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Biochemical Changes in *Mangifera Indica* Linn. Fruit due to Infestation of Scale Insects

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Abstract
Scale insects are serious pests on M. indica. Though alternative disease control methods in mango (De Jager et al., 1995) and postharvest heat disinfestation treatments technologies are available (De Villiers and Korsten, 1994; Jacobi et al., 2001) they remain ineffective for the management of quality of mango fruit. Although the reports of occurrence and epidemics of P. solenopsis have been reported on cotton from several countries (Jhala and Bharpoda 2008; Wang et al., 2009), details of the biological parameters has not yet been explored on other plants in particular on M. indica. Studies were carried out in the laboratory using the fruits collected from unsprayed mango trees in the orchards. Fruits (infected and uninfected) from the mango trees infested with P. solenopsis were brought to the laboratory and analyzed for the nutrient content. Since, scale insect infestation ultimately affects the palatability, shelf life time and quality of the fruit care must be taken to prevent the attack of the insect during the early stage of development. Carbohydrates, proteins &dietary fiber were much reduced (F> 0.05).

Keywords: *Mangifera indica , Scale insect infestation , Nutrient value .*

Introduction
Mango (*Mangifera indica* L.) is one of the choicest fruit crops of tropical and sub-tropical regions of the world, especially in Asia (Singh, 1968). Its popularity and importance can easily be realized by the fact that it is often referred as King of fruits in the tropical world (Singh, 1996). Major mango exporting countries are India, Philippines, Thailand, and Mexico. World mango production has, however, increased by nearly 50% between 1971 and 1993 (FAO, 1993). With an approximate yield of 9.64 million tonnes of fruit from an area of 1.17 million hectare,

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India is the single largest producer of mangoes with approximately 66% of the world's mango production. Mango accounts for 40% of the total fruit exports from India. Mango is densely-foliaged evergreen tree that grows up to 20 m tall and live for 40-50 years or more. Its growth is marked by flushes of new bronze-pink leaves that turn green on maturity. Flowers are produced on terminal panicles. The tree generally bears fruits in the month of April to June.

Unripe fruits are used in pickles, chutneys, salads or consumed fresh. Ripe fruits are eaten raw as dessert, whole, or in fruit salads. They may also be frozen, dehydrated, canned or made into jellies, jams, juices and incorporated into yoghurts and iced confectionery. Ripe mangoes are considered as an excellent source of vitamins C, B1 and B2 and provitamin A (Mukherjee, 1997).

India's share in the world mango market is about 15-25% (Lakshminarayana *et al.,* 1970). It is expected that the volume of fresh mango in world trade will increase in the coming years (Jacobi *et al.,* 2001). Although, India is the largest mango producing country, the export of fruit is limited due to infestation by scale insects that results in decrease in the yield and brings undesirable change in the nutrient content of the fruit.

Scale insects (Coccoidea) are diverse group of insects with 30 families and 8000 species (Gullan and Cook, 2007). Many species of scale insects are extraordinarily invasive in nature (Ben-Dov, 1994). The fact that drives invasiveness of these insects may be the flexibilities offered by both the individual and the colony. However, the impact of invasions depends on the species, the host, environmental factors, and natural enemies (Moiler, 1996). They invade a wide range of host plant including Mango (Germain *et al.,* 2010), tomato (Culik and Gullan, 2005) cotton (Wu and Zhang, 2009; Nagrare *et al.,* 2009).

In scale insects, adult females and nymphs are immobile as they remain wingless. Immature insects and adult females have a characteristic round or oval to elongate and flat or hump like appearance. Immature males often have a different color and shape when compared to the females, especially in later nymphal stages (instars). Adult males are fragile and small in size with a pair of wings.

Since, males are rare with short life span, females reproduce without mating. At maturity, adult females produce eggs that remain hidden under the body. Eggs hatch into tiny crawlers (1^{st} instar - nymphs). Crawlers begin feeding within a day or two after emergence. Nymphs may spend their entire life in the same spot without moving as they mature into adults. However, they are blown by wind to near by plants (Williams, 1992; Gullan and Cook, 2007).

Scale insects are mostly present on the bark, leaves or fruit. They insert a tiny straw like mouthpart into plants and suck fluids. Scale insects may be serious pests on *M. indica*. Though many alternative disease control methods in mango (De Jager *et al.,* 1995) and postharvest heat disinfestation treatments technologies are available (De Villiers and Korsten, 1994; Jacobi *et al.,* 2001) they remain ineffective for the management of quality of mango fruit.

Materials and Methods

Studies were carried out in the laboratory at NRMC, Periyakulam, Theni using the fruits collected from unsprayed mango trees in the orchards. Fruits (infected and uninfected) from the mango trees infested with *P. solenopsis* were brought to the laboratory and analyzed for the nutrient content. Moisture and fat free samples were analyzed for their nutrient contents by enzymatic and gravimetric method of the Association of Official Analytical Chemists (AOAC) (Prosky *et al.,* 1988), using TDF-100 kit obtained from Sigma chemical company, USA. Along with the test samples, blank and reference samples were also analyzed simultaneously in duplicate for comparison. The data obtained were subjected to statistical analysis.

Results

Biochemical changes in the nutrient content of the mango fruit due to infestation of scale insects is given in Table 1. Data indicate that there is a significant decrease in the nutrient content in the infected fruit as against the uninfected fruit for all the biochemical parameter tested. This ultimately affects the palatability, shelf life time and quality of the fruit.

Table 1 Change in Nutrient Content (mg/g) of Mango fruit

Principle	Nutrient Content (mg/g)		Level of significance
	Uninfected	Infected	
Carbohydrate	143.45 ± 35.41	102.6 ± 23.08	F > 0.05
Protein	226.81 ± 2.00	90.70 ± 3.17	F > 0.05
Calcium	5.55 ± 0.33	5.10 ± 4.74	F < 0.05
Phosphate	0.38 ± 0.08	0.24 ± 0.08	F < 0.05
Cholesterol	0.0 ± 0.0	0.0 ± 0.0	F < 0.05
Dietary Fiber	180.01 ± 0.0	120.01± 0.0	F > 0.05

Discussion

Although the reports of occurrence and epidemics of *P. solenopsis* have been reported on cotton from several countries (Jhala and Bharpoda 2008; Wang *et al.,* 2009), details of the biological parameters has not yet been explored on other plants in particular on M. *indica*. Tanwar *et al.,* (2007) described many species of mealybugs, including *P. solenopsis*, and attributed the buildup of mealy bugs to abiotic changes in the environment. Akintola and Ande (2008) indicated that *P. solenopsis* on *H. rosa-sinensis* progressively develop in a time dependent manner. Furthermore, the development duration is

species dependent (Chong *et al.*, 2003). A wide range of host plants and short developmental duration as observed suggests that *P. solenopsis* is more acclimatized to a tropical conditions across the sub-continent.

Nevertheless, less number of male populations is an indication to the fact that that male has no role in reproduction, although, under field conditions sexual reproduction may occur. Viewed in juxtaposition with the biology of *P. solenopsis* it is evident that longevity of adults, and their larger size with increased waxy coating, and higher food requirement, result in visibility of the pest and symptoms on the host plant. Therefore, all aspects related to the developmental biology of *P. solenopsis* and the mode of infestation on host plants is essential to make management decisions for eco-friendly management.

Chong *et al.*, (2003) reported that higher mortality of the crawlers, the longer effective reproductive period and increased longevity of adult females along with the expected natural mortality factors such as predation, parasitization and action of abiotic factors on crawlers and adults under natural field conditions, suggest that management interventions should be focused on adult females rather than males and crawlers to prevent the multiplication and spread of this insect pest.

Since, studies pertaining to the life history and pattern of biological activities are difficult under field conditions, laboratory studies have become rather indispensable (Vennila *et al.*, 2010). However, it must be stressed that under laboratory conditions developmental patterns vary significantly, indicating the influence of ecological conditions and the role of host plant on the development of the insects. Results of the present study indicate that management of *P. solenopsis* must be taken into consideration for maintaining the quality of the mango fruit to export standards. Since, scale insect infestation ultimately affects the palatability, shelf life time and quality of the fruit care must be taken to prevent the attack of the insect during the early stage of development. Further, an eco-friendly approach by the application of bio pesticides must be developed to prevent the growth and development of the insect at the larval stage.

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Reference

1. Akintola AJ, Ande AT 2008 First Record of *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) on *Hibiscus rosa-sinensis* in *Nigeria Agri J* 3(1):1-3
2. Ben-Dov Y 1994 A systematic catalogue of the mealybugs of the world, Intercept Limited, Andover, UK pp 686
3. Chong JH, Oetting RD, Iersel MWVan 2003 Temperature effects on the development, survival and reproduction of the Madeira Mealybug, *Phenacoccus madeirensis* (Hemiptera: Pseudococcidae) on Chrysanthemum *Ann Entomol Soc Amer* 96(4):539-543
4. Culik MP, Gullan PJ 2005 A new pest of tomato and other records of mealybugs (Hemiptera: Pseudococcidae) from Espirito Santo, Brazil *Zootaxa* 964:1-8
5. De Jager ES, Hall AN, Korsten L 1995 Towards alternative disease control in mango South African Mango Growers' Association Yearbook 15:67-74
6. De Villiers EE, Korsten, L 1994 Biological treatments for the control of mango postharvest diseases South African Mango Growers' Association Yearbook 14:48-51
7. FAO Production Yearbook 1993 Food and Agricultural Organization, UN, Rome Germain JF, Vayssieres JF, Matile-Ferrero D 2010 Preliminary inventory of scale insects on mango trees in Benin *Entomologia Hellenica* 19:124-131
8. Gullan PJ, Cook LG 2007 Phylogeny and higher classification of the scale insects (Hemiptera: Sternorrhyncha: Coccoidea) *Zootaxa* 1168:413-425
9. Jacobi KK, MacRae EA, Hetherington SE 2001 Postharvest heat disinfestation treatments of mango fruit *Scientia Horticulturae,* 89(3):171-193
10. Jhala RC, Bharpoda TM, Patel MG 2008 *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae), the mealy bug species recorded first time on cotton and its alternate host plants in Gujarat, India *Uttar Pradesh J Zool* 28(3):403-406
11. Lakshminarayana S Subhadra MV, Subramanyam H 1970 Some aspects of

developmental physiology of mango fruit *J Hort Sci*, 45:133-142

12. Moiler H 1996 Lessons for invasion theory from social insects *Biol Conser* 78:125-42
13. Mukherjee SK 1997 Introduction: botany and importance In: Litz, R E (Ed), The Mango: Botany, Production and Uses CAB International, Wallingford, UK, pp 1-19
14. Nagrare VS, Kranthi S, Biradar VK, Zade NN, Sangode V, Kakde G, Shukla RM, Shivare D, Khadi BM, Kranthi KR 2009 Widespread infestation of the exotic mealybug species, *Phenacoccus solenopsis* (Tinsley) (Hemiptera: Pseudococcidae), on cotton in *India Bull Entomol Res* 99:537-541
15. Prosky L, Asp NG, Schweitzer TF, DeVries WJ, Furda I 1988 Determination of insoluble, soluble and total dietary fiber in foods and food products: Inter laboratory study *J Asso Off Ana Chem*, 71:1017–1024
16. Singh RN 1996 Mango ICAR, New Delhi Singh LB 1968 The Mango: Botany, Cultivation and Utilization World Crop Books, Leonard Hill, London, 438 pp
17. Tanwar RK, Jeyakumar P, Monga D 2007 Mealybugs and their management, Technical Bulletin 19, National Centre for Integrated Pest Management, New Delhi, India
18. Vennila S, Deshmukh AJ, Pinjarkar D, Agarwal M, Ramamurthy VV, Joshi S, Kranthi KR, Bambawale OM 2010 Biology of the mealybug, *Phenacoccus solenopsis* on cotton in the laboratory *J Insect Science* 10:115
19. **a**Wang YP, Wu SA, Zhang RZ 2009 Pest risk analysis of a new invasive pest, *Phenacoccus solenopsis*, to China *Chinese Bull Entomol* 46(1):101-106
20. Williams DJ, Granara de Willink MC 1992 Mealybugs of Central and South America, CAB International pp 635
21. Wu SA, Zhang RZ 2009 A new invasive pest, *Phenacoccus solenopsis* threatening seriously to cotton production *Chinese Bull Entomol* 46(1):159-162