparently healthy. Leaf crops including lettuce, endive, escarole, chicory and spinach may turn into watery green, slimy masses within a day or two at room temperature if stored in plastic containers or in warm humid storage areas (Seo *et al*., 2004).

Cucumber pods may rot in wet soil. Shoots arising from infected parts becomes watery, wilt and then collapse. If the soil moisture level is lowered, the base of the shoots may become soft brown to inky-black and shriveled. The leaves on such shoots are dwarfed, stiff, curled upward, and are yellowish, red or bronzed. Affected shoots are also stunted more upright and pale in colour such plants often die prematurely or their yield is reduced (Parry *et al*., 1990).

MATERIALS AND METHOD

Field Preparation/Layout and Experimental Site

The experiment was conducted in the western farm of Michael Okpara University of Agriculture, Umudike which lies in longitude 07^{o}33'N and latitude 05^{0}29'N and 122 m above sea level (NRCRI, 1998).

The field was cleared and ridges were made. Randomized complete block design (RCBD) was used with eight treatments and three replications. A land area of 260 m^{2} was used with a total of 24 ridges, each of 10 m long.

The seeds were sourced from National Root Crop Research Institute (NRCRI) Umudike, and the variety was Asheley. The net weight of each satchet of cucmber seeds were 2.0 g. Planting was done on ridges at planting spacing of 1 m x1 m. The seeds were planted and later thinned to two per hole

Organic wastes/Preparation

The following organic wastes were used as treatment after subjecting them to decomposition.

1. Cassava peels, Palm bunch, Orange peels, Maize husk, Pineapple peels, Plantain peels Poultry droppings and untreated Control.

Each waste was was allowed to decompose for four weeks before being used on the ridges as top dressing.

Data Collection

This started three weeks after planting and the parameters considered were growth and yield parameters based on the following:

- Vine length
- Number of leave
- Number of branches
- Stem diameter
- Number of flowers
- Number of fruits
- Weight of fruit
- Seed weight

Disease Assessment

Disease assessment was based on scale 0-5 similar to the one developed by Wokocha, (2000), in terms of severity as follows:

0 Healthy plant, no symptom
1 - 5% of fruit surface covered with spots or lesions
2 - 25% of fruit surface covered with spots or lesions
3 - 50% of fruit surface covered with spots or lesions
4 - 75% of fruit surface covered with spots or lesions
5 - 100% of fruit diseased and collapse

Disease Incidence

Data were collected at two weeks interval across the whole area.

The disease incidence of bacterial soft rot is determined using the formula.

$$\text{Percentage disease incidence} = \frac{\text{Number of plant affected}}{\text{Total number of placnt sample}} \times \frac{100}{1}$$

Data collected were subjected to analysis of variance (ANOVA) using "The GLM Procedure 2009" and Fisher's Least Significant Difference (LSD) at 5% level was used to separate means (Steel and Torie, 1981).

RESULTS AND DISCUSSION

Influence of Organic Wastes on Growth Parameters

The influence of organic wastes on disease, growth parameters, and yield of *Cucumis sativus* is presented in Table1 as follows:

Vine length: From the result, it was observed that the treatments had no effect on vine length at three weeks

Table 1: influence of organic wastes on disease, growth parameters and yield of cucumber

Treatment/Dis. Severity	DiSv	PL.Ht (cm)	No.Lf	No.Br	St.Dia (cm)	No. Flw	No.Frt	FrtWt (g)	Sdwt (g)
Orange peels	0.00a	12.08a	4.25a	3.17a	0.69a	14.00a	2.33a	453.33a	21.67a
Poultry droppings	2.00a	12.50a	5.17b	4.25b	1.00b	18.33b	4.67b	886.67b	61.33b
plantain peels	4.00b	12.78a	4.94c	3.83c	0.87b	15.33b	3.00a	563.33c	27.33a
Cassava peels	1.00a	12.75a	4.67c	3.58c	0.67a	15.33b	3.67b	566.67c	36.00c
Palm bunch	3.00b	12.33a	4.58c	3.58c	0.95b	14.67a	1.33c	513.33c	21.67a
Control	5.00c	12.08a	3.75d	2.08d	0.53c	6.67c	1.00c	226.67d	7.33d
Maize husk	0.67a	12.17a	4.42c	3.58c	0.61b	14.33a	2.33a	566.67c	25.33a
Pineapple peals	4.00b	12.17a	4.25a	3.50c	0.50c	13.67a	2.33a	553.33c	20.33a
LSD (P<0.05)	**0.35****	**0.87ns**	**0.79***	**0.97***	**0.16****	**3.26****	**1.06****	**700.00****	**20.00****

Note: ns = none significant
* = significant at 5%
**= significant at 1%

after planting (3WAP). This may be due to short period of interaction between the treatments and the plant.

Number of leaves and number of branches: The mean values obtained from number of leaves and number of branches differs among the treatments. Poultry droppings show higher values of 5.17 and 4.25, while control (no treatment) shows lower values of 3.75 and 2.08 respectively. All other treatments have almost equal mean values.

Stem Diameter: Poultry dropping (1.00), plantain peels (0.87) and palm bunch (0.95) differs non significantly from other treatments. Maize husks (0.61), orange peels (0.69) and cassava peels (0.67) had equal influence on stem diameter while pineapple peels (0.50) have no mean effect on stem diameter when compared with the control at 1% significant level.

Influence of Organic Wastes on Yield Parameters

Number of flowers: The influence of treatments on number of flowers of *Cucumis sativus* is highly significant (P<0.01) poultry droppings (18.33), plantain peels and cassava peels (15.33) influence number of flowers at equal level of higher mean values, orange peels (14.00), maize husks (14.33), pineapple peels (13.67), palm bunch (14.67) and plantain peels (3.00) have equal influence on number of flowers at lower mean values.

Number of fruits: Poultry droppings (4.67) and cassava peels (3.67) affected number of fruits at equal level, orange peels, maize husks, pineapple peels (2.33) and plantain peels (3.00) influence the number of fruit at equal level while palm bunch (1.33) has no influence on number of fruits ($P \leq 0.01$).

Fruit weight: Among the treatments, poultry dropping (886.67) has the greatest influence on the fruit weight. Plantain peels (563.33) cassava peels (566.67), palm bunch (513.33), maize husks (566.67) and pineapple (553.33) have equal influence on fruit weight, while orange peels (453.33) have a minimal influence on fruit weight of *Cucumis sativus* at a probability level of 0.05.

Seed weight: Poultry droppings (61.33) have the greatest influence on seed weight while all other treatments influence seed weight of *Cucumis sativus* at the same probability level of 0.01.

Disease incidence: Data obtained in the trials showed that all the treatments had bactericidal effect. The effectiveness of these treatments in controlling *Erwinia carotovora* on *Cucumis sativus* occurred as shown below (Table 2):

Disease severity: The trials showed that the severity of soft rot disease differs significantly with the treatment. Orange peels (0.00), maize husk (0.67), and poultry dropping (2.0) have equal influence on disease severity, while plantain peels, pineapple peels (4.0) and palm bunch (3.0) have equal influence on the severity of the disease.
However, control (no treatment) showed the highest disease severity while poultry droppings showed the lowest severity at 0.001 probability level.

DISCUSSION

From the result obtained, it was found that all the treatments used were effective in controlling *Erwinia*

Table 2: Influence of organic wastes on incidence and severeity of *Erwinia carotvora* on *Cucumis sativus*

Treatment	% Disease incidence	% control
Orange peels	7.1	92.9
Poultry droppings	10.7	89.3
Maize husks	10.7	89.3
Cassava peels	11.4	88.6
Plantain peels	13.8	86.2
Pineapple peels	17.9	82.1
Palm bunch	20.0	80.0
Control	62.8	37.2

carotovora of *Cucumis sativus.* The results also proved that organic wastes (orange peels, poultry droppings, plantain peelings, cassava peelings, palm bunch, maize husks and pineapple peels) led to less disease incidence, severity and increased fruit weight when compared with the control. The reduction in disease incidence was in line with the work of Roshan *et al*., 2014 who reported that soil amendment with *Jatropha* leaf powder reduced the disease incidence (DI) and percentage disease intensity (PDI) of leaf spot of tomato caused by *(Alternaria solani).* Asawalam *et al*, 2007 reported that the application of goat manure and poultry manure significantly reduced the prevalence of *podagrica* sp.This could be attributed to the active ingredients of the test organic wastes. Many scientists have worked on the anti-microbial properties of several plants in Nigeria (Amadioha and Obi, 1998; Amadioha, 2000, Emeasor *et al*., 2005, Opara and Wokocha, 2008). The reduction in disease severity and increase in the yield of *Cucumis sativus* could be attributed to the resistance conferred on the crop by the active ingredients of the organic wastes. Investigations on the mechanisms of disease suppression by plant products have suggested that the active principles present in plant extracts may either act on the pathogen directly (Amadioha, 2000) or induce systemic resistance in host plants resulting in a reduction of the disease development (Kagale *et al.,* 2004).These are the evidences from the earlier work that plants possess the pesticidal activity that can play a pivotal role in the management of the plant disease which are cheap, locally available, and biodegradable and environment friendly. This study demonstrated that many plant organic wastes *O. basilicum*, *A. indica*, *E. chamadulonsis*, *D. stramonium*, *N. oleander*, and *A. sativum,* can be used for the biocontrol of the soft rot disease. Thus, this method of control can contributes to minimizing the risks and hazards of toxic pesticides, especially on vegetables produced for fresh consumption.

CONCLUSION

This study was demonstrated to determine the efficacy of organic wastes in the control of soft rot disease of *Cucumis sativus* and to evaluate its yield response to organic wastes. Organic wastes are less costly than synthetic pesticides, and from the results of this study, organic wastes such as poultry droppings, plantain peels, cassava peels, palm bunch, maize husks, orange peels and pineapple peels had positive effect on organic cucumber production and thus can be utilized efficiently in the control of plant diseases not only on cucumber but other crops species of economic importance.

Based on the results from this study, all the organic wastes used were effective with poultry droppings as the best, followed by cassava peels and maize husk, plantain peels, pineapple peels, orange peels and palm bunch for combined aim of the control of soft rot disease and as well improved yield production of *Cucumis sativus* were acpomplished.

REFERENCES

Agro Meterological Division (1998). National Root Crops Research Institute Umudike Abia State, Nigeria.

Alverson AJ, Rice DW, Dickson S, Barry K, Dalmer JD (2011). Origins and Recombination of the Bacterial-sized Multi-chromozomal Mitiochoridrial Genome of Cucumber (*Cucumis sativus*) plant cell 23:2491-2513.

Amadioha AC (2000). Controlling rice blast in vitro and in vivo with extracts of *Azadirachta indica*. Crop Protection 19, 287-290

Amadioha AC and Obi VI (1999). Fungitoxic activity of extracts from *Azadiracta indica* and *Xylopia ethiopica* on *Colletotrichum lindemuthianum* in cowpea. *J. herbs, spices med. plants, 6(2). Harworth press pp. 33-40.*

Anonymous (July, 1990). Report on Plant Diseases RPD No. 943 bacterial soft rot of vegetables fruits and Ornamental.

Anonymous (2002). Cucumber Diseases, Departmental Electronic Publications Pp7.

Anonymous (October, 1999). Report on Plant Disease, RDP No 902. Bacterial disease of cucumber and muskmelon.

Anornymous, (1999): Root, Tuber and Vegetable Improvement Program Report, IITA Ibadan, Pp 58.

AVRDC (2003b). Effects of natural and synthetic pesticides in controlling Diamond back moth in cabbage. Progress report 2002. Shanhua, Taiwan: AVRDC-The World Vegetable Centre, pp.157-158, 2003b.

Bhat KA, Masood SD, Bhat NA, Razvi SM, Mir MR (2010). Current Status of Post-Harvest Soft Rot in Vegetables: A Review. Asian J. Plant Sci. 9: 200-208.

Bradbury JE, Foatem DA (2002). Morphological Diversity of Sohannum accessions in Cameron plant genetic resources Newletter 131:42-48.

Brookyln BG (2000). National Disease Control; common sense approach to plant First Aid.

Buchanan, David (2012); Taste Memory: Forgotten Foods, lost flavours and why they matter VT, USA, Chealsea Green Publishing P. 109.

CABI Crop Protection Compendium.(2008); *Cucumis sativus* Datasheet.

Coolong, T. (2010); University of Kentucky Cooperative Extension Service.

De Lannog JK (2001). Profitable Curcubit Production in the Tropics. Principles and Practice, University of Honolulu I.S.A Pp. 74-128.

Emeasor KC, Ogbuji RO and Emosairue SO (2005). Insecticidal activity of some seed powders against *Callosobruchus maculatus* (F.) (*Coleoptera Bruchidae*) on stored cowpea. *Journal of Plant Diseases and Protection*, 112 (1): 80–87.

FAO (2002). FAO Production Year Book (2001) Food and Agricultural Organization. United Nations Pp 141-157.

Folman LB, Postma J (2003). Characterization of *Lysobacter* enzymogenes (Christensen and Cook, 1978) strain 3.1T8, a powerful antagonist of fungal disease of cucumber. Microbiology Res. 158: 107-115.

Gerken A, Suglo JV and Braun M (2001). Crop protection policy in Ghana. Pesticide Policy Project produced by Plant Protection and Regulatory Services Directorate of Ministry of Food and Agriculture, Accra.

IITA, (1992). Sustainable Food Production in Sub-Saharan Africa, IITA'S contribution Ibadan Nigeria Pages 98-109.

Jeger MJ (2004); Analysis of Disease Progress as a basis for evaluating disease management practices. Annual Review of Phytopathology. 42: 61-82.

Kagale S, Marimuthu T, Thayumanavan B, Nandakumar R and Samiyappan R (2004). Antimicrobial activity activity and induction of systemic resistance in rice by leaf extract of *Daturametel*against *Rhizoctoniasolani*and *Xanthomonas oryzae*pv. *oryzae*. Physiological and Molecular Plant Pathology, **65**: 91–100.

Latorre BA, Rioja ME, Lillo C (2002). The Effect of Temperature on infection and a warning system for pear blossom blast caused by *Pseudomonas syringae* pv. *Syringae*. Crop Protection, 2002, 21: 33-39.

Lavery, Bernard (1995); How to Grow Giant Vegetables, harper Collins publishers, first impression Pages 67-71.

Lerner BR and Dana MN (2001). Growing Cucumbers, Melons, Squash, Pumpkins and Gourds. Purdue University Cooperative.

Marechal A and Brison N (2010). Recombination and the Maintenance of Plant Organelle Genoms Stability, Newphytol 186:299-317.

Margaret TM (2004). Attractiveness to Cucumber Beettles and Susceptibility to Bacterial with long Island horticultural research and Extension centre, New York, U.S.A.

Mary P (2002); Sustainable Practice for Vegetable Production in South American NCSU-North Carolina State University U.S.A first impression.

Messian CM (1992). The Tropical Vegetables Garden; principles for improvement and increased production with application to the main vegetables types pages 246-280.

Nwofia GE, Amajuoyi AN, Mbah EU (2015). Response of three cucumber varieties (Cucumis sativa L.) fertilizer rates in lawland humid topics; sex expression, yield and inter-relationships between yield and association traits.

Obeng-Ofori D, Owusu EO and Kaiwa ET (2002). Variation in the level of carboxyl esterase activity as an indicator of insecticide resistance in populations of the diamond back moth, *Plutella xylostella* L. attacking cabbage in Ghana. J. Ghana. Sci. Assoc., 4(2): 52-62, 2002.

Opara EU and Wokocha RC (2008). Efficacy of Some Plant Extracts on the *In vitro* and *In vivo* Control of *Xanthomonas campestris* Pv. *Vesicatoria*. *Agricultural Journal, 3: 163-170.* http://medwelljournals.com/abstract/?doi=aj.2008.163.170.

Parry DW (1990). Plant Pathology in Agriculture, Second edition Cambridge university press great britan pages 249-320.

Ralph N and Terebelski D (2003). Pickle History Timeline.New York Food Museum.Retrieved January 6, 2008.

Raupech GS, Kloepper JM (2002). Biocontrol of Cucumber Disease in the Field. Plant Disease Journal 84:1073-1075.

Renner SS, Schaefer H and Kocyan A (2007). "Phylogenetics of Cucumis (Cucurbitaceae): Cucumber (C. sativus) Asian/Australian Clade from Melon (C.mmelo)," BMC Evolutionary Biology, Vol. 7, pp. 58-69. Vol: 10.1186/1471-2148-7-58.

Robort, L. W, and Fernald H., (1994); Common Diseases of Vegetables Crops, hortscience journal 321:1-3.

Roderick, Mckinlay G., (1992). Vegetable Crop Pests, Macmillan press Ltd, second Edition pages 139-149.

Roman, Raemaekers. (2002); Vegetable Crop Production in Tropical Africa, second edition, Geopinkt publishers AV., Pp 608-670.

Ronald CS, Hae RC, Margriet MH, Pim L and Jaap MT (2004). Genetic Variation in Zantedeschia spp. (Araceae) for resistance to soft rot caused by *Erwiniacarotovra* subsp. *carotovora*). Euphytica 135: 119128.

Roshan R, Ravi JL, Sobita S and Abhilasha AL (2014). Effect Of Jatropa Leaf Powder Amendment Against Leaf Spot *(Alternariasolani)* on *Lycopersicum esculentum* L *.ARPN J. Agric. Biol. Sci.* 9 (9).

Sheng DX, Jia Y, Ran LP, Teng JX and Chen RC (2007). The Control Effect for Different Antibiotics to Soft rot of *Amorphophal luskonjac*. Anhui Agric. Sci. Bull.13: 153-155.

Sigmand R And Gustar E (1991). The Cultivated Plants of the Tropics and Subtropics, second edition pages 126-179.

Steel RC and Torie TH (1981). Principles and Procedures of Statistics. Macmillan press. New York. Page 34.

Stoll G (2005). National Crop Production in the Tropics, first edition, margrate publishers, pages 56-81.

Thurston (1998). Tropical Diseases second edition, APS, American phytopathological society, Sain Paul, U.S.A pages 208-264.

Toit AD (2010). Health Benefits of Cucumbers. Natural news. Web.<http:// www.naturalnews.com/038769.cucumbers-health-benefits-rehydration html.

USDA (1999). United State Department of Agriculture Bulletin No 628, pages 78-94.

Walter ES (1990). Vegetables Growing Handbook, Organic of Traditional Methods. Third Edition. Van Norstand Reinhold, New York pages 228-233.

Watt BK and Merrill AC (1990). Composition of Foods Feserved edition, US department of agriculture handbook No. 8 Washington D.C. Pp 72.

Wokocha RC (2000). Determinant of disease severity in a plant population.

Woloszynsk M (2010). Heteroplamy and Stochiometric Complexity of Plant Mitochrondrial Genomes. Exp. Bot. 61:657-671.

Wu JP, Liu XY, Diao Y, Ding ZL and Hu ZL (2012). Authentication and Characterization of a Candidate Antagonistic bacterium against soft rot of Amorphophalluskonjac. Crop protection. 34: 83-87.

Xu N (2003). Forecasting and Management system of cucumber powdery mildew and downy mildew in plastic greenhouse tunnel. Masteral Dissertation, Nanjing Agricultural University, China, 2003 (in Chinese).

Yan X, Huang L, Wang X, Yao M and Kang Z (2012). *Saccharothrixy anglingensis spp*; an antagonistic endophytic actinomycete isolated from cucumber plant. Antonie van Leeuwenhoek. 101: 141146.

Zhou Y, Chen L, Chai XL, Yu ZL and Sun M (2007). Isolation of Endophytic Antagonistic bacterium from Amorphophalluskonjac and research on its antibacterial metabolite.ActaMicrobiol.Sin. 47: 1076-1079.

Zhou Y, Liu SY and Zou LF (2004). The inhibiting effect of extracts from some wild plants on plant pathogens. Chin. Wild Plant Resour. 23: 30-32.

Zitter TA, Hopkins DL. and Thomas CE (1996). Compendium of Cucurbit Diseases. American Phytopathological Society Press.

Zitter TA and Knipscheer A (2002). Botany of Vegetable Garden Crops, Conell University, USA Pp 62.