GLOBAL JOURNAL OF SCIENCE FRONTIER RESEARCH: C BIOLOGICAL SCIENCES (BOTANY & ZOOLOGY)

DISCOVERING THOUGHTS AND INVENTING FUTURE

HIGHLIGHTS

Proximate Composition

Culex quinquefasciatus

Thompson Seedless Grapes

Incidence of rice hispa

Volume 12

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Proximate Composition and Sensory Qualities of Snacks Produced from Breadfruit Flour

By Ajani Alice O., Oshundahunsi O.F., Akinoso Rahman, Arowora Kayode A, Abiodun Aderibigbe A & Pessu Patricia O

Federal University of Technology, Akure, Nigeria

Abstract - Breadfruit is a valuable food resource, but its usage is limited by poor storage properties of the fresh fruit. Therefore, there is need for conversion into flour to provide a more stable storage form as well as increasing its versatility. Breadfruit flour was processed into two conventional food forms; namely cake and chin-chin. The cake and chin-chin samples were made from blends of 10%, 20%, 30%, 40% and 100% breadfruit flour. The proximate composition and sensory evaluation were determined. The proximate composition showed that 40% breadfruit flour blend had highest protein content (1.39%). The value for 100% wheat flour was 1.05%, while that of breadfruit flour only was 1.31%; this showed that supplementation of breadfruit flour would improve the protein nutritional quality of the products. The moisture content of the samples varied between 12.77% and 9.57%, decreasing with increasing substitution of breadfruit flour , hence prolonging the shelf-life. Protein content had range of (1.05-1.39%) and ash content (0.94-1.12%).

Keywords : breadfruit flour, wheat flour, proximate composition, sensory evaluation.

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PROXIMATE COMPOSITION AND SENSORY QUALITIES OF SNACKS PRODUCED FROM BREADFRUIT FLOUR

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Proximate Composition and Sensory Qualities of Snacks Produced from Breadfruit Flour

Ajani Alice O.^α, Oshundahunsi O.F.^σ., Akinoso Rahman ^ρ, Arowora Kayode A^ω, Abiodun Aderibigbe A[¥] & Pessu Patricia 0.[§]

Abstract - Breadfruit is a valuable food resource, but its usage is limited by poor storage properties of the fresh fruit. Therefore, there is need for conversion into flour to provide a more stable storage form as well as increasing its versatility. Breadfruit flour was processed into two conventional food forms; namely cake and chin-chin. The cake and chin-chin samples were made from blends of 10%, 20%, 30%, 40% and 100% breadfruit flour. The proximate composition and sensory evaluation were determined.

The proximate composition showed that 40% breadfruit flour blend had highest protein content (1.39%). The value for 100% wheat flour was 1.05%, while that of breadfruit flour only was 1.31%; this showed that supplementation of breadfruit flour would improve the protein nutritional quality of the products. The moisture content of the samples varied between 12.77% and 9.57%, decreasing with increasing substitution of breadfruit flour, hence prolonging the shelf-life. Protein content had range of (1.05-1.39%) and ash content (0.94-1.12%). The 10% flour blend in all cases gave results comparable to the 100% wheat flour cake and chin-chin and produced better quality products than 20% and 30% flour blends. The sensory evaluation showed that there were no significant differences (p>0.05) between 100% wheat products and 10% breadfruit flour blend in the sensory attributes.

Keywords : breadfruit flour, wheat flour, proximate composition, sensory evaluation.

I. INTRODUCTION

Breadfruit (*Artocarpus altilis*) is widely cultivated to appreciable extent in South-West States of Nigeria. Present level of breadfruit production in the South-Western Nigeria has been estimated to about 10million tonnes dry weight per year with potentials for exceeding 100million tonnes every year (Adewusi *et al.*, 1995; Ajayi, 1997). Breadfruit (*Artocarpus altilis*) is a tree and fruit native to Malaysia and countries of the South Pacific and the Caribbean. It is an important food in these areas

(Taylor and Tuia, 2007). Breadfruit is a fruit tree that is propagated with the root cuttings and the average age of bearing first crop is between 4 to 6 years (Amusa et al., 2002). The tree has a great productive ability with an average sized tree producing 400 to 600 fruits per year (NTBG,2009). It produces fruit twice a year, from March to June and from July to September with some fruiting throughout the year. Breadfruit is highly nutritious. cheap and readily available in overwhelmina abundance during its season, it has found limited applications in the food industries (Omobuwajo, 2003). The breadfruit pulps are made into various dishes; it can be pounded, fried, boiled, or mashed to make porridge; it can also be processed into flour and used in bread and biscuit making (Amusa et al.,2002). Breadfruit has also been reported to be rich in fat, ash, fibre and protein (Ragone, 1997).

Usually, farmers helplessly watch their harvested stored breadfruits rot awav because routine methods of processing are inadequate to utilize all the breadfruits harvested. Other constraints include the short shelf-life of the fruit. Much of the food problems in the developing countries have been attributed to huge post-harvest losses (Adebayo and Ogunsola, 2005). One way to minimize post-harvest losses and increase the utilization of breadfruit is through processing into flour, which is a more stable intermediate product. The use of composite flours in bread making has been reported by many researchers.

Olaoye et al. (2006), investigated the use of supplementation of flours of soybean and plantain in wheat in the production of bread. Also, Mepba al. (2007), produced composite breads et and biscuits from mixed flours of wheat and plantain, with 30% supplementation of plantain flour. Though the breadfruit has been made into flour and evaluated in bakery products (Omobuwajo, 2003; Olatunji and Akinrele, 1978; Graham and De-Bravo, 1981), except the work by Oyeniyi (2006), not much has been done in the area of chin-chin like and cake products. The objective of this work was therefore to provide information on the proximate composition and sensory acceptability of the snacks produced from breadfruit flour. Also, to reduce

Author a : Nigerian Stored Products Research Institute, P.M.B. 5044, Ibadan, Nigeria. E-mail : popwie@yahoo.com

Author o : Department of Food Science and Technology, Federal University of Technology, P.M.B.704, Akure, Nigeria.

Author p : Department of Food Technology, University of Ibadan, Nigeria.

Author C ¥ : Nigerian Stored Products Research Institute, P.M.B. 1489, Ilorin.

Author § : Nigerian Stored Products Research Institute, P.M.B. 12543, Lagos.

wheat flour inflation and curtail excessive losses of breadfruit during season.

II. MATERIALS AND METHODS

a) Materials

Matured green ripe and wholesome fruits of breadfruit (*Artocarpus altilis*) were obtained from a farm in Ile-ife, Osun state. A commercial wheat flour (Eagles flour Mill, Ltd, Ibadan, Nigeria) and all other ingredients of baking cake and chin-chin such as fat, sugar, milk powder, salt, flavor, egg, sodium bicarbonate and vegetable oil were purchased from Bodija market in Ibadan, Nigeria.

b) Processing of Breadfruit flour

The breadfruits were processed into flour as shown in Figure 1. Breadfruit samples were washed, peeled and sliced manually into 1cm thick slices using stainless steel knife. The washed sliced breadfruit pieces were immersed in a 70ppm solution of sodium metabisulphite. The sulphited slices were steam blanched at 70°C for 10mins in a water bath (Clifton model) and then dried at 55°C for 16hrs using a cabinet dryer. The dried chips were milled and sieved through a 0.25mm British standard sieve (Model BS 410) (Giami et al.,2004). The flour was packaged in thick gauge (0.04mm) transparent polyethylene nylon for further use.

c) Processing of cake

The recipe for the cake production is shown in Table 2

The cake samples were in ratios of wheat flour: breadfruit flour of 100:0, 90:10, 80:20, 70:30 and 0:100. All the ingredients (butter, sugar, salt, egg, milk) except flour and sodium bicarbonate were added with continued mixing in a mixer. Then, flour and sodium bicarbonate were added. Mixing was carried out for 5mins. The batter was dispersed into small baking pans. Baking was done at 100°C for 30mins in an oven.

d) Processing of Chin-chin

The chin-chin recipe is shown in Table 4

The chin-chin samples were in ratios of wheat flour : breadfruit flour of 100:0, 90:10, 80:20, 70:30 and 60:40. Flour, salt and nutmeg were sieved first into a bowl. Then margarine was mixed together with flour evenly. Egg, sugar and other ingredients were added to make fairly stiff dough. The stiff dough was rolled tightly to 1cm thickness on a board and cut into cubes. Cut dough was fried in deep hot vegetable oil until golden brown. Chin-chin is then drained, cooled and packaged.

Chin-chin is a fried snack popular in Nigeria and West Africa. It is a sweet, hard, donut-like baked or fried dough of wheat flour. Chin-chin may also contain cowpeas. Many people bake it with ground nutmeg for flavour. It is usually kneaded and cut into small squares of 1 square inch or to about a quarter of an inch thick before frying. This can be served as a side dish and make no ideal savoury snack with drinks at parties or simply in between meals (Akubor, 2004; Mepba et al., 2007).

e) Proximate Analysis

The proximate composition of the breadfruit blend samples were determined using suitable methods. The samples were analyzed for moisture, ash, crude fibre, crude protein, crude fat and carbohydrate

f) Sensory Evaluation

The sensory attributes, including colour, taste, aroma, texture, and general acceptability, were evaluated by a semi trained 10-member panel ,using a 7-point Hedonic scale with 1 representing the least score(Dislike very much) and 7 the highest score (Like very much). Analysis of variance(ANOVA) was performed on the data gathered to determine differences, while the least significant test was used to detect significant differences among the means(lhekoronye and Ngoddy, 1985).

III. Results and Discussion

The proximate composition of the breadfruit flour blends are presented in the Table 1. The protein content increases with increase in the level of breadfruit substitution. The values ranged from 1.08 - 1.43%. At 40%, breadfruit flour blend had the highest protein, followed by 30% and 20%. It was observed that the protein value for 100% breadfruit flour was higher than 100% wheat flour. This was similar to the work of Bhandary and Amadi (2004) who worked on the development of composite flour using breadfruit and wheat flour. Hence, protein is an important component that determines the rheological properties of composite flours. The ash content of the flour blends were high in values (0.82 - 1.11%), suggesting that the breadfruit is high in minerals. This is in agreement with report by Morton, 1987; Ragone, 1997. Therefore, the increase in substitution of breadfruit flour will improve the nutritive value of the snacks. This will be an advantage in the preparation of weaning food formulation. It can also contribute to the dietary intake of consumers or serve as special diet/meal.

Moisture content of the flour blends ranged between 9.61 – 12.87%. The decrease in moisture content with increase in level of substitution showed the certainty of prolonging shelf-life. Besides, the range of moisture content implied that the breadfruit blends flour had good storage potential, since it was known that moisture and water activity of the product determine greatly the keeping quality of the foods. These values were minimal and may not have adverse effect on the quality attributes of the product (Kure et al., 1998).

The fat content of the flour blends increase with increment in substitution levels. The values ranged from

0.37 – 0.60%. It was also noticed that fat content in breadfruit flour is higher compared to wheat flour, 0.59 and 0.42% respectively but the incremental values were minimal (Olaoye et al.,2007).Fat plays a significant role in the shelf life of food products and as such relatively high fat content could be undesirable in baked food products. This is because fat can promote rancidity in foods, leading to development of unpleasant and odorous compounds (lhekoronye and Ngoddy, 1985)

Fibre content for the blends increase with increase in substitution of breadfruit (0.84–1.26%). Breadfruit has relatively higher crude fibre than wheat and this could justify the result obtained for the different snack samples. This observation is in support of the findings of Olaoye et al.,2007;Esuoso and Bamiro(1995)

The carbohydrate content of the flour blends were slightly higher than that reported by Oyeniyi (2006). Flour blends of 10% breadfruit had the highest percentage, although the differences between the other blends were not appreciable. The highest carbohydrate content was observed with 100% wheat flour, while the lowest was recorded for 100% breadfruit flour. High percentage of carbohydrate content in all the flour blends suggested that the blends were good source of energy. Also, it might found application as soup thickeners, useful in food formulation for diabetics and hypertensive patients requiring low sugar diet. This is similar to the work by Oladunjoye et at.,2010 who found that the mature fruit is a good source of carbohydrate(84%) with starch constituting more than 60% of the total carbohydrate.

The results of sensory evaluation are shown in Table 4 and Table 5. Sensory evaluation showed that the cakes produced were not significantly different (p>0.05) up to 20% in terms of all the sensory attributes tested but there were slight differences in 30% and 100% breadfruit flour.

Table 5 indicated that there were no significant difference in chin-chin (p>0.05) up to 20% in terms of appearance, taste, aroma, texture and general acceptability. Although, there were slight differences in the snacks produced, however, the snacks were successfully produced, appealing and acceptable for consumers' consumption. This is similar to work done by Olaoye et al., 2007 in using breadfruit flour for baking biscuit.

IV. Conclusion

The breadfruit flour produced was creamy in colour, smooth and odourless. During the production, the ratio of the flour blends were more than five ratios, but only the chosen ratios found acceptable. Substitution of wheat flour with breadfruit flour would greatly improve the protein nutritional quality of cake and chin-chin. This would be of nutritional importance in most developing countries such as Nigeria, where people can hardly afford high proteinous foods because of their expensive costs. However, other methods of processing could increase the protein content if properly done Also, research breakthrough will increase the utilization of the breadfruit. The result output will benefit growers of the crop economically and open other area of research.

References Références Referencias

- Adebayo SF, Ogunsola EM (2005). The proximate analysis and functional properties of fortified instant pounded yam flour. In: Proceed 29th Annual Conference of Nigerian Institute of Food Science and Tech (NIFST). 244.
- Adewusi SRA, Akpobome JU, Osuntogun BA (1995). Studies on the carbohydrate content of breadfruit (*artocarpus communis forst*) from South-West Nigeria. Starch/starke. 47:287-294.
- 3. Ajayi OP (1997). Studies on some physic-chemical and enzymatic changes in breadfruit (artocarpus altilis) during storage.M.Sc Research Thesis. Food Technology Department, University of Ibadan.
- Akbor PI (2004). Protein contents, physical and sensory properties of Nigerian snack foods (cake, chin-chin and puff-puff) prepared from cowpeawheat flour blends. International Journal of Food Sci and Techn. 39(4): 419-424.
- 5. Amusa NA, Kehinde IA, Ashaye OA (2002). Biodeterioration of breadfruit (*Artocarpus communis*) in storage and its effects on the nutrient composition. *Afri. J. Biotechnol.* 1(2): 57-60.
- Bhandary CS, Amadi EC (2004). Proximate Composition of Fortified pasta from blends of the African breadfruit (*Treculia africana*) Flour and Wheat (*Tritium durum*) Semolina. In: Proced.29th Annual Conference of Nigerian Institute of Food Science and Tech. (NIFST). 56.
- Giami SY, Amasisi T, Ekiyor T (2004). Comparison of bread making properties of composite flour from kernels of roasted and boiled African breadfruit (*Treculia africana decne*) seeds. J. Material Res. 1(1): 16-25.
- Graham HD, Negron de Bravo E (1981). Composition of the breadfruit. *J. Food Sci.* 46: 535-539.
- Mepba HD, Achinewhu SC, Aso SN, Wachukwu CK (2007). Microbiological quality of selected street foods. In Port Harcourt, Nig. Journal of Food safety 27(2): 208-218.
- Mepba HD, Eboh L, Nwaojigwa SU (2007). Chemical composition, functional and baking properties of wheat-plantain composite flours. Afri. J. Food Nutri. Devt. 7(2): 1-22.
- 11. Morton JF, Miami FL (1987). Breadfruit: *Artocarpus altilis*. Fruits of warm climates.pp.50-58

- National Tropical Botanical Garden (NTBG) (2009). Hunger Initiative. Breadfruit Institute. National Tropical Botanical Garden. (http://www.ntbg.org/ breadfruit/hunger.phb).
- Oladunjoye IO, Ologhobo AD, Olaniyi CO (2010). Nutrient composition, energy value and residual anti-nutritional factors in differently processed breadfruit (Artocarpus altilis) meal. Afri. J. Biotechnol., 9(27): 4259-4263.
- Olaoye OA, Onilude AA, Oladoye CO (2007). Breadfruit flour in biscuit making: effects on product quality. Afri. J. Food Science: 20-23.
- Olaoye OA, Onilude AA, Idowu OA (2006). Quality characteristic of bread produced from composite flour of wheat, plantain and soybeans. Afri. J. Biotechnol. 5(11): 1102-1106.
- Olatunji O, Akinrele IA (1978). Comparative rheological properties and bread qualities of wheat flour diluted with tropical tuber and breadfruit flours. Cereal Chemistry. 55(1): 1-6.

- Omobuwajo TO (2003). Compositional character ristics and sensory quality of biscuit, prawn-crackers and fried chips produced from breadfruit. J. Innovative Food Science and Emerging Technologies.4 (2): 219-225.
- Oyeniyi OO (2006). Compositional Characteristics and Sensory Quality of Biscuits, Cake and Prawn crackers from breadfruit (*Artocarpus communis*). Unpublished M.Sc. Thesis. University of Ibadan, Ibadan.
- Ragone D (1997). Breadfruit (*Artocarpus altilis*) (Parkinson) Fosberg. Promoting the conservation and use of underutilized and neglected crops. Institute of Plant Genetics and Crop Plant Research, Gatersleben International Plant Genetic Resources Institute, Rome, Italy.
- 20. Taylor MB, Tuia VS (2007). Breadfruit in the pacific region. Acta Horticulturae (ISHS) 757: 43-50.

	WHEAT	FLOUR/BREAI	OFRUIT FLOUR S	SAMPLES (ME	AN ± SD)		
CONSTITUENTS	А	В	С	D	Е	F	
% Moisture	12.755	12.87	12.125	12.34	11.29	9.605	
Content	± 0.015	± 0.02	± 0.025	± 0.04	± 0.02	± 0.035	
%Protein	1.08	1.165	1.325	1.26	1.425	1.345	
	± 0.03	± 0.025	± 0.055	± 0.03	± 1.00	± 0.035	
%Fat	0.42	0.37	0.500	0.455	0.54	0.595	
	± 0.01	± 0.02	± 0.01	± 0.015	± 0.01	± 0.15	
%Fibre	0.08425	1.12	1.165	1.195	1.225	1.26	
	± 0.247	± 0.01	± 0.015	± 0.015	± 0.015	± 0.01	
% Ash	0.93	0.82	1.02	1.07	1.105	1.045	
	± 0.01	± 0.01	± 0.01	± 0.02	± 0.015	± 0.015	
%Carbohydrate	97.57	97.645	97.155	97.215	96.93	96.91	
by difference	± 0.01	± 0.005	± 0.035	± 0.005	± 0.01	± 0.100	

Table 1 : Proximate Composition of Wheat and Breadfruit Flours

Note:

A = Wheat flour (100%)

B = Wheat flour (90%) and breadfruit flour (10%)

C= Wheat flour (80%) and breadfruit flour (20%)

D = Wheat flour (70%) and breadfruit flour (30%)

E = Wheat flour (60%) and breadfruit flour (40%)

F = Breadfruit (100%)

Ingredients	Weight (g)
Flour	500g
Fat	250g
Sugar	150g
Salt	10g
Sodium bicarbonate	5.4g
Egg	10 pieces
Milk	50g

Table 2 : Ingredients Composition for Cake Production.

Source: Oyeniyi (2006)

Samples	Appearance	Taste	Aroma	Texture	Overall Acceptability
100% WF	6.0 ^a	5.7 ^a	6.0 ^a	6.1 ^a	6.1 ^a
90%WF 10%BF	6.5 ^a	4.4 ^a	5.5 ^a	5.5ª	5.7 ^a
80% WF 20% BF	5.5 ^a	5.4 ^a	5.3 ^{ab}	5.2ª	5.3 ^{ab}
70% WF 30% BF	4.0 ^b	4.7 ^a	4.9 ^{ab}	5.2ª	4.3 ^b
100% BF	3.7 ^{bc}	2.6 ^b	3.8 ^b	2.3 ^b	2.3 ^c

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Table 3 :	Sensory	/ Evalution	of Cake

Any samples with the same alphabet in the vertical line are not significantly difference at 1% level while anyone with different alphabet is significantly difference.

NB:

WF = Wheat flour

BF = Breadfruit flour

Table 4 :	Ingredients	Composition for	or Chin-chin	Production.
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Ingredients	Weight (g)
Flour	200g
Fat	4g
Sugar	40g
Salt	2g
Sodium bicarbonate	2g
Egg	50g
Water	20ml

Source: Robert (1990)

Samples	Appearance	Taste	Aroma	Texture	Overall Acceptability
100% WF	6.1ª	6.0ª	5.7 ^a	5.7 ^a	6.1 ^ª
90%WF 10%BF	5.5 ^{ab}	6.1 ^a	5.7 ^ª	5.6 ^ª	5.7 ^ª
80% WF 20% BF	5.4 ^{ac}	4.4 ^{ac}	4.9 ^{ab}	4.5 ^{ab}	4.9 ^{ab}
70% WF 30% BF	3.7 ^d	4.1 ^{abc}	4.3 ^{ab}	3.9 ^b	4.0 ^b
60% WF 40% BF	4.0 ^{cd}	3.3°	4.0 ^b	3.1 ^{bc}	2.9 ^{bc}

Table 5 : Sensory Evaluation of Chin-Chin

Any samples with the same alphabet in the vertical line are not significantly difference at 1% level while anyone with different alphabet is significantly difference.

NB:

WF = Wheat flour

BF = Breadfruit flour.







Figure 1 : Flow Chart for the Processing of Breadfruit Flour.









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Status of Phenolics and Amino Acids in Leaf of Thompson Seedless Grapes Grafted on Different Rootstocks Under Indian Condition

By R. G. Somkuwar, J. Satisha, S. D. Ramteke, D.D. Bondage, Prernaitroutwar, Manishasurange, Supriyanavale & Dashrathoulakar

National Research Cnetre for Grapes, Pune (India)

Abstract - The study on status of phenolics and amino acid content in leaf of 8 years old Thomson Seedless grapes grafted on different rootstock was conducted during the year 2008 -2009. Leaf samples were collected at different growth and development stage of a vine. The status of phenols and amino acid at four major growth stages in the leaf of Thompson Seedless grapevine grafted on different rootstocks using high performance liquid chromatography was studied. The differences for phenolic compound at different stages were observed. The accumulation of amino acid in leaf in grape rootstock was found to be stage specific. The concentration of phenolic and amino acid was found to be increased and decreased from one stage to another and was more specific in different rootstocks showing that individual rootstock has capacity to synthesize their food differently.

GJSFR-C Classification: FOR Code: 060310

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Status of Phenolics and Amino Acids in Leaf of Thompson Seedless Grapes Grafted on Different Rootstocks Under Indian Condition

R. G. Somkuwar ^α, J. Satisha^σ, S. D. Ramteke^ρ, D. D. Bondage^ω, Prernaitroutwar [¥], Manishasurange[§], Supriyanavale^x & Dashrathoulakar ^v

Abstract - The study on status of phenolics and amino acid content in leaf of 8 years old Thomson Seedless grapes grafted on different rootstock was conducted during the year 2008 - 2009. Leaf samples were collected at different growth and development stage of a vine. The status of phenols and amino acid at four major growth stages in the leaf of Thompson Seedless grapevine grafted on different rootstocks using high performance liquid chromatography was studied. The differences for phenolic compound at different stages were observed. The accumulation of amino acid in leaf in grape rootstock was found to be stage specific. The concentration of phenolic and amino acid was found to be increased and decreased from one stage to another and was more specific in different rootstocks showing that individual rootstock has capacity to synthesize their food differently.

I. INTRODUCTION

rape (*Vitisvinifera L.*) is one of the major important commercial fruit crops of India with 111,000 ha area under cultivation and production of 1,235,000 tonnes (Anonymous 2012). Since the last decade, grape cultivation has been facing adverse situations like soil salinity and high chloride content in the irrigation water. The decline in yield due to these problems along with drought and poor fruitfulness has stressed the need of rootstock in vineyard establishment. To overcome these adverse conditions in grape cultivation, use of rootstock became necessary. Among the grape rootstock varieties, Dog Ridge (Vitischampini) is one of the most popular rootstock with the grape growers in addition to 110-R as the second alternative (Somkuwar et al, 2006). The rootstocks have potential to combat the soil problems and also act as tool for manipulating the vine growth and productivity (Wolf and Pool, 1988). This helps in altering the shoot vigor thus bringing equilibrium between the growth and yield. Grape production is a very intensive business and is related to good quality and higher yield leading to better profitability. After nearly a century of research and development in India and other countries, great progress has been made in the sciences of Enology and Viticulture. Grapes are used for juice, dry fruits (raisins),

fresh consumption (table grapes), wine, distilled liquors and concentrate. It is one of the most commercially important fruit crops in the world owing to its excellent fruit quality and also being a good source of minerals like calcium, phosphorous, iron and vitamins like B_1 and B_2 .

Grape is a major source of phenolic compounds (Maxcheix et al., 1990) with good neutraceutical potential. It has attracted an increased attention in the field of nutrition, health and medicine largely because of their anticarcinogenic/ antimutagenic, antimicrobial properties and also antioxidant activity (Amellai et al., 1985; Livero and Puglisi, 1984; Bagchi et al, 1998; Catterall et al., 2000). Polyphenolic compounds are secondary metabolites naturally present in the wine grapes which are released during the vinification process (Mikes et al., 2008). They participate in the plant metabolism and are responsible for the plant growth regulation. As phytoallaxins, they protect plants against infection and the attack by microorganism (Ecarpa and Gonzalez, 2001; Matejicek et al., 2003). Phenols have been associated with plant and tissue maturation processes, defence mechanism (Kubo and Matsumoto, 1984) and sensory characterization of plant derived food products (Cimato et al., 1990).

All the plants like any other organism need certain components for growth over and above soil, rain and air. The basic component for living cells is proteins with building block material. L-amino acids. Plants synthesize amino acids by means of photosynthesis and combining it with nitrogen, received from soil (During, 1994). Among other things, amino acids help plants combat stress, increase root mass, activate natural defense mechanisms and enhance photosynthesis. This helps the plant to produce more biomass and thus increase in yield. Among the different amino acids,L-Glutamic acid and L-Aspartic acid by transamination give rise to the rest of the amino acids. L- Proline and Hydroxyproline mainly act on the hydric balance of the plant in strengthening the cellular walls in such a way that they increase resistance to unfavourable climatic conditions (Treeby et al., 1998). The amino acids found in grapes make an important contribution to the quality. The amino acid content of

Author $\alpha \sigma \rho \oplus \mathcal{L}$ (Notional Research Centre for Grapes, Pune – 412 307 India.

Vitisvinifera has been investigated by a variety of methods. Castor (1953) determined the amount of 14 free amino acids in seven varieties of grape produced in California. Castor and Archer (1956) reported large amount of proline and lower levels of serine and threonine in French Colombard grapes. Although it is true that all amino acids do not have same importance inside the plants and that they are required in different quantities, they are all essential and interdependent in such a way that the excess or deficit of one of them can block the synthesis of others.

The changes in concentration of free amino acids during maturation of berries of *V. vinifera* grapes have also been examined. Kliewer (1968) determined the concentrations of 8 amino acids in six table and twelve wine varieties during the ripening and ripe period of the fruit development. The amount of free amino acids in grapes can vary considerably for the number of reasons, including sample preparation and method of determination (Shiraishi et al. 1986).

The objective of the study was to define the amino acid content and phenolics status in grape leaves to understand the growth stage dependent changes in concentration of Thompson Seedless grapes grafted on different rootstocks and also compare with the own rooted vines under Indian condition.

II. MATERIALS AND METHODS

The present investigation was carried out at the research and development farm of National Research Centre for Grapes, Pune during the year 2008-2009. Pune is situated in Mid-West Maharashtra at an altitude of 559 m above sea level; it lies on 18.32 N latitude and 73.51°E longitude. Eight year old vines of Thompson Seedless grapes grafted on different rootstock and own rooted Thompson Seedless as a scion was selected for study. The rootstocks (110-R, 1103-P, 1613-C, Dog Ridge) and own rooted vines of Thompson Seedless grapes were planted in August 2000 in a randomized block design with four replications in each treatment consisting of ten continuous vines per replicate. These rootstocks and own rooted Thompson Seedless grapes were planted in North-South direction. The vines were planted at the spacing of 3.0 m between the rows and 1.83 m between the vines, totalling the density of 1815 vines per hectare. The vines were trained to flat roof gable system of training with horizontally placed cordons. The distance between two cordons was maintained at 60 cm so as to receive uniform sunlight required for effective bud differentiation. In this region, the vines are pruned twice in a year i.e. double pruning and single cropping pattern is followed for grape cultivation. During both the pruning, all the standard recommended cultural practices were followed to maintain the vines healthy and fruitful.

III. Plant Material

The leaf samples were obtained from the vines of Thompson Seedless grafted on different rootstocks and own root at different phenological stages. To study the amino acid content, fully developed and recently matured leaves were selected from current season's growth (usually the fifth and sixth leaf from apex). The leaf samples were collected from three-leaf stage till harvest.

a) Sampling

The leaf samples were collected randomly in all the four replications from ten mother vines of each rootstock at every stage from berry setting till harvest. The leaf samples were packed in polythene bag and brought to laboratory in ice box for further analysis. The samples were then washed thoroughly with distilled water, air-dried and stored at -20°C prior to extraction and analysis. The berries were also collected at harvest to study the quality of Thompson Seedless grapes grafted on different rootstocks. The berries were then crushed in mixer cum grinder and the total soluble solids were recorded using hand refractometer. The model used for TSS analyzing was Erma Inc., Tokyo, Japan. The sampling for amino acid estimation in leaf was done at following stages.

Sampling stage	Growth stage of vine
1 st	Berry setting stage
2 nd	6-8 mm berry stage
3 rd veraison stage	

Harvest stage

4th

b) Extraction and sample preparation

While preparation of the samples, 1g of crushed sample was taken into polypropylene tube containing 5 ml of 0.1% formic acid in 20% methanol. After vortexing, the mixture was centrifuged at 5000 rpm for 5 minutes. One ml supernatant was taken in Eppendorf tube and again centrifuged at 10,000 rpm under 4°C for 10 min. A supernatant was filtered through 0.2μ m-membrane filter (Pall life sciences, India) and the filtrate was used for analysis.

c) Biochemical Analysis-(amino acids and phenolic compounds)

HPLC (Perkin Elmer 200 series) coupled to mass spectrometer (API 2000 Applied Biosystem, Canada) equipped with electro spray ionization (ESI+) probe and a chromatographic column, Zorbax SB C-18 (4.6mmx50mmx1.8 μ m, Agilent technologies), was used with 1.0 ml/min flow rate (with split) to analyse amino acids (Fig.1). The mobile phase A was made of 0.1% formic acid in water: Methanol (95:5) and Phase B was of 0.1% formic acid in water: Methanol (5:95). A gradient

programmed consist of 0-1min 95% phase A, 1-10min 95-2% A phase, 10-13min 2% A phase, 13-14min 2-95% A phase, 14-20 min 95% A phase. A total run time was 20 min with oven temperature 30°C, curtain gas 20 psi, ion spray voltage 5500V, source temperature 450°C, nebulizer gas 30 psi and heater gas 60 psi.

A HPLC (1200 series Agilent Technologies, Singapore) coupled to mass spectrometer (API 4000Qtrap, Applied Biosystem, Canada) equipped with electro spray ionization (ESI+) probe. A chromategraphic column, Atlantis dC-18 (2.1 mmx100mmx5 μ m, Waters India Itd, Bangalore), was used with 0.4 ml/min flow rate to analyze phenolic compounds (Fig 2). The mobile phase A was made of 0.1% formic acid in water: Methanol (95:5) and Phase B was of 0.1% formic acid in water: Methanol (5:95). A gradient programmed consist of 0-1min 95% phase A, 1-10min 95-2% A phase, 10-13min 2% A phase, 13-14min 2-95% A phase, 14-20 min 95% A phase. A total run time was 20 min with oven temperature 30°C, curtain gas 20 psi, ion spray voltage 5500V, source temperature 550°C, nebulizer gas 30 psi and heater gas 60 psi.



Figure 1 : Standard Graph of amino acids



Figure 2: Standard graph of phenolic

d) Statistical analysis

The biochemical parameters estimated at different growth stages in different rootstock was analyzed statistically using SPSS program and presented in table and figures.

IV. Results and Discussion

The data collected on various quality parameters of Thompson Seedless grapes grafted on different rootstock are presented in Table 1. Significant differences were recorded for days taken to bud sprout and berry characters. Own rooted vines were early to sprout as compared to the grafted vines. Yield per vine was higher on 110-R rootstock grafted vines than other rootstocks. The differences for total soluble solids (TSS) among the rootstocks were significant. Higher TSS was recorded in 1613-C grafted vines as compared to other vines. The proline content was also higher in the same rootstock at the time of harvest. These results are in accordance with the results obtained by Sampaio et al, (2006) who reported an influence of rootstocks on anthocyanin profile, gas exchange parameters, total soluble solids and pH of Merlot wine grapes. Genetically and environmental variation in fruit traits have been reported for grapes (Sato et al. 2000; Wei et al. 2002; Liu et al 2007). These studies demonstrate that commercially important fruit traits such as berry ripening time, berry weight are quantitative and fluctuate due to environmental factors.

a) Phenolic status in leaf

The data collected on phenolic status in leaf at different growth stages is presented in Table 2. Significant differences were recorded for phenolic content in different rootstocks. At berry setting stage, the total phenolic content was higher in Thompson Seedless vines grafted on Dog Ridge rootstock and was followed by 1613-C whereas own rooted Thompson Seedless had less phenol accumulation in the leaf. At 6-8 mm berry development stages, the phenol content in leaf was reduced in all the rootstocks. The trend of decrease in phenols from berry setting stage to 6-8mm berry stage was same in all the rootstocks studied. The increase in phenol from 6-8mm to veraison stage and sudden decrease at the time of harvest was observed in all the rootstocks. At harvest, the phenol content in leaf was higher in own rooted vines as compared to the grafted vines. This might be due to the variation in geneticalmake-up of the plant. Phenolic content in plant depends on a number of genetic, agronomic, environmental, postharvest handling and storage factors (Tomas-Barberan and Espín, 2001). Many epidemiological studies showed that phenolic compounds have beneficial effects on human health due to their antioxidant activity (Fang et al., 2002).

Among the individual phenolic compounds, variation in the concentration of different phenols at growth stages was recorded. different Epicatechingallate was found in very small quantity among all the phenolic compounds. The increase of epicatechingallate in leaf was recorded at veraison but later it reduced to almost nil in majority of the rootstocks. The same trend was observed for caffeic acid, guercetin, ellagic acid, resevatrol and catechin. The phenolic compound viz., trans-Piceatannol was found to be increasing from veraison to harvesting in majority of the rootstocks except in 110-R and own rooted vine where it was reduced at harvest. The reduction of phenolic compound from veraison to harvest was also recorded in Quercetrin hydrate and rutin hydrate. However, in syringic acid, vanillic acid and myrecetin, the tremendous increase was noticed in all the rootstocks. At harvest, the quercetin was lowest in Dog Ridge rootstock whereas higher quantity was recorded in 1613-C rootstock.

b) Total amino acid content in leaf

Total leaf amino acid content of individual rootstock at four major growth stages was estimated to compare the amino acid accumulation pattern among the different rootstocks. Total amino acid content was expressed as summation of nineteen amino acids analyzed in leaf samples (Table 3). The data showed major differences in the amino acid accumulation pattern among the grape rootstocks indicating the existence of wide range of variation. Among the different rootstocks, significant differences were recorded for total amino acid content in the leaf at different growth stages. At berry setting stage, the vines grafted on Dog Ridge rootstock had lowest total amino acid in leaf followed by 1613-C rootstock whereas the maximum amino acid was recorded in the leaf of 110-R rootstock. The increase in amino acid from berry setting stage to 6-8 mm berry stage was maximum in the leaf of 1103-P grafted vines and was followed by 1613-C rootstock grafted vines whereas in 110-R rootstock, the decrease in amino acid content from berry setting to 6-8mm berry stage was recorded. The increase in total amino acid content in leaf from 6-8mm berry stage to veraison was recorded in the vines grafted on 110-R rootstock whereas reduction in total amino acid was recorded in the vines grafted on 1103-P, 1613-C, Dog Ridge and also own rooted Thompson Seedless. However, at harvest stage, maximum reduction in amino acid was recorded in all the rootstocks with lowest in 1613-C grafted vines. Methionine estimated in leaf was almost absent at all the stages but was reported in small quantity at harvest stage. The changes in the concentration of amino acid content at different berry development stages might be due to the response of individual rootstock or their graft combination. Factors

including cultivar, rootstock/scion combinations, vine nutrient management, vineyard site and growing season affect the amino acid concentration within grapes (Bell andHenschke, 2005; Gump et. al, 2002; Rodrigueze-Lovelle & Gaudillere, 2002).

It was observed that the variation in amino acid content in different grape rootstocks was phenological stage specific. The quantity of amino acid was found to be increased or decreased from one stage to another and was more specific in different rootstocks. This clearly shows that individual rootstock has a capacity to synthesize their food differently. The grafting of scion on different rootstock must have influenced the physiological processes in the scion that has resulted into changes in amino acid content at different concentration. As the phenology and biochemistry of rootstock vary under similar set of condition, the biochemical as well as physiological composition of mother vine might be playing role in propagation, growth and development of a vine, water use efficiency, pest and disease tolerance and ultimately the quality of the grapes (Staudt, 1997). Satisha and Prakash (2006) in their studies also reported inherent capacity of each rootstock to synthesize biochemical constituents, which influence scion physiology either directly or indirectly after grafting.

Nasar and Kliewer (1966) reported three to eight fold increase in total amino acid content during four stages of growth in Thompson Seedless grapes. A number of reviews show ranges in concentration of amino acids (Gallander, 1974). Pandyet al. (1974) reported that continuous increase of total amino acid content right from the time of anthesis. The rate of increase was rather slow in the beginning, but accelerated after a lag phase (stage II) of berry development. Glutamic acid was the predominant amino acid in stage I, aspartic acid in stage II and arginine in stage III. In stage III there were massive increases in several amino acids. The ripening process was observed to be intimately associated with the metabolism of arginine, proline and glutamic acid. The proline level in particular increased at the height of the ripening process

c) Individual amino acid status in leaf

The changes in amino acids of individual group in the leaf of different rootstocks estimated at different growth stages were recorded. The concentration of alanine, glutamic acid, aspartic acid and arginine was highest as compared to other amino acids in all the rootstocks and at all the different phenological growth stages. The result obtained in this study confirms the findings of Pandy et al (1974) who reported that glutamic acid, aspartic acid and arginine were the major predominant amino acids. Arginine was found to be increased in leaf from veraison to harvest stage in almost all the rootstocks including own rooted vines. Highest amount of alanine was recorded in 110-R rootstock at berry setting stage whereas Dog Ridge had very less quantity of alanine.

With the advancement of berry veraison stage, alanine concentration in the leaf was found to be increased in majority of the rootstocks, with highest quantity recorded in 110-R at berry setting stage, however, the least amount was observed in Dog Ridge and own rooted vines of Thompson Seedless. The sample analyzed at the harvest was found that the alanine concentration was reduced in majority of the rootstock. These results are in accordance with the findings of Ough and Amerine, 1966; Kliewer, 1968, 1969, 1970, Shiraishi et al, 1986; Huang and Ough, 1989, 1991. Among the predominant amino acids, alanine is produced in large amounts and becomes one of the most abundant amino acid in plant roots under hypoxic conditions. The concentration decreases after the plants were returned to normal oxygen conditions. Upon return to normal oxygen conditions, alanine degradation releases the stored nitrogen and carbon pool (Miyashita et al, 2007).

Variation in aspartic acid content in leaf was recorded among the different rootstocks. A drastic reduction of aspartic acid from berry setting stage to 6-8 mm berry development stages was noticed in all the rootstocks. There was again increase in the concentration at vearison stage and reduced to maximum at harvest. Aspartic acid, a non- essential amino acid, by transamination acts as the precursor of essential amino acids lysine, threonine, methionine and isoleucine in higher plants (Shiraishi et al, 1986). It gets incorporated into purine and pyrimidine biosynthesis pathway in the form of Carbamyl-L-Aspartic acid. Collins and Gaunt (1970) in their studies on Rape, Red Campion and Peas showed that during detoxification of herbicide. 4-chloro-2-phenoxyacetic the (MCPA). aspartic acid gets conjugated with MCPA and forms MCPA-aspartic acid which had growth promoting activity. Beside these some of physiological roles, at molecular level, an invariant aspartic acid has been found in the active site of enzyme DNA glycosylaseenzyme that initiate repair of DNA by excising damaged or mispaired bases. Replacement of this residue reduces the catalytic activity of an enzyme (Yeonhee Choi et al, 2004).

The arginine content in leaf varied significantly among the different rootstocks. The concentration of arginine was found to be increased from veraison to harvest stage in all the rootstocks and own rooted vines studied. These results supports the findings of Kliewer (1968) who reported that concentration of arginine usually increased rapidly during the ripening period. Arginine, in addition to serving as an important nitrogen reserve, participates in various physiological processes through nitric oxide pathway. Rabe and Lovott (1986) showed that white roots and young leave exhibit higher levels of arginine metabolism than brown roots and mature leaves, respectively. As both polyamines and nitric oxide are multifunctional molecules involved in plant development and stress response, it is possible to conclude that the unique physiological role of arginine in plants might be associated with the coordinated biosynthesis of both polyamines and nitric oxide via arginine metabolism (Azevedo et al, 2006). Rabe and Lovott (1986) showed phosphorus deficiency causes the plants to accumulate arginine.

Proline accumulation also varied significantly among the different rootstocks. It was increased from berry setting stage to 6-8mm berry stage, however sharp reduction upto harvest stage in proline content was recorded. In the initial growth stage, higher amount of proline was recorded in the leaf of 110-R rootstock and lowest in 1613-C rootstock. On the other hand, Kliewer, (1968) reported in their study that proline, generally increased very rapidlyduring the latter stages of ripening and during fruit senescence. Proline accumulation is common metabolic response of higher plants to water deficit and salinity stress (Ashraf and Foolad, 2007) and has numerous reviews over the last 20 years (Stines et al, 1999; Yang et al, 1999; Singh and Gupta, 1983; Thomas et al, 1992; Taylor, 1996; Rhodes et al, 1999).

It was observed in the study that when the proline content in leaf started decreasing, the arginine content was increased during harvesting stage. Grape cultivar differs from one another in the amount of certain amino acid (Orte et al, 1999). The amino acid profile of juice from a given grape cultivar from the same location is generally similar from one year to another, but the concentration of individual amino acid varied from year to year (Huang and Ough, 1991). This might be due to the seasonal effect of variety. However, Satisha et al, (2010) reported increase in berry proline content during the start of maturity, there was reduction in arginine content.

Methionine was found to be almost in negligible guantity in all the rootstocks before harvest. At harvest stage, higher quantity of methionine was recorded in the leaf of Dog Ridge grafted vines. This sudden appearance of methionine at harvesting stage is due to the fact that, it is the precursor of ethylene, a ripening hormone, whose synthesis starts at the time of harvesting. Methionine is used at multiple levels in cellular metabolism:as а protein constituent, intheinitiation of mRNA translation, and as a regulatory molecule in the form of S-adenosylmethionine(SAM). SAM itself has key functionsas a primary methyl-group donor and as a precursor for metabolitessuch as ethylene (by Yang cycle), polyamines, vitamin B1, 3dimethylsulphoniopropionate (an osmo protectant), and

as a source of atmospheric sulphur:dimethylsulphide (Amir *et al.*, 2002). A derivative of Met, *S*-methylmethionine(SMM), is used as a major transport molecule for reduced sulphurin some plant, connecting sink and source organs (Bourgis*etal.*, 1999). Glutamic acid was the main amino acid in Thompson Seedless grapes (Kliewer, 1968). However, research suggests that rootstocks can strongly affect free amino-N concentrations in the fruit of the scion (Sponholtz, 1991).

Amino acid pattern of grape berries have been extensively examined and was found that varietal differences in the pattern are frequently found within vitis cultivars (Kliever, 1969, 1970; Gallander, 1974; Kluba et al., 1978; Huang and Ough, 1991; Shiraishi, 1996). As per Lamikanra and Kassa (1999) the concentrations of most of the major amino acids (alanine, glycine, histidine, valine, isoleucine, aspartic acid, and serine) were highest at verasion. Glutamine and threonine contents dropped sharply after fruit set, while those of arginine and proline increased gradually with maturity and ripening. Amino acids in addition to being the structural components of protein are one of the classes of organic compounds through which nitrogen can be encased by the plant during the growth and development.

V. Conclusion

A study on status of phenols and amino acid in leaf of Thompson Seedless grapevine grafted on different rootstocks was conducted. It was evident from the study that phenol concentration was varied from one stage to another. The increase from 6-8mm to vearison stage and again sudden decrease at all the time of harvest was observed in all the rootstocks. At berry setting stage, the vines grafted on Dog Ridge rootstock had higher phenols followed by 1613-C whereas the own rooted vines had less phenols.

References Références Referencias

- Anonymous. (2012). Grapes. In: Indian Horticulture Database 2011.Eds. Kumar, B.; Mistry, N. C.; Singh, B. and Gandhi, C. P., National Horticulture Board, Gurgaon, India.:68-75.
- Amellai, M., Bronner, C., Braincon, F., Haag, M., Anton R. and Landry, Y. (1985). Inhibition of mast cells histamine release by flavonoids and bioflavonoids. PlantaMedica, Feb (1): 16-20.
- Amir, R., Hacham Y and G. Galili(2002). Cystathionine ?-synthase and threonine synthase operate in concert to regulate carbon flow towards methionine in plants. Trends in Plant Science. 7:153–156.
- 4. Ashraf, M. and Foolrad, M.R. (2007). Role of Glycine betaine and Proline in improving plant abiotic stress resistance. Environmental and Experimental Botany.59:206-216.

- 5. Azevedo, R.A., Lancien, M. and Lea, P.J. (2006). The aspartic acid metabolic pathway, an exciting and essential pathways in plants. Amino acids, 2006 Mar. 30(2):143-62.
- 6. Bagchi, D., Garg,A. and Krohan, R. L. (1998). Protective effect of grape seed proanthocyanidins and selected antioxidants against TPA- induced hepatic and brain lipid peroxidation and DNA fragmentation and peritoneal macrophage activation in mice. General Pharmacology. 30: 771-776.
- Bell, S. and Henschke, P.A. (2005). Implication of nitrogen nutrition for grapes, fermentation and wine. Australian Journal of Grape and Wine Research.11:242-295.
- 8. Bourgis, F., Roje, S., Nuccio, M.L., et al. (1999). Smethylmethionine plays a major role in phloem sulphur transport and is synthesized by a novel type of methyltransferase. The Plant Cell 11:1485–1497.
- 9. Castor, J.G.B. (1953). The B-Complex vitamins of musts and wines as icrobial growth factors. Appl. Microbiol. 1:97
- 10. Castor, J.G.B. and Archer, T.E.(1956). Aminoacids in must and wines,proline,serine and threonine.Amer.j.Enol.7:19-25.
- Catterall, S., Souquet, J. M., Cheynier, V., M. N. Clifford and C. Ioannides. (2000). Modulation of the mutagenicity of food carcinogens by oligomeric and polymeric procyanidins isolated from grape seeds: synergistic genotoxicity with nitrosopyrrolidin. Journal of the Science of Food and Agriculture. 80: 91-101.
- 12. Cimato, A., Mattei, A. and Osti, M. (1990). Variation of polyphenol composition with harvesting period. Acta Horticulture. 286:453-456.
- 13. Collins, D. J. and Gaunt, J. K. (1970).The metabolism of 4-chloro-2-phenoxyacetic acid in plants. Biochem. J. 118:54.
- 14. During, H. (1994). Photosynthesis of ungrafted and grafted grapevines: effects of rootstock genotype and plant age. Amer. J. Enol. Viticult. 45:297-299.
- Ecarpa, A. and Gonzalez, M. C. (2001). An overview of analytical chemistry of phenolic compound in foods. Critical Review of Analytical chemistry. 31: 57-139.
- 16. Fang, Y.Z., Yang, S. and Wu, G. (2002). Free radicals, antioxidant and nutrition. Nutrition 18:872–879.
- Gallander, J. F. (1974). Chemistry of grapes and other fruits as the raw material involved in wine making. In: A. D. Webb (ed). Chemistry of winemaking. Amer. Chem. Soc., Washington D. C: 11-49.
- 18. Gump, B.H., Zoecklein, B.W., Fugelsang, K.C. and Whiton, R.S. (2002). Comparison of analytical

methods for prediction of prefermentation nutritional status of grape juice. American journal of Enology and Viticulture. 53:325-329.

- 19. Huang, Z. and Ough, C. S. (1991). Amino acid profile of commercial grape juices and wine. Am. J. Enol. Vitic.42: 261-267.
- 20. Haung, G. and Ough, C.S. (1989). Effect of vineyard location, varieties and rootstocks on juice amino acid composition of several cultivars. Amer. J. Enol. Viticult.40:135–139.
- Liviero, L. and Puglisi, P. P. (1994). Antimutagenic activity of procyanidins from Vitisvinifera Fititerapia. LXV: 203- 209.
- 22. Kliewer, W.M.(1968). Changes in the concentration of free amino acids in grape berries during maturation. Am. J. Enol. Vitic. 19 (3):166-174.
- 23. Kliewer, W.M. (1969). Free amino acids and other nitrogenous substances of table grape cultivars. Journal of Food Science.34:274-278.
- 24. Kliewer, W.M. (1970). Free amino acids and other nitrogenous fractions in wine grapes. Journal of Food Science.35:17-21.
- 25. Kluba, R. M., Mattick, L. R. and Hackler, L. R. (1978). Changes in free and total amino acid composition of several Vitislabruscana grape cultivars during maturation. Am. J. Enol. Vitic. 29:102-111.
- 26. Kubo, I. and Matsumoto, A. (1984). Molluscides from olive oleaeuropaea and their efficient isolation by countercurrentchromatographies. Journal of Agril and Food Chemistry. 32:687-688.
- 27. Lamikanra, O. and Kassa, A. K.(1999).Changes in the Free Amino Acid Composition with Maturity of the Noble Cultivar of VitisrotundifoliaMichx. J. Agric. Food Chem.47 (12):4837–4841.
- 28. Matejicek, D., Klejdus, B., Mikes, O., Sterbova, D. and Kuban, V.(2003). Application of solid phase extraction for determination of phenolic compound in barrique wines. Analytical and Bioanalytical Chemistry. 377: 340- 345.
- 29. Maxcheix, J. J., Fleuriet, A. and Billot, J. (1990). The main phenolics of fruits. Journal of Fruit Phenolics. 1-98.
- Mikes, O., Vrchotova, N., Triska, J., Kyselakova, M. and Smidrkal, J. (2008). Distribution of major polyphenolic compounds in the wine grapes of different cultivars growing in South Moravian vineyards. Czech. J. Food Sci. 26(3): 182-189.
- Miyashita, Y., Dolferus, R., Ismond, K.P., Good,A.G. (2007). Alanine aminotransferase catalyses the breakdown of alanine after hypoxia in Arabidopsis thaliana. Plant J. 49 (6):1108-1121.
- 32. Nasar, A.R. and Kliewer, W.M. (1966).Free aminoacids in various parts of *Vitisvinifera* at

different stages of development .Pro .Amer.Soc. Hort.Sci.89:281-294.

- Ough, C.S. and Amerine, M.A. (1966). Fermentation rates of grape juice. IV. Compositional changes affecting prediction equations. American journal of Enology and Viticulture, 17: 163-173.
- 34. Orte, P.H., Guitart, A., and Cacho, J. (1999). Changes in the concentration of amino acids during the ripening of *Vitisvinifera* Tempranillo variety from the De'nominationd'OrigineSomontano (Spain). Amer. J. Enol. Viticult.50:144–154.
- 35. Pandey,R.M.,Rao,M.M and Singh, R.N. (1974). Studies on the metabolism of amino acids during development,ripening and senescence of 'Pusa Seedless' grapes Scientia Hort.2(4):383-388.

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- Rabe, E. and Lovott, C. J. (1986). Increased arginine biosynthesis during phosphorus deficiency. Plant Physlol, 81:774 - 779.
- Rhodes, D. and Verslues, P.E. (1999). Role of amino acids in abiotic stress resistance. In (BK Singh Ed.). Plant Amino Acids: Biochemistry and Biotechnology. Marcel Dekker, NY: 319-356.
- Rodriguez-Lovelle B.and Gaudillere, J. (2002). Carbon and nitrogen partitioning in either fruiting or non-fruiting grapevines: Effect of nitrogen limitation before and after veraison. Australian Journal of Grape and Wine Research. 8:86-94.
- Satisha, J., and Prakash, G.S. (2006). The influence of water and gas exchange parameters On grafted grapevines under conditions of moisture stress. South Afr. J.Enol. Viticult. 27:40–45.
- Sampaio, T., Kennedy, J. and Vasconcelos, C. (2006). Effect of rootstocks on anthocyanins and tannins in grapes and wines. Amer. J. EnolViticult. 57:534–537.
- Somkuwar, R. G., Satisha, J. and Ramteke, S. D. (2006). Effect of different rootstocks on fruitfulness in Thompson Seedless grapes. Asian J. Plant Sciences. 5(1): 150-152.
- 42. Satisha, J., Somkuwar, R. G., Sharma J, Upadhyay A K and Adsule P G. (2010). Influence of rootstocks on growth yield and fruit composition of Thompson Seedless grapes grown in the Pune region of India. South African Journal of Enology and Viticulture 31(1):1-8.
- 43. Singh, B.B. and Gupta, D.P. (1983). Proline accumulation and relative water content in Soyabean (Glycine max) varieties under water stress. Annals of Botany. 52:109-110.
- Sato, A., Yamada, M., Yamane, H. and Hirakawa, N. (2000). Optimal spatial and temporal measurement repetition for reducing environmental variation of berry traits in grape breeding. Sci. Hort.85:75-83.
- 45. Staudt, G.(1997). Evaluation of resistance to grapevine powdery mildew (*Uncinulanecator*) in accessions of Vitis species. Vitis 36:151-154.

- Stines, A.P., Naylor, D. J., Høj, P. B., van Heeswijck R. (1999). Proline accumulation in developing grapevine fruit occurs independently of changes in the levels of D1-pyrroline-5-carboxylate synthetase mRNA or protein. *Plant Physiol*, 120: 923 –931.
- Shiraishi, Shin-ichi., Sumi,Toshiaki. andNotsuka, Kazunori. (1986). Changes in the chemical constituents of three table grape varieties during maturation in Japan. J. Japan. Soc. Hort. Sci. 55 (1):15-21.
- 48. Shiraishi, M. (1996). Proposed biochemical descriptors for amino acid to evaluate grape germplasm. J. Japan. Soc. Hort. Sci. 65: 283-289.
- 49. Sponholtz, W.R. (1991). Nitrogen compounds in grapes must and wine. Proceedings of the International Symposium on Nitrogen in Grapes and Wine, Seattle, Washington, USA, June 18-19:67-77.
- 50. Taylor, C.B. (1996): Proline and water deficit: ups and downs. Plant Cell 8:1221-1224.
- 51. Staudt, G. 1997. Evaluation of resistance to grapevine powdery mildew (Uncinulanecator) in accessions of Vitis species. Vitis 36:151-154.
- 52. Wei, X., Sykes, S. R. and Clingeleffer, P. R. (2002). An investigation to estimate genetic parameters in CSIRO's table grape breeding program. 2. Quality characteristics. Euphytica. 128:343-351.
- 53. Wolf, T.K. and Pool, R.M. (1988). Effects of rootstock and nitrogen fertilization on the growth and yield of Chardonnay grapevines in New York. Amer. J. Enol. Viticult. 39:29-33.
- Liu, H. F., Wu, B. H., Fan, P. G., Xu,H. Y. and Li,S. H. (2007). Inheritance of sugar and acids in berries of grape. Euphytica. 153: 99-107.
- 55. Thomas, J.C, De Armond R.L., Bohnert, H.J.(1992). Influence of NaCl on growth, Proline and Phosphoenolpyruvate carboxylase levels in Mesembryanthemumcrystallinum suspension cultures. Plant Physiol. 98: 626-631.
- 56. Tomas-Barberan, F., Espin, J.C., 2001. Phenolic compounds and related enzymes as determinants of quality of fruits and vegetables. J. Sci. Food Agric. 81:853–876.
- Treeby, M.T., Holzapfel, B.P., Walker, R.R. and Nicholas, P.R. (1998). Profiles of free amino acids in grapes of grafted Chardonnay grapevines. Austral. J. Grape and Wine Res. 4:121-126.
- Yang, C.-W., Lin, C.C. and Kao, C.H. (1999). Endogenous ornithine and arginine contents and dark-induced proline accumulation in detached rice leaves. J. Plant. Physiol. 155: 665–668.
- Yeonhee, Choi., Harada, John J., Goldberg, Robert, B., and Fischer, Robert L. (2004).An invariant aspartic acid in the DNA glycosylase domain of DEMETER is necessary for transcriptional activation of the imprinted MEDEA gene. ProcNatlAcadSci U S A. 101(19): 7481–7486.

	days taken for sprout	Berry Diameter (mm)	Acidity (%)	Juice pH	Yield / vine(Kg)	Av. Bunch Wt. (g)	T S S (0Brix)
110 R	14.68	16.23	0.48	3.55	16.35	348.61	21.13
1103 P	16.12	15.40	0.49	3.72	11.02	297.86	20.73
1613 C	13.28	15.03	0.46	3.77	6.35	286.33	21.53
Dog Ridge	23.16	16.13	0.54	3.70	13.17	337.20	21.20
Own root	10.76	14.60	0.51	3.63	9.38	243.12	21.26

Table 1 : Quality parameters of Thompson Seedless grapes grafted on different rootstock

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Table 2 : Phenolic content in leaf of Thompson Seedless grapes grafted on different rootstocks at different growth stages

Bootetooke	etadoe	ic II	Caffoin	+	Enicatochin	Chlorocorio	d	Oueroetrin	Ditio	Curindia	Vanillo	Oueroetin	Flacio	Beeveratrol	Catachin	Kamnafarn	Muracatin
	200	gallate	acid	Piceatannol		acid	Coumaric	hydrate	hydrate	acid	acid		acid	0			
		0:30	0.75	1.59	0.40	0.00	0.30	73.00	78.80	0.10	1.57	2400	89.70	0.00	0.26	6.04	2.43
	2	0.00	3.92	0.97	0.10	0.00	2.13	55.80	132.00	0.24	0.26	2230	58.90	0.14	0.00	11.20	2.14
	ო	0.58	8.59	1.15	1.05	0.30	5.60	64.30	161.00	0.73	1.19	3560	115.00	0.67	1.72	4.45	0.00
	4	0.00	0.13	0.97	0.37	0.00	1.75	51.20	56.90	0.94	1.90	1860	8.50	0.03	0.00	1.15	3.20
	, -	0.30	0.77	06.0	0.44	0.00	0.23	78.70	82.50	0.09	1.33	2400	149.00	0.00	0.22	5.05	2.52
	2	0.22	2.94	0.59	0.17	0.00	2.97	154.00	116.00	0.31	0.74	2310	121.00	0.20	0.00	9.52	2.78
1001	ო	0.38	5.11	0.15	4.12	0.24	3.83	201.00	195.00	0.81	1.75	3530	76.00	0.63	1.24	4.10	1.41
	4	0.00	0.12	1.69	0.52	0.00	0.65	25.70	61.70	0.99	2.45	2070	0.00	0.00	0.08	0.00	3.49
	-	0.35	1.13	1.13	0.41	0.00	0.50	69.50	99.50	0.05	1.25	2610	111.00	0.00	0.24	4.60	2.79
	5	0.27	7.46	2.19	0.06	0.20	3.65	62.00	110.00	0.02	0.30	2620	82.60	0.52	0.18	7.85	2.23
10130	ო	0.65	9.85	1.25	4.14	0.23	6.55	63.70	216.00	1.13	1.32	4320	194.00	1.16	5.16	14.70	0.98
	4	0.24	0.37	1.54	1.69	0.00	0.72	34.80	125.00	1.59	0.24	2820	23.40	0.42	0.38	1.08	0.00
	-	0.25	0.78	0.94	0.36	0.00	0.27	75.30	88.70	0.00	1.00	2620	153.00	0.00	0.19	6.11	1.92
Dog	2	0.24	6.26	0.46	0.12	0.18	2.94	62.00	130.00	0.07	0.51	2510	87.20	0.47	0.12	5.51	1.39
Ridge	ო	0.70	7.31	0.66	5.29	0.27	2.89	65.20	180.00	0.72	1.30	3830	64.20	0.29	2.46	6.48	2.47
	4	0.00	0.07	0.67	0.41	0.00	3.63	26.30	46.20	0.97	0.78	1650	22.60	0.60	00'0	0.48	3.94
	،	0.34	0.80	0.94	0.35	0.00	0.36	78.50	72.70	0.08	1.56	2240	126.00	00.00	0.24	3.97	3.19
	2	0.24	9.47	0.83	0.06	0.18	2.90	77.40	162.00	0.20	0.32	2830	8.56	0.53	0.00	8.44	0.00
	ო	1.01	14.70	0.98	2.42	0.35	6.05	63.00	218.00	0.69	0.12	4230	127.00	0.31	3.48	6.38	1.40
	4	0.00	0.02	0.67	0.30	0.00	0.87	30.40	76.50	0.71	1.11	2530	22.90	0.28	0.00	0.80	5.50

Table 3 : Status of amino acids present in leaf of Thompson Seedless grapes grafted on different rootstocks at different growth stages

Serine	16.4	0	6.65	35.85	0	6.35	0	3.1	0	25.75	2.745	0	0.995	0	0	6.7	4.05	13.55	0	11.4
Aspartic acid	36.95	16.4	13.35	15.2	18.6	88.5	0.795	13.45	16.6	43.65	8.25	6.85	13.1	40.65	8.35	23.2	23.55	46.1	8.8	13.6
Phelethla	101.5	5.0	8.2	1.745	109	6.15	2.185	1.18	128	9.15	5.2	2.055	93.5	9.6	14.6	0.75	112.5	9.6	9.35	0.73
Valine	70.5	61	24.75	30.85	39.2	330.5	2.24	26.3	37.45	166.5	23.35	26.2	27.85	123.5	14.6	33.9	52	184.5	16.75	28.6
Tyrosine	21.8	79.5	14.3	27	14.5	378	0	11.8	11.35	317	13.3	4.795	17.25	113	10.1	20.8	12	169.5	12.25	21.05
Tryptophan	0.89	0	2.725	4.78	0.0	10.95	0	4.455	0.327	2.915	3.83	5.75	0.735	0.71	1.87	6.15	0.895	2.195	2.115	4.3
Serine	260.5	27.3	94	28.1	179	57	15.5	30.05	137	47.85	121	13.65	126.5	63	80.5	45.3	196	88.5	115	36.1
roline	76	89	83	83	54	213.5	66.5	91.5	51.5	137	92.5	06	62	116	86	83.5	57.5	140.5	82	78.5
henylalnine	11.7	20.95	10.6	7.65	8.9	92.5	3.21	3.495	6.05	72.5	8.4	4.115	6.3	36.85	9.55	11.25	8.2	67	4.53	1.155
Drnithine P	9.5	7.8	4.56	5.3	7.25	3.955	0	9.25	11.45	15.25	2.255	11.85	7.1	11.3	0	17.5	9.75	5.2	8.85	3.76
Lyssine C	32.95	76.5	23.85	86	26.5	210.5	3.01	77.5	17.1	130.5	12.1	26	14.5	113	11.4	117.5	27.8	195.5	14.2	57.5
Leucine	99	33.75	21.9	17.55	36.15	135	5.25	16.25	22.75	93	17.05	10	35.45	59.5	10.2	19.2	50.5	96	9.5	16.1
Hydproline	26.25	0	3.645	0	15.25	0	0	0	18.75	0	0	0	21.75	2.96	1.33	0	21.85	2.265	3.285	0
Histidine	7.9	10.35	9.05	22.9	4.54	14.1	0.54	31.05	2.565	35.1	17.65	9.35	1.76	16.3	6.3	39.95	4.68	13.75	4.77	10.2
Alanine	189	220	225.5	128	114	1180	46.85	106.5	124	069	185	85.5	85.5	575	119	94	133	595	114	86
Glutamine	350	54.4	202	150.5	218.5	142	33.5	122	174	<u> </u>	406	20.5	156.5	91.5	348	182	229.5	74.5	431.5	169.5
Cystein	102.5	5	2.8	1.745	109	6.15	2.185	1.18	128	9.15	2.2	2.055	<u> </u>	9'6	14.6	0.75	112.5	9.6	35.95	0.73
Asparagin	332	19.35	328.5	61	176.5	102.5	48.05	74.5	147	55.5	473	52.5	91.5	66.5	228.5	63.5	177.5	77.5	187.5	53
Arginin	41.05	79.5	77.5	68	34.3	119.5	69	87.5	55.5	114	71.5	75	37.55	89.5	72.5	114.5	45.45	113.5	78.5	83.5
stages	-	0	ო	4	-	2	ო	4		0	ო	4		2	e	4		2	ო	4
Rootstock				110 R				1103 P				1613 C			Dog	Ridge			Own	root



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Effect of Local Isolate of *Bacillus Thuringiensis* on *Aedes Aegypti* Linn.and *culex Quinquefasciatus* Say Larvae

By Jessil Ann L. Pajar, Jing R. Bautista & Franco G. Teves

College of Science and Mathematics

Abstract - Ten millions more are killed and debilitated by a host of mosquito-borne diseases, including filariasis and dengue. One alternative measure of control involves the use of entomopathogen, *Bacillus thuringiensis* (Bt)—a gram positive spore-forming soil bacteria that produces δ -endotoxins, which make-up the crystalline inclusions as part of its metabolic process. In this study the local isolate of Bt was identified through its morphological and biochemical characteristics and was tested for toxicity against *Aedes aegypti* and *Culex quinquefasciatus* larvae. With concentrations 0.5, 1.0, and 3.0% of Btspore-crystal complex, samples were subjected to 24, 48, and 72h of exposure. In both species, the 72 h of exposure showed a mean difference of significance at the 0.05 level. Since the crystal proteins bind specifically to certain receptors in the insect's intestine, certain processes require a longer span of time to exhibit their effects on the mosquito species. Hence, the activity of Bt with respect to span of incubation had a significant effect on *A. aegypti* and *C. quinquefasciatus* larvae. Also, the results differed with respect to the species of tested mosquito.

Keywords : crystal proteins, dengue, endotoxin, entomopathogen, filariasis. GJSFR-C Classification : FOR Code: 060501

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Effect of Local Isolate of *Bacillus Thuringiensis* on *Aedes Aegypti* Linn.and *culex Quinquefasciatus* Say Larvae

Jessil Ann L. Pajar^a, Jing R. Bautista ^o & Franco G. Teves ^p

Abstract - Ten millions more are killed and debilitated by a host of mosquito-borne diseases, including filariasis and dengue. One alternative measure of control involves the use of entomopathogen, Bacillus thuringiensis (Bt)-a gram positive spore-forming soil bacteria that produces δ -endotoxins, which make-up the crystalline inclusions as part of its metabolic process. In this study the local isolate of Bt was identified through its morphological and biochemical characteristics and was tested for toxicity against Aedes aegypti and Culex quinquefasciatus larvae. With concentrations 0.5, 1.0, and 3.0% of Btspore-crystal complex, samples were subjected to 24, 48, and 72h of exposure. In both species, the 72 h of exposure showed a mean difference of significance at the 0.05 level. Since the crystal proteins bind specifically to certain receptors in the insect's intestine, certain processes require a longer span of time to exhibit their effects on the mosquito species. Hence, the activity of Bt with respect to span of incubation had a significant effect on A. aegypti and C. *auinauefasciatus* larvae. Also, the results differed with respect to the species of tested mosquito.

Keywords : crystal proteins, dengue, endotoxin, entomopathogen, filariasis.

I. INTRODUCTION

More of a growing concern over the past decade or so. They are prevalent in more than 100 countries, infecting 300-500 million people and causing about 1 million deaths every year (Zinsser, 1934).

During the 19th century, dengue was considered a benign sporadic disease that caused epidemics at long intervals but in the past five decades, the incidence was reported to have increased 30-folds (Sivanathan, 2006). Transmitted to humans through *Aedes* species, dengue outbreaks usually occur when mosquito is at its peak. Those infected with dengue can suffer from a spectrum of illnesses ranging from a viral flu to severe and fatal hemorrhagic fever (DHF).

Culex quinquefasciatus was identified as one of the mosquito species that plays a role in the transmission of lymphatic filariasis. Also known as elephantiasis, this mosquito-vectored disease is endemic throughout most of the southern half of the Philippine archipelago (Kron et.al, 2000).

At present, the best control methods for these vector borne diseases are based on vector control (Baird, 2000) primarily accomplished by using chemical insecticide which have been criticized because of the hazards it brought to the environment andits toxicity to non-target organisms, especially humans. Moreover, mosquitoes have already developed resistance to such insecticides.

One alternative measure of control involves the use of entomopathogens that are specific against certain pest species. One is *B. thuringiensis* (Bt), an ubiquitous, gram-positive, spore-forming bacterium that forms a parasporal crystal during the stationary phase of its growth cycle (Schnepf et al., 1998).Bt produces protienacious inclusions during sporulation that are toxic to insect larvae upon ingestion. These toxins are highly specific, harmless to humans, vertebrates and plants and are completely biodegradable, leaving no residual toxic products accumulate in the environment (Ibbara et. al., 2003).

A local isolate of *B.thuringiensis* was identified in this study through its morphological and biochemical characteristics and was tested for toxicity to *A. aegypti* and *C. quinquefasciatuslarvae.*

II. MATERIALS AND METHODS

a) Sample Collection

Soil samples were collected from three randomly selected sites at the Vegetable Garden in MSU-IIT, Iligan City. The surface layer of the soil was scraped off with hand shovel and was placed in a sterile plastic container.

b) Isolation of the Bacterial Strain

Isolation of Bt strain was conducted according to the method of Obeidat *et. al* (2004).

The suspensions were incubated at 30°C for 24 hours and after, the suspensions were placed in 80°C water bath for 15 minutes. As described by Travers *et al.*, this selection method eliminates most spore-forming bacteria and all non-sporeforming organisms in the soil sample.

Shaeffer-Fulton staining was done to determine the presence of endospores of Bt which differentiates it

Author α σ ρ : Department of Biological Sciences, College of Science and Mathematics, MSU-Iligan Institute of Technology, Iligan City, Philippines 9200. E-mail : jngbautista@gmail.com

from other Bacillus species. Microscopic observation was performed afterwards.

c) Cultural Method of Characterization of Bacterial Isolates

The following differential tests were performed following the identification flow charts on Bergey's Manual of Determinative Bacteriology: determination of oxygen requirement, starch hydrolysis, catalase test, Voges-Proskauer Test, and test on Triple Sugar Iron agar.

d) Isolation of Spores and Parasporal Crystals

A mass production of Bt in nutrient agar plates was done. The plates were incubated for 48 h in $30\pm2^{\circ}$ C. After incubation, 3-ml of sterile distilled water was added to each lawn and were scrapped off from the surface of the agar using a sterile inoculating loop. Using micropipette, the collected lawns were aseptically transferred into 50-ml centrifuge tubes. Sterile distilled water was added to make 10-ml of bacterial suspension and was centrifuged at 5000 rpm for 15 minutes. Pellets (spores and parasporal protein crystals) were washed twice with 10-ml sterile distilled water and centrifuged at 5000 rpm for 5 minutes. The pellets were oven dried at 40-60°C.

e) Identification of Mosquitoes

The mosquito larvae samples were collected from Barangay Puga-an andLuinab, Bahayan. Classification of *A. aegypti* and *C.quiquefasciatus* larvae, involves ocular inspection through its significant morphological characteristics (presence of hair in different body parts, structure of air tubes, number of hair in antenna and siphon, and etc.) which are unique among each species.

f) Larval Bioassay

The toxicity of the isolate was assayed in triplicate with three different concentrations for *C. quinquefasciatus* (0.5, 1.0 and 3.0%) and two different concentrations for *A. aegypti* (0.5% and 1.0%). Such concentrations were prepared by mixing 25ml of distilled water with 0.125g, 0.25g, 0.75g of the dried *B. thuringiensis* pellets for 0.5, 1.0 and 3.0% concentrations respectively. Fifteen larvae of *C. quinquefasciatus* and twelve larvae of *A. aegypti* for each replicate were placed in a glass container with their respective concentrations of *B. thuringiensis*. The larvae were incubated at 30°C and examined for 72 h in every 24 h interval.

III. Results and Discussion

The selection method by Obeidat *et. al.* applied on the isolation of bacterial strain eliminated most of the spore-forming bacteria and all non-sporeforming organisms in the soil sample. The entomopathogenic properties of Bt are due at least in part to the production of δ -endotoxins that make-up the crystalline inclusions characteristic of *B. thuringiensis* strains (Agaisse and Lereclus, 1995).

a) Analysis for A. aegypti

Twelve larvae per replicate were observed for mortality rate, treated with Bt with only two different concentrations (0.5% and 1.0%).

Figure 9 and 10 shows the development of adult *A. aegypti.* When exposed to 1.0% Bt spore-crystal concentration, the development slowed down which is not the usual trend for the *A. aegypti* because its pupal stage is short and usually last 1 to2 days (Lee, 2000). The number of dead larvae also increases with longer length of exposure for both concentrations.

b) Analysis for C. quinquefasciatus

Fifteen larvae per replicate were treated with three different concentrations of Bt spore-crystal complex and were observed for mortality rate every 24 h within three days.

Figure 5 shows the effects of the three concentrations on the mortality rate with respect to the span of time when the number of dead larvae was counted. The longer the length of exposure, the more larvae died. Hence, this figure shows that the length of exposure is directly proportional to the number of dead larvae. Larvae pupated more on 1.0% and 0.5% concentrations respectively, while development into adult is more prominent on 0.5% concentration.

c) Overall Analysis

The larvicidal effect of *B. thuringiensis* sporecrystal complex was compared for the two mosquito species. The patterns differ among species such that *C. quinquefasciatus* shows no trend since the mortality rate increased from the control to 0.5% concentration yet decreased from 0.5% to 1.0% concentration and increased again on the preceding concentration.

For both *C. quinquefasciatus* and *A. aegypti* larvae, species of mosquito and the incubation period are the factors that posed a significant effect on the mortality rates of the mosquito larvae as shown in Table 7. However, when statistically tested together, incubation and mosquito become insignificant. This implies that these factors had independent effects on the test performed.

Different processes occurred for each tested species due to the difference in the length of their development. The effects of the length of exposure varied with respect to species tested considering that *A. aegypti* has shorter life cycle than C. quinquefasciatus Laboratory studies showed that mosquito larvae require five to ten days for completion. Thus the variation of duration depends on temperature or larval diets (Hawley, 1988).

Bt is more toxic to *C.quinquefasciatus* at higher concentration and longer period of exposure. This entails that the mechanism through which Bt persist its effect on the mortality of the larvae is related to the gradual effect of the bacteria in the insect's intestine. Longer length of time is required to complete the process of gut integrity disruption and finally to the death of the insect larva from starvation or septicemia.

IV. Summary and Conclusion

Results indicate that the activity of *B. thringiensis* with respect to span of exposure has a significant effect on *A. aegypti* and *C. quinquefasciatus* larvae as well as to the development of the said mosquito species. Also, the results differ with respect to the species of tested mosquito. And so, different effects were exhibited on each tested mosquito, perhaps due to difference in the length of development of each tested species as well as the reported chitinase activity on *A. aegypti.* Furthermore, factors which was not given great emphasis in the study like water preferences of each species and specific age of the larvae, may have contributed to the outcome of the experiment.

References Références Referencias

- 1. Agaisse, H, Lereclus D (1995), How Does *Bacillus thuringiensis* produce So Much Insecticidal Crystal Protein? Journal of Bacteriology, p.6027-6032.
- Baird, JK (2000). Resurgent malaria at the millennium: Control strategies in crisis. Drugs. 59(4):719-743.
- 3. Hawley, WA (1988). The biology of *Aedes albopictus*. Journal of the American Mosquito Control Association. 1: 1-40.
- 4. Ibarra, J. *et al* (2003) Diversity of *Bacillus thuringiensis* Strains from Latin America with

Insecticidal Activity against Different Mosquito Species. American Society for Microbiology, p.5269-5274.

- 5. Kron, M, Walker, E, Hernandez, L, Torres, E, and Libranda-Ramirez, B (2000). Lymphatic Filariasis in the Philippines. Parasitology Today.16(8).
- Obeidat, M, Hassawi, D, and Ghabeish, I (2004). Characterization of *Bacillus thuringiensis* from Jordan and their Toxicity to the Lepidoptera, *Ephestia kuehniella* Zeller. African Journal of Biotechnology. Vol. 3(11): 622-626.
- Schnepf, E, Crickmore, N, Van Rie, J, Lereclus, D, Baum, J, Feitelson, J, Ziegler, DR, and Dean, DH (1998). *Bacillus thuringiensis* and Its Pesticidal Crystal Proteins. Microbiology and Molecular Biology Reviews. 62(3):775-806.
- Sivanathan, M M (2006). The Ecology and Biology of *Aedes aegypti* (I.) and *Aedes albopictus* (Skuse) 9Diptera;Culicidae) and the Resistance Status of *Aedes albopictus* (Field Strain) Asgainst Organophosphates in Penang, Malaysia. Master's thesis, University Sains, Malaysia.
- Smith B (2002). Interactions between Ipomea Spp (Del.) Benth. and fluorescent rhizosphere bacteria Of Zea mays, L. and *Sorghum bicolor* L. Moench for *Striga* suicidal germination In *Vigna unguiculata*. PhD dissertation, University of Fort Hare, South Africa.
- Travers, R, Martin P, Relchelderfer C (1987). Selective Process for Efficient Isolation of *Bacillus* spp. Appl. Environ. Microbiol. 53(6):1263-1266.
- 11. Zinsser, H (1934). Varieties of typhus virus and the epidemiology of the American Form of European typhus fever (Brill's disease). Am.J.Hyg. 20:513.



Figure 1 : Effects of the different concentrations of the isolated B. thuringiensis spore-crystal complex on the development of A. aegypti larvae into pupae with respect to length of exposure.



Figure 2 : Effects of the different concentrations of B. thuringiensis spore-crystal complex on the mean mortality rate of C. quinquefesciatus larvae with respect to length of exposure.

Table 1 : Two-way ANOVA test on the larvicidal activity of B. thuringiensis spore-crystal complex on A. aegypti and C. quinquefasciatus larvae.

Tests of Between-Subjects E	Effects
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Dependent Variable: Larvicidal activity

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	316.317ª	20	15.816	3.718	.000
Intercept	483.100	1	483.100	113.565	.000
treatment	17.481	3	5.827	1.370	.265
exposure	159.272	2	79.636	18.720	.000
mosquito	71.185	1	71.185	16.734	.000
treatment * exposure	6.963	6	1.160	.273	.947
treatment * mosquito	4.148	2	2.074	.488	.618
exposure * mosquito	9.481	2	4.741	1.114	.338
treatment *exposure * mosquito	2.519	4	.630	.148	.963
Error	178.667	42	4.254		
Total	1015.000	63			
Corrected Total	494.984	62			

a. R Squared = .639 (Adjusted R Squared = .467)



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Altitudinal and Seasonal Effect on Herbaceous Biomass in Tehsil Takht-e-Nasrati, District Karak, Pakistan

By Musharaf Khan & Farrukh Hussain

University of Peshawar, Pakistan

Abstract - To record the existing herbaceous biomass diversity of Tehsil Takht-e-Nasrati, Pakistan, field surveys were regularly conducted in spring, summer and winter 2009-2010. There was an increasing inclination of Biomass as of spring to winter. However, the collective amount of grasses and herbs Biomass (426.5 Kg.hec⁻¹) was significantly higher during spring at Stand 1 as compared to other seasons and Stands. The average grasses and herbs Biomass was decreasing with increasing altitude. The herb Biomass was high (730 Kg.hec⁻¹) during spring at Stand 1 and low during summer (194 Kg.hec⁻¹) at Stand 4. The grass Biomass was high during summer (173 Kg.hec⁻¹) at Stand 3 and less during winter (74 Kg.hec⁻¹) at Stand 1. The total herb mean Biomass was greater during spring (536.30 Kg.hec⁻¹) while the grass had (129.9 Kg.hec⁻¹) during summer. The total average Biomass was high at Stand 1 (262.58 Kg.hec⁻¹). The total mean and average Biomass of Tehsil Takht-e-Nasrati was 223.23 Kg.hec⁻¹. The Biomass of herbs helps to conserve the bio energy, chemical constituents and heat in existing area.

Keywords : herbaceous biomass, seasonal effect, altitudinal effect, Takht-e-Nasrati, pakistan. GJSFR-C Classification : FOR Code: 070304

ALTITUDINAL AND SEASONAL EFFECT ON HERBACEOUS BIOMASS IN TEHSIL TAKHT-E-NASRATI. DISTRICT KARAK. PAKISTAN

Strictly as per the compliance and regulations of :



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Altitudinal and Seasonal Effect on Herbaceous Biomass in Tehsil Takht-e-Nasrati, District Karak, Pakistan

Musharaf Khan^a & Farrukh Hussain^o

Abstract - To record the existing herbaceous biomass diversity of Tehsil Takht-e-Nasrati, Pakistan, field surveys were regularly conducted in spring, summer and winter 2009-2010. There was an increasing inclination of Biomass as of spring to winter. However, the collective amount of grasses and herbs Biomass (426.5 Kg hec⁻¹) was significantly higher during spring at Stand 1 as compared to other seasons and Stands. The average grasses and herbs Biomass was decreasing with increasing altitude. The herb Biomass was high (730 Kg.hec⁻¹) during spring at Stand 1 and low during summer (194 Kg.hec⁻¹) at Stand 4. The grass Biomass was high during summer (173 Kg.hec⁻¹) at Stand 3 and less during winter (74 Kg.hec⁻¹) at Stand 1. The total herb mean Biomass was greater during spring (536.30 Kg.hec⁻¹) while the grass had (129.9 Kg.hec⁻¹) during summer. The total average Biomass was high at Stand 1 (262.58 Kg.hec⁻¹). The total mean and average Biomass of Tehsil Takht-e-Nasrati was 223.23 Kg.hec⁻¹. The Biomass of herbs helps to conserve the bio energy, chemical constituents and heat in existing area. The herbaceous Biomass are also depends on the basis of altitude, seasonal variation, environment factors and soil types.

Keywords : herbaceous biomass, seasonal effect, altitudinal effect, Takht-e-Nasrati, pakistan.

I. INTRODUCTION

erbaceous biomass is the total mass of the herbs and grasses within a given unit of ecological region. In the bio-based wealth, herbaceous biomass such as herbs and perennial grasses will turn out to be important cellulosic supply for conversion to bio fuel, chemical constituents, energy and heat in the modern time. Due to environmental condition and grazing the biomass of plants is vastly changeable (Olson & Richard, 1989). The biomasses of rangeland are turning downed with the overgrazing, over exploitation and soil erosion (Hussain & Durrani, 2007). One of the most important factors controlling survival, production of range plants, germination, abundance and subsequent growth is water availability (Brown, 1977, Pitt & Heady, 1978). In deserts the plants are mostly partial by means of water so an important role exerted on structure and function of many rangeland ecosystems are water availability. (Nov-Meir, 1973) still, a direct correlation between precipitation and plant production is not regularly observed (Charley, 1972,

Webb et al., 1978). Biomass and production of plants are diminished or demolish through grazing (Facelli & Pickett, 1991). Decomposition process is very low in arid regions due to lack of water that bounds microbial action on the soil surface and plants availability. (Knapp & Seastedt, 1986). Biomass information and judgment methods have been often discussed by Sah et al., 2004. The evaluation of wild land manners prospective necessitates quantitative estimation of accessible weights by condition and by size category (Rothermel, 1972). Herbs and grasses are one of the mass vital fuel types in the region and has no long been associated with frequent forest. Herbs, grasses and shrubs plant communities and open forest are not widespread in Takht-e-Nasrati due to dry condition of the area. Thus, estimation of herbaceous biomass is of essential influence in combustion, forest, grazing and land management in the region. Different study were done on plants biomass in world and in different area of Pakistan such as: Martin et al., (1981), Smith and Grav, (1983), Hussain and Durrani, (2007), Zhou et al., (2007), Ahmad et al., (2009), Saleem, et al., (2009) Moyo, et al., (2011). Herbs and grasses are one of the mass vital fuel types in the present region and has no long been linked with normal forest. Therefore, numerous studies on different community's level are required to workout to plan the relationships between vegetation structure and composition. No effort is available especially on the herbaceous biomass as of the present area. The key point of this study was to determine the Biomass of herb and grass species in research area. The results of this study will also show useful in ecology, security, conservation and management of plant species. The objective of this research work was to evaluate the fresh biomass of herbs and grasses on the basis of altitude and seasonal variation in Tehsil Takht-e-Nasrati, District Karak, Pakistan,

II. METHODS AND MATERIAL

a) Research area

The Tehsil Takht-e-Nasrati is situated at 32.47° to 33.28° North and 70.30° to 71.30° East. The research area is bounded by Tehsil Karak on the North East, District Mianwali on the East, District Lakki Marwat on the South West and Tribal area Adjoining District Bannu

Author α σ : Department of Botany, University of Peshawar, Pakistan.
on the West. The area was divided into four Stands i.e. Stand 1 (340 -399m), Stand 2 (400 – 499m), Stand 3 (500 – 599m) and Stand 4 (600 – 700m) on the origin of elevation (Fig. 1). The total area of Tehsil is about 613.66 Sq. kilometer. Majority of the area consists of rigged dry

hills and rough fields areas i.e. 323.97 Sq. kilometers and agriculture land is about 289.7 Sq. kilometer. The major income source of the people is Agriculture, which is rain depended. The area is situated at 340 m above the sea level.



Fig. 1 : Map of Tehsil Takht-e- Nasrati showing research spots

The major problem of the area is shortage of drinking water because the rainfall is scanty in the area. In the year 2010, 62.5 mm. y⁻¹ of rainfall recorded. The area is very hot in summer and very cold in winter. June and July are the hottest months, where as December and January are the coldest months. In the year 2010 the mean maximum temperature was 39.5 C°, in the month of the May during summer, where as the mean minimum temperature was as low as 4 C° in the month of January during winter. The wind speed was different in different years. In the year 2009 the wind speed was

high 6 Km per hour (h) in the month of July whereas in the year 2010 it was high in the month of April 7.2 Km. h^{-1} . The humidity is between 62 to 86 during summer and lowest in January and February. The soil temperature is high 31.11 C° in July during summer while low 2.1 C° in January during winter (Table 1).

Months	Temperature	(Cº)	Humid	ity (%)	Rainfall	Soil Temperature	Wind speed	
	Max	Min	Max	Min	(mm)	(C°) Average	(Km h ⁻¹)	
January	20	4	-	-	19.0	2.1	2.1	
February	21	7	-	-	19.2	3.5	3.3	
March	30	15	82	39	11.5	5.9	2.5	
April	35	20	68	32	20.2	10.4	7.2	
Мау	38	23	62	26	1.8	10.6	5.7	
June	34	27	64	40	80.5	13.4	5.1	
July	34	24	86	44	345.2	31.11	5.2	
August	33.7	25.6	84.7	52.6	167	30	3.4	
September	34	20	73	36	82.8	28.33	1.95	
October	32	19	85	48	-	25	2.23	
November	26	10	77	36	-	20.55	2.32	
December	21	4	84	38	2.8	14.34	2.61	

Table 1 : Average climatic data of Tehsil Takht-e-Nasrati, District Karak for the year 2010.

III. Experimental Protocol

Samples were taken on the basis of altitude and preferred designed for diversity of situation through field surveys, in period of three expected seasons i.e. spring, summer and winter for two years 2009-2010, in order to test whether the season's arrangement inclined estimate biomass of plant species. The relationship of growing season to latitude was developed from available global positioning system (GPS) data. Time and length of the growing season was then estimated for each study site. The area was divided into four Stands and each Stand further divided into more than four sites on the source of herbs availability in the area. In each site 10 quadrats (1x1 m) were chosen during spring, summer and winter for estimation of above ground biomass. Relative abundance of each vegetation species as estimated on a broad. All species present in the area were selected for Biomass study on the source of reference unit, relative abundance of each vegetation species, range of stand, age-classes, geographic locations and edaphic conditions. Particular plant specie was designated as reference unit. The number of reference unit of plants were counted and multiplied by average weight of clipped reference unit to estimate herbaceous biomass production with the following formula. The results were expressed in gram per unit area and after that changed it into kilogram per hectare (Kg.hec⁻¹).

Biomass =
$$\frac{\sum_{i=1}^{n} Q_i}{P} X R$$

Q=Weight of total plant species in Quadrate in gramn = Number of plant species in Quadrat

P = Area of Quadrate in square meter

R = Constant value (10)

IV. Result

On different viewpoint the estimation of herbaceous biomass for various region and alternative places is important. The research area was divided into four Stands on the basis of altitude due to the uneven nature of area that is mountainous area, plain and small hillocks. Therefore the Biomass of the different area is different at different altitude. There was an increasing trend of biomass up to the spring to winter during 2009 - 2010. However, the collective biomass amount of both herbs and grasses were significantly higher 426.5 Kg.hec⁻¹ during spring at Stand 1 as compared to other seasons and Stands. The average grasses and herbs biomass was decreasing with increasing altitude. The herb biomass was high 730 Kg.hec⁻¹ during spring at Stand 1 and less during summer (194 Kg.hec⁻¹) at Stand

4. The grass biomass was high 173 Kg.hec⁻¹ during summer at Stand 3 and low 74 Kg.hec⁻¹ during winter at Stand 1. The total herbs mean biomass was high during spring (536.30 Kg.hec⁻¹) while the grasses had (129.9 Kg.hec⁻¹) during summer. The total average biomass was high at Stand 1 (262.58 Kg.hec⁻¹). The total mean and average biomass of research area was 223.23 Kg.hec⁻¹. (Table 2).

V. DISCUSSION

At Stand 1 the Biomass was high during spring just as it was less throughout winter. In spring the grazing speed was low down in plain area owing to the agriculture place for that reason the plants are present in full span and people of area bring cultured plants for their livestock. In summer the grazing speed is very high so the Biomass turn into less for the period of summer (Fig. 2).

Table 2 : Herbaceous Biomass Means (Kg.hec ⁻¹) during different seasons and Stands in 2009- 2010 of Takht-	-е-
Nasrati, District Karak	

	Area	Stand 1	Stand 2	Stand 3	Stand 4	
Seasons	Altitude	340 – 399m	400 – 499m	500 – 599m	600 – 700m	Mean
	Herb	730	426.86	396.85	591.5	536.30
Spring	Grass	123	89.71	84.85	106	100.89
	Average	426.5	258.28	240.85	348.75	318.59
	Herb	303.5	275.4	235	194	251.97
Summer	Grass	107	130.1	173	109.5	129.9
	Average	205.25	202.75	204	151.75	190.93
	Herb	238	222.85	261.43	203.5	231.44
Winter	Grass	74	87.43	109.14	85	88.89
	Average	156	155.14	185.28	144.25	160.16
Total Aver	age	262.58	205.58	210.04	214.92	223.23

At the end of summer and early winter the rain season started through which the new plants grow but that time the agricultural process become in progress so the farmer cut off herbs and grasses meant for their cattle. The plants loss their masses owing to chilly environment in winter's mid and unavailability of cultivated plants thus the people chosen the natural herbs and grasses for their live stocks. The water table of the area is mostly low as compare to other area of the Tehsil apart from eastern area of Stand 4 someplace the water table is very low so increased the biomass of herbs and grasses. Even though it is usually known that a good association be presents between rainfall and biomass production (Rozenzwieg, 1968; Strickland and Haydock, 1978; Carton et al., 1988; Smuts, 1989), it

should, however, be stressed that the production ability of ecotypes can be affected by rainfall factors. It appeared that loss of biomass due to weathering during the winter could, in some situations, be compensated for by harvesting near ground level to include the basal, which would usually be expected to be the heaviest internodes (Boe et al., 2000).



Fig. 2 : Herbaceous Biomass at Stand 1

In Stand 2, the Biomass was high in spring even as low in winter (Fig. 3). The BIOMASS was low as of Stand 1 for the reason that rainwater which move toward Stand 2 through rain stream are directly go away while stored in the ordinary reservoir in Stand 1 as a result increases the vigor of the plants as will as raise water table of the area. In Stand 2 people obtained fuel and livestock's food from xerophytes like *Zizyphus maurtiana* Lam. and *Acacia modesta* Wall. because the area is mostly desert like so the herbs produce in the area turn into deceased owing the water deficiency. The natives count on rain if in the summer's ending rain happen it takes the green revolution in the area as the summer is very warm and no humidity is there inside earth. The Stand 2 takes up the largest part of the farming field of research area depending on rain. The rainfall is very scanty in the area therefore the famous idiom in the area is "Khattak crush as of one drizzle". Difference of biomass production at different Stands might be due to divergence in climatic conditions, rainfall and soil conditions. It has been reported that the association between climatic conditions subsist, of which rainfall is regarded as the most imperative (Rutherford, 1980).



Fig. 3 : Herbaceous Biomass at Stand 2

The Stand 3 area was consisting of small hills. The area is semi arid as the rain water not store in any part of the area. The Biomass of herbs was also high within spring. The Biomass of grasses was high during summer at the same time as low in spring because the area was often used like natural grass land so the animal preferred the young grasses in spring even as reverse in summer for the reason that the grasses turn into floral period (Fig. 4).

It explains that the animals preferred the young grasses as contrast to herbs and mature grasses. In winter the herbs and grasses grow to be less because the people of the area cut both herbs and grasses for burning purposes and livestock's food. The area's people are deprived as a result they cut the grasses like *Cymbopogon jwarancusa* (Jones) Schult. and bring into the local bazaar toward solve their economic crisis. For this progression mainly effort was through female. (Fig. 5).



Fig. 4 : Herbaceous Biomass (Kg.hec⁻¹) at Stand 3

Though, the most critical month differed amongst locations and genotype groups differed in their response to moisture availability. Similarly, Muir et al. (2001) reported switch-grass biomass yield was absolutely associated with precipitation during the growing season in Texas. Smart et al. (2005) also pointed out that it is commonly recognized to the amount of April through June precipitation is highly unpredictable and is a strong indicator of the current year's forage production in the northern mixed-grass prairie.



Fig. 5 : Female bring grasses i.e. Cymbopogon jwarancusa to solve their economic crisis



Fig. 6 : Herbaceous biomass at stand 4

The Stand 4 was the highest region of the Tehsil where the herbaceous Biomass was high in spring and low throughout winter as contrast to further Stands it was high except Stand 1 (Fig. 6). The hills are generally composed of sand and clay so the water accessibility is missing in the hills.



Fig. 7 : Small Dam for water storage at Sarki Lawager



Fig. 8 : Dried well due to low water level.



Fig. 9 : Herbaceous biomass during spring

The small dam is in construction at Sarki Lawager however it must be make sure that the hills are formed from rocky stone excluding it will be unsafe on behalf of the region surface close to dam. (Fig. 7). All the way through the dam will raise the water table of the region which turns out to be low in the course of mislay of vegetation (Fig. 8). The grasses and herbs there on hills are smashed in the course of soil erosion. The occurrence of herbs and grasses are very low rate into Stand as the water is unavailable in slopes. The water table of some area is very low but during rain most herbs and grasses are sprint in the rainy water.

Means of Biomass of herbs at different seasons showed significant differences from season to season at different altitude in research area. The BIOMASS of herbs are raised in spring while trim down in winter in Stand 1 and 2 although in Stand 3 & 4 the BIOMASS of herbs are reduced at some stage in summer by reason of the high percentage of grazing progression into these areas. The average BIOMASS of herbs are high during spring while low during winter at all Stands. (Figs . 9, 10, 11 & 12)



Fig. 10 : Herbaceous biomass during summer



Fig. 11 : Herbaceous biomass during winter

Means for Biomass (kg ha⁻¹) of grasses at different seasons presented in figure 13 showed significant differences for season to season at different altitude in research area. It illustrated that throughout summer the grasses BIOMASS was high at all Stands but Stands 1 where BIOMASS was high during spring as a result of the agriculture approach as well as low grazing rate (Figs. 9, 10, 11 & 13). Cassida et al. (2005) accomplished that water accessibility from April to July was critical for grass biomass production.



Fig. 12 : Biomass Herbs in different seasons



Fig. 13 : Biomass of grasses in different seasons

VI. Conclusions

The quantity and quality of herbaceous biomass depends on a large number of causes including plant form, plant portion, growing season, growing region, harvesting time, harvesting methods and conversion schemes. Most of these factors can be handled to a definite amount to decrease entire herbaceous biomass. A crucial progress to herb biomass organization for conversion systems is needed that will help develop strategies to decrease the problem of the area in plant adaptation. Tough work should be prepared to put together the approach with valuable exercises of herbaceous biomass, including the potential for production of herbs and grasses to the ground.

VII. Acknowledgment

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References Références Referencias

- Ahmad S, Islam M, Bano G, Aslam S and Koukab S. 2009. Seasonal variation in current season and dead Biomass of *chrysopogon aucheri* (boiss) stapf. and *cymbopogon jwarancusa* (jones) schult. in highland Balochistan, Pakistan. *Pak. J. Bot.*, 41(2): 519-527.
- 2. Boe A, Bortnem R, Kephart KD 2000. Quantitative description of the phytomers of big bluestem. *Crop Sci.* 40: 737-741.
- Brown RW. 1977. Water relations of range plants. Ch. 4 In: Rangeland Plant Physiology. (Ed.): R.E. Sosebee. Range Sci. Series No. 4. Doc. For Range Manage., Denver, Colo.
- Carton OT, Brereton AJ, O'Keeffe WF, Keane GP. 1988. Effects of autumn closing date and grazing severity in a rotationally grazed sward during winter and spring. I. Dry matter production, *Irish J. Agric. Res.* 27: 141-150.
- Cassida KA, Muir JP, Hussey MA, Read JC, Venuto BC, Occumpaugh WR. 2005. Biomass yield and stand characteristics of switchgrass in south central U.S. environments. *Crop Sci.* 45: 673-681.
- Charley JL. 1972. The role of shrubs in nutrient cycling, Pp. 182-203. In: Wildland shrubs-their biology and utilization. (Eds.): C.M. McKell, J.P. Blaisdell and J.R. Goodwin. USDA Forest Serv. Gen. Tech. Rep. INT-I, Washington, DC.

- 7. Facelli JM and Pickett STA. 1991. Plant litter: Its dynamics and effects on plant community structure. *Bot Rev.*, 57:2-32.
- 8. Hussain F and Durrani MJ. 2007. Forage productivity of arid temperate Harboi rangeland, Kalat, Pakistan. *Pak. J. Bot.*, 39(5): 1455-1470.
- 9. Knapp AK. and Seastedt TR. 1986. Detritus accumulation limits productivity of tallgrass prairie. *Bio. Sci.*, 36: 622-668.
- Martin RE, Frewing DW. and McClanahan JL. 1981. Average biomass of four northwest shrubs by fuel size class and crown cover. Pacific Northwest Forest and Range Service Experiment Station, USDA Forest Service, Research Note, PNW-374, pp. 6.
- 11. Moyo B, Dube S, Moyo C. and Nesamvuni E. 2011. Heavily stocked 5-paddock rotational grazing effect on cross-bred Afrikaner steer performance and herbaceous vegetation dynamics in a semi-arid veld of Zimbabwe. *African Journal of Agricultural Research.* 6(10): 2166-2174.
- 12. Noy-Meir I. 1973. Desert ecosystems: environment and producers. *Annu. Rev. Ecol. Sys.*, 5: 25-51.
- 13. Olson Bret E. and Richards JH. 1989. Crested wheatgrass growth and replacement following fertilization, thinning, and neighbor plant removal. *J. of Range Mang.*, 42(2): 93-97.
- 14. Pitt MD. and Heady HF. 1978. Response of annual vegetation to temperature and patterns in Northern California. *Ecology*, 59: 336-350.
- Rothermel RC. 1972. A mathematical model for predicting fire spread in wildland fuels. USDA Forest Service, Intermountain Forest and Range Experiment Station Research Paper, INT-115, Ogden, UT, 49 pp.
- 16. Rozenzwieg ML 1968. Net primary production of terrestrial communities: prediction from climatological data. *Am. Nat.* 102: 67-74.
- Rutherford MC 1980. Annual plant production, precipitation relations in arid and semi-arid regions. S. Afr. J. Sci. 76: 53-56.
- Sah JP., Ross MS, Koptur S. and Snyder JR. 2004. Estimating aboveground biomass of broadleaved woody plants in the understory of Florida Keys pine forests. *Forest Ecol. Manag.* 203: 319-329.
- Saleem A., Mirza SN, Khan IA, Franklin J. 2009. Effect of diverse ecological conditions on biomass production of Themeda triandra (Kangaroo grass) at various growth stages, *African Journal of Biotechnology*, 8 (7): 1233-1237.
- 20. Smart AJ, Dunn B, Gates R 2005. Historical weather patterns: A guide for drought planning. *Rangelands*, 27: 10-12.
- 21. Smith W.B. and Gary JB. 1983. Allometric biomass equations for 98 species of herbs, shrubs, and small trees. North Central Forest Experiment Station,

US Department of Agriculture, Research Note, NC-299, pp. 8.

- 22. Smuts TJ. 1989. Production curves for the six most important grass species in the western part of the grassland biome. Potchefstroom: PU vir CHO, pp. 1-4.
- 23. Strickland RW, Haydock KP 1978. A comparison of twenty Digitaria accessions at four sites in southeast Queensland. *Aust. J. Experimental Agric. and Ani. Husbandry*, 18: 817-824.
- 24. Webb W., Szarek S, Lauenroth W, Kinerson R. and Smith M. 1978. Primary productivity and water use in native forest, grassland and desert ecosystems. *Ecology*, 59: 1239-1247.
- 25. Zhou X., Mahalingam S and Weise D. 2007. Experimental study and large eddy simulation of effect of terrain slope on marginal burning in shrub fuel beds. *Proc.* Combust. Inst. 31: 2547-2555.



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Incidence of Rice Hispa, *Dicladispa armigera* (Coleoptera: Chrysomelidae) on *Kharif* paddy in the Agro Climatic Conditions of the Northern Parts of West Bengal, India

By Kaushik Chakraborty & Debes Chandra Deb

University of Gour Bang

Abstract - Incidence of rice hispa (RH), *Dicladispa armigera* population in paddy crop (*Oryza sativa* L.) field was assessed by sweep net estimation during four consecutive crop seasons (2005-2008) at Hemtabad, Uttar Dinajpur, West Bengal. The RH population was initiated at about 29 standard meteorological weeks (SMW), improved at first slowly up to 27 SMW then steadily up to 35 SMW attaining the maximum at about 36 SMW which was maintained up to about 38 SMW. The population then subsumed at first slowly up to 40 SMW then abruptly. After 43 SMW insignificant number of RH population was detected. Abiotic conditions such as maximum temperature, temperature gradient, maximum relative humidity, humidity gradient and average relative humidity had significant positive influence on *D. armigera* population. An insignificantly positive relation was also found with the average temperature. In case of minimum temperature, minimum relative humidity, sunshine hours and heavy rainfall, a negative influence on population development was observed.

Keywords : rice hispa incidence, climatic factors, paddy crop, seasonality. GJSFR-C Classification : FOR Code: 070306



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Incidence of Rice Hispa, *Dicladispa armigera* (Coleoptera: Chrysomelidae) on *Kharif* paddy in the Agro Climatic Conditions of the Northern Parts of West Bengal, India

Kaushik Chakraborty $^{\alpha}$ & Debes Chandra Deb $^{\sigma}$

Abstract - Incidence of rice hispa (RH), Dicladispa armigera population in paddy crop (Oryza sativa L.) field was assessed by sweep net estimation during four consecutive crop seasons (2005-2008) at Hemtabad, Uttar Dinajpur, West Bengal. The RH population was initiated at about 29 standard meteorological weeks (SMW), improved at first slowly up to 27 SMW then steadily up to 35 SMW attaining the maximum at about 36 SMW which was maintained up to about 38 SMW. The population then subsumed at first slowly up to 40 SMW then abruptly. After 43 SMW insignificant number of RH population was detected. Abiotic conditions such as maximum temperature, temperature gradient, maximum relative humidity, humidity gradient and average relative humidity had significant positive influence on D. armigera population. An insignificantly positive relation was also found with the average temperature. In case of minimum temperature, minimum relative humidity, sunshine hours and heavy rainfall, a negative influence on population development was observed. However drizzling rainfall imparted significant positive effect on population growth. Based on the nature of incidence and abundance of *D. armigera*, a package can be generated and accordingly time fitted seedling transplantation as the precautionary measure may be highlighted in the northern parts of West Bengal.

Keywords : rice hispa incidence, climatic factors, paddy crop, seasonality.

I. INTRODUCTION

The need for sustainable intensification in paddy production methods presents a considerable challenge as under the current situation, 'low-input' systems may not be able to deliver the required yields increases, while on the other hand 'high input' escalation often lead to cropping systems that are neither sustainable nor stable due to serious pest outbreak (Shepard *et al.*,1995; Sarma *et al.*, 2010). For this reason a comprehensive study on the pest life cycle at 'local level' aiming to develop a region specific pest control strategy is urgently required. Incidence of pest outbreaks in paddy field has increased with the change of pest complexities, in the last four decades (Rajek et al., 1986; Karim, 1986). Some insects have gained momentum, whereas others declined have in importance. There are convincing documents that 'minor pest species' have been favoured by selective crop intensification (Alam, 1967; Pathak et al., 1994; Dhaliwal et al., 1998). Intensification engrosses the changes in cultural practices such as (i) increase of crop-cycle per year (Dhaliwal et al., 1998), (ii) augmentation of agricultural chemicals like fertilizers and pesticides (Karim, 1986), (iii) improvement of irrigation facilities (Sarma et al., 2010), and (iv) enhancement of higher plant densities (Dutta et al., 1992; Deka et al.,1996).

Paddy (Oryza sativa L.) is the prime cash crop in West Bengal, India. The rice hispa, Dicladispa armigera (Coleoptera: Chrysomelidae) is regarded as one of the major paddy pest in some paddy growing areas of India (Deka et al., 1996; Raman et al., 2001; Hazarika et al. 2005). Activity of D. armigera (RH) covers almost all the crop growing seasons: aus (summer rice), transplanted aman (monsoon rice), and boro (winter rice) (Prakasa Rao et al., 1971; Budhraja et al., 1979). Both upland and deepwater rice are affected by this pest (Reissing et al., 1986; Wang, 1990). Damage especially at vegetative growth stage of the plant results in extensive loss (Islam, 1989). Infestation underscores the paddy yield attributing characters like plant height, tiller number, grain number per panicle and grain yield. Affected deep-water rice plants can hardly tolerate the rising flood water level (Islam, 1973; Khan, 1989). Losses that incurred to the growing paddy crop are insurmountable (Nath et al., 2002; Dutta et al., 2003).

Extent of loss may extend up to 28% in India (Nath *et al.* 2002), 52% in Bangladesh (Karim, 1986; Islam *et al.*,1998; Islam 1989) and 30% in Nepal (Dhaliwal *et al.*, 1998). Rajek *et al.*, (1986) and Hazarika *et al.* (2005) have reported 35-65% grain loss from Assam province of India. But total crop failure, in occasional cases, was also noted from Assam (Hazarika *et al.* 1991). Activity of RH was recorded from Bihar (Agarwala, 1955), Himachal Pradesh (Thakur *et al.* 1957), Choudhary *et al.*,2002), West Bengal (Basu *et al.*, 1957),

Author α : Department of Zoology, University of Gour Banga, Mokdumpur, Malda, West Bengal, India.

Author o : Department of Zoology, University of North Bengal, Raja Rammohanpur. West Bengal, India.

Andhra Pradesh (Rao, 1977), Orrisa (Sontakke et al., 1998), Tripura (Das, 1980) and Punjab (Dhahwal et al., 1978). From West Bengal considerable losses to paddy crop have been reported from the district of Burdwan (Banerjee, 1986). Injudicious application of insecticides of newer brand was found less prudent to control the pest menace (Karim et al., 1989; Budhraja et al.,1979). For this adoption of integrated pest management protocol in paddy is imperative for RH suppression (Dutta et al., 1992; Deka et al., 1997). To formulate a consistent pest forecasting equation for a particular zone, a holistic study on the field dynamic of RH population in relation to climatic parameters is urgently required (Khan, 1989; Dutta et al., 2003). Detection of the field dynamics of RH population in relation to crop phenology and climatic conditions is considered as a prime requisite for the execution of the subsequent crop protection package in view of modern IPM practices.

Among the northern parts of West Bengal, India, the district Uttar Dinajpur offers a congenial environment for paddy cultivation. But the farmers do follow irregular planting dates disregarding the occurrence of RH incidence. Therefore understanding the recent trends of seasonal abundance of RH is the precondition to develop an integrated management system for this pest. Such time bound observation on population dynamics of RH in consideration of pest management decision making is thus found crucial. Grossly, there are three specific objectives of this study. (i) to define the basic population system of *D. armigera* during the five crop seasons at Hemtabad [26.62° N-88.12° E], Uttar Dinajpur, West Bengal, (ii) to consider the role of weather parameters on the incidence of RH population and (iii) to apply the generated information relating to RH population dynamics in integrated pest management decision-making.

II. MATERIALS AND METHODS

Experimental layout. Field study was conducted during four consecutive *kharif* crop years (2005-2008) in insecticide untreated field of paddy cultivar *Swarna mashuri* (MTU 7029). Transplantation to main field was done with 35-day old seedlings at 10 x15 cm spacing on 20-22 standard meteorological weeks (SMW). The soil of the experimental field was sandy loam with PH value 6.2 and EC value 0.29 mmhs/cm. N, P_2O_5 and K_2O was 315, 67 and 367 kg/ha respectively. During land preparation, each plot received 150:60:60 kg/ha NPK as basal dose. Field management was done following national protocol with befitting modifications.

Assessment on pest incidence: Adult individuals of RH were counted by sweep net method.

a) Description of sweep net : Sweep net is a simple and inexpensive way to assess the insect abundance of paddy field ecosystem. The net is funnel-shaped and made up of nylon. The net is mounted on a rigid metal ring. This allows the net to be swept through paddy crop canopy, dislodging insects. For practical applicability the net's ring is attached to a 75 cm long wooden handle. Diameter (r) and length (l) of the net is 25 cm 70 cm respectively.

b) Operational principle: At every 7-day interval 30 sweeps in each plot was done whilst walking slowly through paddy field in diagonal fashion at early morning. Keep the circular frame of the open end of the net perpendicular to the ground and pointing to the direction of the sweeping. Sweep one stroke and one reverse stroke per step Attention was given that the net should not go more than 25 cm below the top of the paddy plants during sampling.

Transfer the collected RH to plastic vial with 70% alcohol. There were five replications (plot) for each experiment year. Incidence of RH was expressed as individuals/ 5 sweeps.

Correlation and matrix analysis: Weekly noted RH population were correlated with the prevailing climatic factors such as maximum temperature (Tmax), minimum temperature (Tmin), temperature gradient (Tgr), maximum humidity (RHmax), minimum humidity (RHmin), humidity gradient (RHgr), sunshine hour (Shr) and rainfall (Rfall).Further inter relationship of the climatic factors was also worked out and then tabulated in matrix pattern.

Statistical analysis: All the data was subjected to the statistical analysis using the software INDOSTAT and Statistica.

III. Results

Population dynamics. No population was noted up to 26 SMW. Very low detectable population was noted at 27-29 SMW. The population then increases gradually and attains the maximum at about 37 SMW which was maintained up to about 38 SMW. High range of population persisted for a few weeks. The RH population then subsumed at first slowly and then rapidly (Table1). Grossly the incidence of RH population have noted from June to October with a very low population in early August which corresponds to the transitions between the Aus and Amon crop seasons. Observation revealed that early growth stage of the plant rather than the late growth stage were adversely affected by this pest. Extent of infestation was relatively more in September (33-36 SMW) when the RH incidence was comparatively higher. Infestation, at that time, in the field was found in patches. The patchy area then gradually increased in size and depressed due to the suntanned growth of the plant and can easily been identified as 'bowl'. The bowl if not managed properly acts as the reservoir for subsequent field infestation. Extent of infestation corroborates to RH incidence (Table1).

Correlation study: Maximum temperatures and high humidity are conducive to RH population growth and multiplication (Table 2 and 3). Present study portrayed that high winter humidity and high winter and summer temperatures tend to have higher hispa abundance. In all the experiment years except in 2007, the RH population showed a significant positive relation with the Tmax. While Tmin had imparted an insignificant positive effect on the incidence of RH in all the years except in 2007. Except in 2007, the incidence of RH population showed significantly positive relation with Tgr. An insignificantly positive relation was also found with the Tavg in 2006, 2007 and 2008, but in 2005 relations were significantly positive. Persistent RHmax (85-94%) exerted a significantly positive impact on the abundance of RH population in all the years, especially at the late tillering growth stage of paddy. A significantly negative relation between RHmin and the field RH population was found in all the years. Significant positive relations existed between the RHgr and the field RH population in all the years except in 2005 where the relation was insignificantly positive. Humidity conditions during November influences RH outbreaks. RH Incidence was positively influenced by RHavg almost in all the years. But the values of relation differed among the years, particularly in 2006 and 2008. RH population growth appears to be more related to winter humidity values. Bright sunshine hour for an average of 8.23 hrs/day had a significant negative effect on the RH population with the exception of 2005 where the relation though negative, was non significant. Drizzling Rfall had a significant positive effect on the pest structure. But heavy shour within a short time had significant negative effect on pest appearance in all the years. Continuous, heavy rain has a negative effect on adult feeding and egg lying. Egg hatching and the survival of larvae are greatly affected by critical level of moisture and thus heavy mortality with reduced population of RH was noted in dry conditions (Table 2).

Multivariate regression study : The results regarding multivariate regression models through steps between the *H.armigera* population and climatic factors along with the coefficient of determination values (Table 3). It is understandable from the results that maximum temperature alone contributed 7.69 % role in population fluctuation of *H.armigera*. This role was subsumed and restricted up to 4.77 % when the effect of minimum temperature was added to It. Subsequent addition of the effect of temperature gradient resulted in 4.61% effect. With for this addition the 100 R² value reached up to 63.01. It means that the average temperature had affected the buildup of *H.armigera* population considerably. Maximum relative humidity influenced the population considerably as the collective contribution

was 44.51%. Combining the effect of average relative humidity, 100 R^2 value reached up to 59.40%. Furthermore, rainfall did not show a significant impact on population fluctuation of *H.armigera* which contributed only 3.01% role.

Matrix analysis: Matrix analysis of important climatic factors leads to determine the relative dynamic of the *H.armigera* population. As most of the climatic factors are interdependent, any change of single climatic factor will lead to multiple effects on pest structure. However impact of maximum temperature and humidity gradient were more profound (Table 4).

Principal component analysis : Principal component analysis of the important climatic factors was also done (Figure 1). Results showed the relative importance and prominence of a single climatic factor within the batches of the factors during the experimental weeks. During the kharif season the total variable was was71.24%. There was two principal components PC-1 and PC-2 respectively. Values of PC-1 and PC-2 were respectively 41.64% and 29.60%. As average temperature, gradient temperature, average humidity and gradient humidly are the byproduct of their original climatic component, it was excluded during such component analysis. Results showed that during kharif season impact of minimum temperature on H.armigera was negligible. Maximum relative humidity followed by maximum temperature significant imparted positive effect on pest incidence. Very low negative effect of rainfall on pest occurrence was noted. Effect of sunshine hours was however significantly negative.

Scree plotting: Scree plot expresses the eigen value of the different component factors (F1 to F7). Maximum value was noted for F1 while the minimum was scored for F7 (Fig.2). This has indicated that the prime factors belong to F1 and marginally in F2. Cumulative variability of all the factors, on the contrary was minimum in F1 and maximum F7. The extent of reduction of the eigen value across the F domains was significant (R^2 : 0.827).Climatic factors of F1 domain thus influences much the distribution and abundance of *H.armigera* population.

Dendogram analysis: Depending on the similarity of the collective impact of the climatic factors during the experimental weeks, dendogram was drawn (Fig. 3). Weeks that belong to the same cluster have nearly same gross climatic condition. Abhorrently there were two mega-domains in the dendogram (A and B). Domain A includes 32, 33, 36 and 44 SMW respectively. While rest of weeks of the kharif season belongs to domain B. Domain B includes two sub-domains (Bi and Bii) each of which contains two micro-domains. Climatic conditions of the micro-domains differ insignificantly. So in each micro-domain the gross impact of the climatic component on *H.armigera* incidence was nearly same. Climatic components of the sub-domain differed marginally while that of mega-domain varied noticeably.

IV. DISCUSSION

The intensity of outbreaks seems to increase following the large-scale adoption of high-yielding rice varieties and their associated newly adopted production technologies (Khan, 1989; Islam et al., 2004). Karim (1986) have suggested that the warmer winter conditions to drive RH outbreak. Thakur et al. (1979) have documented that RH incidence is associated with high temperature and relative humidity. Rao (1977) from Andhra Pradesh have reported an incursion of RH at high humidity following heavy rain and during "intermittent bright sunshine". Prakasa et al.(1971) have mentioned that unusual high rainfall in August-September favoured RH out-break .Choudhary et al.(2001) have reported that RH started to appear as early as second fortnight of May and remain active on the paddy till to the second week of November. Contrary to these findings, in the present observation, incidence of RH population was initiated from the late May, which was then continued to build up slowly attaining the first peak at early June. The population then subsumed gradually. The next highest peak was noted at late August. High level of RH population persists till to the end of September. Though the population then decreased but RH activity was recorded till to the crop harvest.

Incidence of RH in the present findings partly corroborates to the observation of that of Deka et al. (1999) and Raman et al. (2001). They have observed nearly similar population dynamics of RH with the maximum abundance in the month of September. But the quantity of trap collection in the present experiment differed considerably from their experiments. This may due to the differences of the agro-climatic conditions of the two study area. Contrary to the present observation Sontakke et al. (1998) have reported that the maximum light trap collection of RH during October. Though there are substantial differences in the process of recording the pest incidence, the present study is primarily supported by Banerjee (1986). He observed that RH population was low in the first three months of cropping season, attaining the highest activity in the last week of October. From the eastern parts of India (Orrisa), Sontakke et al.(1998) have reported that RH population gradually developed reaching the maximum at about 33 SMW. This observation is fully supported by the present observation. Present result of impact of climatic parameters on RH population was also supported by the findings of Dutta et al. (2003). Dhahwal et al.(1978) from Punjab have reported that Tmin and Rfall had insignificant effect on RH population structure which partly matches with the present observation. Present finding was also supported by Karim (1986) and Islam et al.(2004). They too have commented that high humidity imparts positive impact on population development. Dutta et al. (2003) and Islam et al. (2004) have reported

that early monsoonal rain followed by long dry spell and humid weather is conducive for RH multiplication which matches with the present observation. So, paddy seedling transplantation should be done in such time that the maximum crop growth stage and the maximum RH abundance do not coincide (Karim *et al.*1999). Highest level of RH population was noted at about 34-36 SMW. If the crop passes the vulnerable growth stage before the peak pest emergence, the crop is well protected (Rahman *et al.*2001). In this consideration early transplantation of paddy seedlings during *kharif* season is thus found prudent to minimize RH menace.

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References Références Referencias

- 1. Agarwala, S. (1955). On the control of paddy hispa (*Hispa armigera* Ol) at Pusa (Bihar). Indian Journal of Entomology 17(1),11-16.
- Alam, M.Z. (1964). Insect pests of rice in East Pakistan. In: Major insect pests of rice. Proceedings of a Symposium at the International Rice Research Institute, Los Baños, Laguna, Sept. 1964. Baltimore, Md. (USA): Johns Hopkins Press. p 643-655.
- 3. Alam, M. Z. (1967). Insect pests of rice in East Pakistan. Pp. 643-655 *In:* Major insect pests of the rice plant. Johns Hopkins Press, Baltimore.
- 4. Banerjee, D.K. (1986). Rice hispa in Burdwan, West Bengal. *Int. Rice Res. Newsl.* 11(1),14-15.
- 5. Basu, A. C. and Banerjee, S. N. (1957). Study on the assessment of damage done by *Hispa armigera* OI. to paddy crop. *Indian J.Agric. Sc.* 27(3),295-301.
- Budhraja, K., Rawat, R. R., and O. P. Singh (1979). Feeding behavior of *Dicladispa armigera*. *Intl. Rice Res. Newl.* 4(6),15-16.
- Choudhary, A., I. Dogra, P. K. Sharma, and B. K. Kaul (2002). Record of some new alternate hosts of rice hispa, *Dicladispa armigera* Olivier from Himachal Pradesh (India). *J.Entomol. Res.* 26(2),183-184.
- Deka, M., Hazarika, L.K. (1996). Mating behavior of Dicladispa armigera (Coleoptera: Chrysomelidae). Annals of the Entomol. Soc. of Am. 89, 137–141.
- 9. Deka, M, Hazarika L.K. (1997) Investigation of male sex pheromone in rice hispa, *Dicladispa armigera*

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(Oliv.) (Coleoptera: Chrysomelidae). *Pestology.* 21, 24–25.

- Deka, M., Hazarika, L. K. and Kalita, D (1999). Seasonal variation of frequency of mating of rice hispa, *Dicladispa armigera*. *Crop Res.* HISAR 18(2),287-289.
- Dhahwal, G. S. and Saini, S. S. (1978). Rice hispa found on wheat in the Punjab, India. *Intl. Rice Res. Newsl.* 3(3),17.
- Dhaliwal, G.S, Arora, R, Randhwa, N.S, Dhawan, A.K. (1998). Ecological Agriculture and sustainable development. In: *Proc. Intl. Conf. Ecol. Agric.*: Towards Sustainable Development, Vol 1, Chandigarh, India,15–17 November, 1997.
- Dutta, B. C. and Hazarika, L. K. (1992). Reaction of summer and winter rice cultivars to hispa in Assam, India. *Intl Rice Res. Inst. Newsl.* 17(2):10-11.
- Dutta, B. C. and Nath, R. K. (2003). Seasonality of rice hispa, *Dicladispa armigera* (Olivier) (Coleoptera: Chrysomelidae). *Res. Crops* 4(2), 258-262.
- Hazarika, L.K, Deka, M., Bhuyan, M. (2005). Oviposition behavior of the rice hispa *Dicladispa armigera* (Coleoptera: Chrysomelidae). *Intl. J.Trop. Ins. Sc.* 25, 1–6
- Hazarika, L. K. and Dutta, B. C. (1991). Reaction of rice cultivars to rice hispa. *Internl. Rice Res. Newl*, 16 (3), 14 - 15.
- 17. Islam, Z. (1989). Crop losses due to hispa beetle damage in deepwater rice (DWR). *Intl. Rice Res. Notes.* 14, 53
- Islam, Z., Heong, K.L, Bell, M, Hazarika, L.K, Rajkhowa, D.J., Ali, S., Dutta, B.C, Bhuyan, M. (2004). Current status of rice pests and their management in Assam, India – a discussion with extension experts. *Intl. Rice Res. Notes.* 29, 89–91.
- 19. Islam, Z. 1989. Crop losses due to hispa beetle damage in deepwater rice. *Int. Rice Res. Newsl.* 14(6):53.
- 20. Islam, Z; Rabbi, MF. (1998). Parasitism of rice hispa, *Dicladispa armigera* (Oliver) grubs in Bangladesh. *Bangladesh J. Entomol.* 8, 127-129.
- Islam, Z.M. (1973). Notes on the biology of rice hispa *Dicladispa armigera* (O1.) (*Coleoptera, Hispidae*) in Bangladesh. *Bangladesh J. Biol.Agric. Sci.*, 2: 2, 14-16.
- 22. Karim, A. N. M., Rezaul and Haque, N. M. M. (1999). Evaluation of certain neem products against some rice insect pests in Bangladesh. *Bangladesh J. Zool.*, 26, 97 99.
- 23. Karim, A.N.M.R. (1986). The Hispa Episode. A paper presented at the 12th workshop on Modern Rice Cultivation in Bangladesh jointly sponsored by BRRI and DAE, 5-7 April 1986, BRRI, Joydebpur, Gazipur.
- 24. Khan, A.R. (1989). Rice hispa: A threat to Bangladesh Agriculture. In: *Proceedings of the*

SAARC Workshop on Rice Hispa. Bangladesh Rice Research Institute Publication, **94**: 28-29.

- 25. Nath R, Dutta, B. (1997). Economic injury level of rice hispa, *Dicladispa armigera* (Oliv.). *J.Agric. Sc. Society of North East India.* 10, 273–274.
- Nath, R. K. and Dutta, B. C. (2002). Yield loss assessment and economic injury level of rice hispa, *Dicladispa armigera* (Oliv.) (Coleoptera: Chrysomelidae). *Res. Crops* 3(1),154-158.
- 27. Parkasa Rao, P. S., Israel, P. and Rao. Y. S. (1971). Epidemiology and control of rice hispa, *Dicladispa armigera* (Olivier). *Oryza.* 8, 345-389.
- 28. Pathak, M.D., Khan, Z.R. (1994). Insect pests of rice. Manila (Philippines): *Intl Rice Res. Inst.* 89 p.
- 29. Rahman, M. H. & M. H. Rahman. 2001. Growth, development and reproduction of rice hispa, *Dicladispa armigera* Olivier (Coleoptera: Chrysomelidae). *Bangladesh J. Zool.*29(2),181-186.
- Rajek, R. L., Raghvan, K. V. and Srivastava, D. N. (1986). *Country Report. 5th Natl. Progm. Leader's meeting of the FAO* Inter country programme for integrated pest control in rice in South and South East Asia. 12 - 22, March, 1986. Kuala Lampur, Malayasia.
- 31. Rao, VG. 1977. Outbreak of rice hispa in Nellore District, Andhra Pradesh, India. *Intl. Rice Res. Notes.* 2(5), 18-9.
- 32. Reissig WH, Heinrichs EA, Litsinger JA, Moody K, Fiedler L, Mew TW, Barrion AT. 1986. Illustrated guide to integrated pest management in rice in tropical Asia. Manila (Philippines): *Intl Rice Res. Inst.* 411 p.
- Sarma, S. and Rahman, Z. (2010). Indigenous Technical Knowledge Adopted by Farming Community of Nalbari District of Assam against Different Insect Pests of Rice. *Environ. Ecol.*, 28 (2): 887 - 891.
- 34. Shepard, B.M, Barrion, A.T., Litsinger, J.A. (1995). Rice-feeding insects of tropical Asia. Manila (Philippines): *Intl Rice Res. Inst.* 228 p.
- 35. Sontakke, B.K. and Rath, L.K. (1998). Pink stem borer and hispa on hybrid rice in Western Orissa. *Insect Environ.* 4(1): 8.
- Thakur, AK, Kashyap, NP, Hameed, SF, Suri, SM 1979. Unusual occurrence of rice hispa on rice in Himachal Pradesh, India. *Intl. Rice Res. Notes.* 4(6), 7.
- 37. Wang, Y. Q. (1990). Bionomics of *Dicladispa armigera similis* (Uhmann) and its control. *Entomol. Knowledge* 27(2), 80-81. [in Chinese].
- Chatterjee, P.B, Bera, P.K (1990). Rice grain yield loss due to rice hispa damage. *Intl. Rice Res. Notes.* 15(15), 21.
- 39. Das B B (1980). A note on the hispa epidemic in rice field of Tripura. *Indian J. Entomol.* 42:530-531.

SMW	N Temperature					Relative h	umidity	Average	Rainfall	Individuals	
	[T(max)]	[T(min)]	[T(gr)]	[T(avg)]	[RH(max)]	[RH(min)]	[RH(gr)]	[RH(avg)]	sunshine hour [Sh Hr]	(mm) (Rain F)	/5 trap
24	32.41	24.24	8.17	28.33	96.23	67.71	28.52	81.97	5.74	0.00	0.17±0.12
25	32.21	24.24	7.97	28.23	96.32	67.71	28.61	82.02	5.74	0.00	0.37±0.21
26	33.11	24.16	8.95	28.64	96.37	47.25	49.12	71.81	5.78	0.00	0.50±0.24
27	32.85	24.81	8.04	28.83	95.47	46.38	49.09	70.93	1.84	9.87	0.76±0.37
28	33.76	24.13	9.63	28.95	94.57	47.14	47.43	70.86	5.17	0.00	1.09±0.87
29	34.32	24.56	9.76	29.44	96.53	47.12	49.41	71.83	8.47	2.03	1.57±1.05
30	34.22	23.21	11.01	28.72	96.22	65.01	31.21	80.62	2.29	2.17	2.58±1.12
31	34.82	24.65	10.17	29.74	95.53	56.27	39.26	75.90	2.04	1.09	3.98±1.53
32	33.85	24.13	9.72	28.99	95.47	44.53	50.94	70.00	3.48	65.32	4.33±1.71
33	32.72	25.35	7.37	29.04	95.84	46.12	49.72	70.98	6.47	47.32	5.21±2.47
34	34.58	25.25	9.33	29.92	94.63	40.12	54.51	67.38	6.94	11.98	6.45±2.03
35	33.72	25.89	7.83	29.81	94.76	41.79	52.97	68.28	8.69	56.87	6.87±2.78
36	32.23	25.85	6.38	29.04	94.91	48.41	46.5	71.66	7.35	62.12	7.45±2.61
37	32.81	25.34	7.47	29.08	96.04	41.59	54.45	68.82	8.51	12.11	7.28±2.05
38	32.15	24.72	7.43	28.44	84.53	39.25	45.28	61.89	5.61	7.12	7.04±3.97
39	30.69	24.92	5.77	27.81	85.42	47.41	38.01	66.42	8.53	2.09	6.53±1.03
40	29.97	21.39	8.58	25.68	87.89	53.53	34.36	70.71	8.73	0.00	6.07±1.19
41	29.48	20.39	9.09	24.94	88.31	57.12	31.19	72.72	6.12	0.00	4.51±2.13
42	29.98	19.83	10.15	24.91	86.35	53.24	33.11	69.80	4.08	0.00	2.87±1.12
43	28.94	18.68	10.26	23.81	90.75	57.13	33.62	73.94	6.27	0.00	0.62±1.08
44	28.94	18.68	10.26	23.81	90.89	57.13	33.76	74.01	6.27	0.00	0.32±0.12

Table 1	: Average climatic	parameters	and the i	ncidence	of rice h	hispa populat	on during the	e period (of study

 Table 2 : Correlation coefficient of incidence of rice hispa population with the climatic factors indicating the level of significance

Climatic parameters	Years of observation						
	2005	2006	2007	2008			
Maximum temperature [T(max)]	0.502*	0.645*	0.481	0.711*			
Minimum temperature [T(min)]	0.367	0.311	0.525	0.351			
Temperature gradient [T(gr)]	0.508*	0.578*	0.420	0.721*			
Average temperature [T(avg)]	0.518*	0.358	0.375	0.265			
Maximum humidity [RH(max)]	0.575*	0.525*	0.501*	0.534*			
Minimum humidity [RH(min)]	-0.795*	-0.891*	-0.748*	-0.605*			
Humidity gradient [RH(gr)]	0.379	0.528*	0.623*	0.828*			
Average humidity [RH(avg)]	0.701*	0.556*	0.887*	0.519*			
Sunshine hours / day[Sh Hr]	-0.435	-0.752*	-0.578*	-0.831*			
Rainfall (Rain F)	0.329	0.345	0.267	0.415			

Significant at 5% level

Step wise regression model	\mathbb{R}^2	$100R^2$	%
			Contribution
Y = 10.50 + 1.52 X1 - 7.43 X2 + 5.66 X3 + 2.17X4 - 5.41X5 + 4.18 X6 - 0.40X7	0.998	59.8	3.01
+ 0.62 X8- 0.47 X9- 0.17 X10			
Y = 9.52 + 1.52 X1- 7.43 X2 + 5.66 X3+2.17X4 - 5.21X5 + 4.18 X6 - 0.40 X7	0.68	76.8	3.54
- 0.52 X8- 0.42 X9			
Y = 10.20 + 1.52 X1- 7.41 X2 + 5.66 X3+2.17X4 - 4.21X5 + 2.18 X6 - 0.59 X7	0.430	59.4	6.63
+ 1.72 X8			
Y = 11.51 + 1.52 X1 - 7.53 X2 + 5.66 X3 + 2.17X4 - 5.76X5 + 3.08 X6 - 0.49 X7	0.594	43.0	3.22
Y = 14.57 + 1.52 X1- 7.43 X2 + 5.56 X3+2.17X4 - 5.43X5 + 2.18 X6	0.511	11.31	8.21
Y = 13.48 + 2.84 X1 + 3.06 X2 - 6.06 X3 + 2.32 X4 + 4.15 X5	0.998	99.8	44.51
Y = 20.13 + 1.16 X1 + 1.13 X2 - 2.50 X3 - 0.39 X4	0.968	90.81	13.81
Y = 13.56 + 2.28 X1 + 2.45 X2 + 4.87 X3	0.930	63.01	4.61
Y = 8.24 + 2.03 X1 + 1.05 X2	0.594	59.4	4.77
Y = 5.76 + 0.20 X1	0.411	21.35	7.69

Table 3: A Step down multiple regression model showing the influence of various abiotic factors on hispa abundance

Y= H.armigera incidence (%), X1 = maximum temperature, X2 = minimum temperature, X3 = gradient temperature, X4 = average temperature, X5 = maximum relative humidity (%), X6 = minimum relative humidity, X7 =average relative, X8 = humidity average relative humidity, X9 = gradient relative humidity, X10 = rainfall (mm)

Table 4 : Correlation matrix [Pearson (n)] showing correlation coefficient of important climatic factors in relation to
hispa incidence

Variables	T(max)	T(min)	RH(max)	RH(min)	Sh Hr.	Rain F	Pest
T(max)	1.000						
T(min)	0.794	1.000					
RH(max)	0.696	0.483	1.000				
RH(min)	-0.292	-0.448	0.100	1.000			
Sh Hr.	-0.250	0.093	-0.194	-0.304	1.000		
Rain F	0.292	0.450	0.288	-0.435	0.117	1.000	
Pest (Hispa)	0.505	0.211	0.580	-0.512	-0.431	0.293	1.000



Figure 1 : Principal component analysis of the importance of the climatic factors showing their relative importance



Figure 2: Scree plot showing the eigen value of the principal components and their relative importance



Figure 3: Dendogram showing the assemblage of the experimental weeks (SMW) depending of the similarity of the important climatic factors

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