Bioscience and Bioengineering
Vol. 1, No. 3, 2015, pp. 41-47
http://www.aiscience.org/journal/bio

Mite Pests (Acari) in Mango (*Mangifera indica* L.) Plantations and Implementation of Control Strategy

Muhammad Sarwar*

Nuclear Institute for Agriculture & Biology (NIAB), Faisalabad, Punjab, Pakistan

Abstract

This publication describes the major mite pests of mango (*Mangifera indica* L.), gives their identifying characteristics, control methods and Integrated Pest Management (IPM) strategies. Mango is a leading fruit and without hesitation it is among the greatest essential fruits developed in our world. It is indeed a fruit with an enormous monetary prospective that can be vastly profitable to the growers. Mango is attacked by various types of maladies causing serious problems, among which are the arthropods including mite pests which bear 4 pairs of legs contrary to insects having 3 pairs of legs. The most important mite pests attacking on mango are Mango Bud mite *Eriophyes mangiferae* (Sayed), Red mite *Aceria mangiferae* Sayed, Spider mite *Oligonychus mangiferus* (Rhaman and Sapra), Broad mite *Polyphagotarsonemus latus* (Banks) and Erinose mite *Aceria litchii* (Keiffer). These species of mites primarily infest to the surface of leaves and remove leaf juices causing a stippling or etching of the host. The attacked leaves frequently become reddish or bronze in color, may drop and yield can be greatly reduced. The feedings of these mites lead to physiological problems within cell sap for ensuing the irregular development, and additionally the origin of damage also provides entry site for the fungus resulting nutritional dis-balance in the various plant parts. In this context, the orchards may be checked quite repeatedly for any malady from time to time and good orchard management practices occupy paramount importance and play a vital role in checking of pests. Pruning of the affected twigs and application of acaricides may reduce the extent of the damage. Certain, resistant varieties can sustain only very small mite colonies, whereas the use of integrated mite management strategies including their relative advantages and limitations may eliminate the extent of the damage.

Keywords

Acarine, Mite, Pest, Pathogens, Disease, Mango, Fruit, Control, Orchard

Received: May 5, 2015 / Accepted: May 25, 2015 / Published online: June 28, 2015

1. Introduction

Mites are very thoroughly correlated to spiders than insects, however like the spiders, mites have two main body parts, four pairs of legs, and the plant-feeding mites often have rasping mouthparts. Under certain occasions, the mites play vital roles to humans, animals and plants. Certain mite species are beneficial to human being for their function to act as natural control means to tackle with other arthropods, otherwise take action as predators and assist in controlling of farming insect pests. Additionally, the biological role played by mites in the form of nutrients cycling to provide "ecology services" may never be overlooked. Alternatively, some mites, for instance the mite causing scabies on humans, are important sources of illness, or else some of chigger mites and ticks, act as carriers of many pathogens. An interrelated set of astigmatid mites within the family Pyroglyphidae, in addition, ancestrally inhabit the nests. From the bird nests,

* Corresponding author
E-mail address: drmsarwar64@yahoo.com

these mites have occupied human being residences and are the key resource for allergic reactions within home dirt. In addition, many mites generally recognized as "house dust mites," are groups predominantly within the genus Dermatophagoides, which yield a lot of proteins which promote sensitive responses to susceptible persons. Home dirt allergy can take the mode of breathing suffering otherwise body irritation in individuals. Mites characteristically dwell on carpets, beds, tables and chairs within home, as well as their drop crusts along with feces deliver the majority of the allergens into home dirt excavate. Some further species of mites invade as parasites on household fauna and can be responsible for fatalities in meat, hide, egg and wool production. Numerous groups of Astigmata mites are recognized as "stored product mites" because these have advancement towards human being foodstuff storages from their ancestral habitat rodent nests. These species of mites can as well be a source of injury in the feed of animals by generating allergic reactions in domestic and farm animals, and likewise are recognized for causing body annoyance on human being holding the contaminated matters. Several other mites can disturb individuals through infested stockpile foodstuffs. On plants, if there are seen the symbols of curled, yellow leaves, minute webs or just sickly plants, there might have an occurrence of mites that are approximately unseen. Mites are difficult to observe with the naked eye, however their occurrence can be examined by sticky cards or even just shaking the plant on a piece of white paper (Lo, 1999; Zhang and Lairong, 2000; Sarwar, 2012; Sarwar et al., 2013 a).

Mango (*Mangifera indica* L.), fruit mainly belongs to the most important produces due to appetizing taste, excellent flavor, attractive fragrance and requires moderately low maintenance costs due to its hardy nature. Mango fruit is utilized in its immature and mature development stages in many global states. It is a sugary, juicy, aromatic, beneficial and nutritious fruit. While still in green form, it can be used for manufacture of chutney, pickles and dried preserves. When ripe, it may be treated into juice or squash, pulp or puree, nectar and jam. It may be eaten as canned slices, with ice cream or as a dessert fruit. Certain mango hybrids have been released for cultivation which may be susceptible to many pests to cause flower and fruit shedding. The mites (Acari) are important pests of mango in most of the tropical regions of the world and have long been recognized as affecting mango quality and yield, especially when conditions are optimum and their populations explode. The most of species feeding on plant belong to the obligate plant parasitic Eriophyoidea (gall mites, bud mites, erinose mites, rust mites) and Tetranychoidea (false spider mites, spider mites), while a number of species belong to other lineages (Eupodoidae, Tarsonemidae and single oribatid mites) (Al-Azzazy, 2005; Sarwar et al., 2013 b; 2014; 2015; Shah et al., 2014). The mites feeding on plants form a fundamental and imperative fragment of the natural ecosystem, and various plant feeding mites are of economic significance as pests of plants. It is important for the mango growers to be able to identify pests such as mites, and to have unknown species expertly identified so that they can be appropriately controlled. This article delivers inclusive information regarding the identification, biology, damage and integrated management of mites attacking mango orchards.

2. Mango Bud Mite *Eriophyes mangiferae* (Sayed)

Mango bud mite *Eriophyes mangiferae* Sayed (Eriophyidae) is found all over the mango developing areas of the world. These mites are responsible to cause dieback of flower panicles and distortion of fresh plant growth. The distorted terminals build up a “dried-up” form, and the side buds are as well hit and eventually the branch possibly can expire. During strict circumstances the plants turn into leafless and non fruit producing. The carrot shaped white colored mites, are not observable to the nnaided eye, however may be visible with 10 X magnifying glass or hand lens. Black otherwise brown markings of the bracts near the bottom of the buds give an indication of mite’s action. This is allied by way of two sorts of signs i.e., gall creation as well as injure to buds. As soon as the buds are attacked and the presence of fungus (*Fusarium* sp.) is missing, the consequence is stems proliferation on the terminal branch. Such type of sign is identified as witches broom. While the fungus is existing the plants grow foliar and floral galls (Abou-Awad, 1981). The control of pest includes a stern trim during January, and trailed by applications of pesticide are suggested. Miticides for mango are Ethion 46.5 EC, Kelthane 42 EC and Wettable sulphur as foliar applications at 2 week intervals.

3. Red Mite *Aceria mangiferae* Sayed

This mite *Aceria mangiferae* Sayed is a common pest of mango, its nourishing is initially restricted to the upper surface of mango leaves; and is primarily found along the midrib and later on along secondary leaf veins. Owing to its attack, the spaces along the veins change to reddish-brown and in full infestations can be concealed with cast skins of mites. Injury to the surface of leaf is commonly detected from the month of October throughout February, resulting up to 30% lessening of photosynthetic action of the leaves. This mite is an irregular pest in certain orchards and is

occasionally detected in others. Episodic checkups for this pest are suggested during the months of December, January and February. Control actions may possibly be initiated as soon as the population touches 6 otherwise more than this level of mites per leaf. The shape of eggs of mite is globular and stalked, and adults bear a pinkish shade in their middle area of body by way of a lot of purplish-brown marks. The period of the various life forms can be ranged from 14 to 15 days. Female mites can produce from 40 to 50 eggs throughout their living duration. A small number of miticides are on record to utilize for controlling this pest on mango plantations. Application of sulfur dust or else spraying of sulfur by means of 10 pounds wettable sulfur in 100 gallons of water are useful. Use of Insecticidal soap and Akar 50 EC have also been registered (Gamliel et al., 2009).

The recognized fraction of the mango bud mite *A. mangiferae* is to some extent built on the point that eriophyoid mites are recognized to cause bud proliferation, and gall signs of inflorescences in other plants. Additionally, herbivores can enable fungal infection by two main mechanisms, whichever by vectoring pathogen propagules or by forming wound spots for fungal penetration. The part of the mango bud mite *A. mangiferae*, for vectoring the conidia of *Fusarium mangiferae*, then transmitting these into apparent infection locations, and helping in fungal contamination and spreading is studied. These outcomes recommend that *A. mangiferae* can bring and vector conidia among buds and supports in fungal dissemination, however does not perform a function during the airborne dispersion of conidia between trees. The mango bud mite *A. mangiferae,* primarily attacks buds of terminals. For the reason of the trouble to judge mite densities in the field, the correlation among bud proliferation and mite densities might be used to conclude action levels (Westphal and Manson, 1996; Hatcher and Paul, 2001).

4. Spider Mite *Oligonychus mangiferus* (Rhaman and Sapra)

Spider mites within the genus *Oligonychus* generally *Oligonychus mangiferus* (Rhaman and Sapra) infest mango orchards in the specific countries. Nourishing is mainly restricted on the upper area of leaf, alongside the midrib and later on alongside the secondary veins. The areas alongside the veins grow into reddish-brown. Destruction of plants commonly by means of the spider mites is perceived starting from October through February resulting in a decrease of photosynthesis activity equal to 30%. The contaminated leaves frequently turn to abscise prematurely. The control process is regularly initiated as soon as mite's pressure reaches 6 otherwise still many mites for every leaf. The life cycles of spider mites commonly may last for some weeks. The female mite can produce from 40 to 50 eggs within its entire life span and these are able to overwinter inside the orchard's grove (Ben-David et al., 2013).

5. Broad Mite *Polyphagotarsonemus latus* (Banks)

The broad mite is as well called as yellow tea mite, yellow jute mite, broad spider, tropical mite or broad rust mite in different states of world. Adult of broad mites are practically tiny creature measuring body length less than 0.2 mm long. These have shining body and range from colorless to pale brown in appearance. These have four couples of legs; the terminal pair of legs in the male trimmings in a physically powerful claw, whereas this pair finishes in a long hair in the female mite. The eggs laid are colorless, oval in shape, lustrous, measuring approximately 0.08 mm in length and enclosed with 29 to 37 white bumps. The hatching larvae of broad mite have three pairs of legs and are white in color because of tiny creases over the surface of the body. Its body length is just about 0.1 mm extended. The broad mites have may host plants and nourish upon a large number of field crops, together with mango. The plants infested by broad mites convert to unthrifty. The attacked foliage curls downward and changes into purplish or coppery color. The internodes are condensed and side buds breakdown further than customary. The fresh growth can as well be undersized otherwise may be destroyed which results in the formation of extra shoots. The flowers formed are inaccurate and flop up for opening customarily. Without controlling, broad mites typically damage to the marketable price of contaminated fruit. The size of broad mite is very minute and these are nearly undetectable over infested hosts in spite of using a high-quality magnifying lens. Likewise this pest has a tendency to mass within cracks as well as buds, and forages over the emergent tree tips. The poisonous spit of this pest is able to cause hardened, twisted along with imprecise development of the apical parts on the host plant. Owing to their feeding, the effects on the host plant can be continuing for extensive period subsequent to the pests have been eliminated. A female mite can lay about 30 to 76 eggs over the surface of leaf in 8 to 13 days oviposition period. Females mated with males mite typically lay four female eggs for each male egg and unmated female mites produce only male eggs. The larvae emerge from eggs after 2 or 3 days and subsequent to hatch from the egg shell nourish on plant host. The hatching larvae are sluggish in movement and do not scatter for a long distance. The larvae grow into a sluggish

immature form within 2 or 3 days. Female larvae in quiescent form are good-looking to the males which lift these up and move them to the new flora. Both females and males are extremely active; however, actually the males make up a good deal of the dispersion of broad mite's inhabitants to transmit particularly the female larvae in quiescent form to fresh leaves. Males instantly copulate with female as soon as females develop from the quiescent phase. Life span of male is from 5 to 9 days, while females live for duration of 8 to 13 days. The broad mites are especially responsive to temperature or hotness. As a result, for dropping mites from infested plants, a hot water treatment detained at 43 to 49°C upto 15 minutes can kill population of broad mites exclusive of injurious to the host plants. Broad mites are as well susceptible to a lot of miticides. Conversely, these are further problematic to manage within winter season as a result of lower temperature in comparison to summer time (Pena and Bullock, 1994; Ashraf et al., 2011).

6. Erinose Mite *Aceria litchii* (Keiffer)

Erinose mite *Aceria litchii* (Keiffer) is also known as hairy mite, its females lay eggs singly on the leaf surface amongst the erineum induced by their feeding. The eggs are only 0.032 mm in diameter, spherical and translucent white. The mites are also small, only 0.13 mm long and pinkish-white. All stages have only four legs, but are quite mobile and move easily from old leaves to infest new flushes. Their feeding stimulates the production of the erineum where these shelter and feed. Numbers vary with the cycle of shoot growth, and are highest in summer and lowest in winter. Planting material obtained as marcots may be infested if these have been taken from trees with the mites. Later infestations occur when the mites are moved around the orchard by direct contact between trees, or carried around by orchard workers, wind and bees (Waite and McAlpine, 1992). The mites attack new leaves causing a felt-like erineum to be produced on the under-surface. This forms as small blisters, but may eventually cover the entire leaf, causing it to curl. In severe cases, whole terminals may be deformed. The young erineum is silver-white, changing to light brown and dark reddish-brown, and eventually black. The greatest numbers of mites are found in the intermediate stages. Branches infested with the mite should be cut off and burnt. The mites can be controlled by applying insecticides when these move from the older leaves to a new flush. The leaves should be checked regularly for symptoms over summer and autumn. Not all trees in an orchard will be flushing or infested at the same time. Three sprays of dimethoate or wettable sulphur every two to three weeks during leaf emergence and expansion generally provide an adequate control. Other chemicals recommended include dichlorvos, dimethoate, dicofol, chlorpyrifos and omethoate (Zhang, 1997).

7. Overall Impact of Mite Pests on Mango

Regardless of where mango is grown in all tropical regions, several mite groups attack the flowers, fruit, leaves and branches. Some mites may affect production in nearly all locations, while many others are of local significance only. Relatively few species cause significant crop losses and are only a problem when the population exceeds the damaging thresholds. The less important species may at certain times require special attention, especially if their natural enemies have been disrupted by chemical sprays. Many leaves are ruined if mite's infestations are severe. This generally causes no problems in established trees, but can debilitate young orchards. There can also be a problem if the mite moves from leaves onto the developing flowers and fruit, and fruit setting can be disrupted.

8. Integrated Management for Mango Mites

Integrated pest management (IPM) is one of a justifiable method to manage pests that groups physical, cultural, biological and chemical implements in a system that curtails economic, health and environmental hazards. The objective of IPM is to eradicate or decrease possibly injurious pesticide usage by using a blend of control means that can decrease the pest to a tolerable level. The control approaches must be on a social basis, suitable, ecologically nontoxic and economically useful. Several marketable agricultural structures practice IPM techniques to reduce pest difficulties, and home growers can use alike approaches to control pest complications in their gardens. The principal strategy of IPM is to classify the pest and the subsequent key is to identify which stages of the pest cause injury, and which are most vulnerable to manage with the numerous promising control techniques (Sarwar, 2004; Marjorie, 2011; Sarwar, 2013).

9. Sampling Technique for Mites

For any specific control method, a good sampling and monitoring program for mites is essential to implement an integrated pest management strategy for mango. This sampling method simply uses to determine the presence or absence of mites (occur or do not occur) on the collected leaves. The sampling should be beginning in mid-June and it

is necessary to monitor for mites every 1-2 weeks through mid-September or during the hottest months monitor weekly. The sampling materials comprise plastic Ziploc bags in which to collect leaves and 16-20 X hand lens or magnifying glass to proceed as following:-.

1. For orchard pest control, choose representative orchard blocks of each fruit type for sampling.
2. Randomly choose 10 trees distributed all over a 2 to 5 acres block, specially include trees where known problems exist, or where mite infestations may occur sooner such as drought-prone areas or stressed trees.
3. On every sampling date accumulate 10 leaves from each of 10 trees (100 leaves total) and choose leaves from representative areas of the entire tree canopy.
4. Retain leaves from each tree in isolated bags in order to recognize hot spots.
5. Check both sides of each leaf with a hand lens, looking for pest and predatory mites.
6. Record the sum of leaves from each tree infested with each type of mite (pest and predator).
7. Obtain the average mite density by adding all 10 estimated mite densities and divide by 10 to take note of per leaf.

In order to evolve a better sampling technique, the other simple way is an adhesive tape method. In this method, to know the number of mites in three spots, each of one square centimetres on the fruits or leaves is counted under a stereo binocular microscope, and to follow this an adhesive tape is pasted gently on these portions. The tape with the mites sticking to it is then separated from the host and pasted on a microscopic slide. The mites on the slide are counted under a phase contrast microscope in three spots on the slide in each of one cm^2. This procedure is repeated for 100 fruits or leaves collected on three different dates and data are analyzed statistically (Aghajanzadeh and Mallik, 2007).

10. Identification of Pest and Predatory Mites

Pest mites are normally oval-shaped, yellow-green in color, turning brown with age, two spotted mite has two black spots on back, and some others may have multiple spots and these only move forward. Predatory mites are similar in size to the pest mites but shinier and teardrop shaped, have longer legs than spider mites, clear to yellow in color, move forward and backward quickly through spider mite colonies looking for prey. Treatment threshold is to treat plant if mean number of mites each leaf is > 5 or else 10 and there is < 1 predator for every leaf.

11. Following are the Guidelines or the Steps the Orchardists Ought to Take

1. Know how to pinpoint the mite pests, fundamental means and the natural enemies.
2. Choose the suitable mango variety that is quite adjusted to a local environment and each time select decent and pest free seedlings.
3. Maintain a fine soil and usually keep in notice that extra-fertilizing is not essentially suitable for pest control needs.
4. Grow plants as intercrops to increase the field's diversity and to boost natural enemies in orchards.
5. Usually, follow the recommended pruning practices of mango trees.
6. Continuously practice appropriate plant hygiene by eradicating and trimming mite-ridden plant parts, and field cleanliness through safety of the region by keeping free of weeds and other plant residues.
7. Monitor the plants regularly for presence of any mite and damage.
8. When there is uncertainty, usually request for technical service from the local agriculturists.

While controlling mite pests using pesticides, always follow the standard procedures for the preparation and application of chemicals. Some of the precautions include:-

1. It is necessary to identify the mite pests to which the growers are dealing with and know about their status.
2. Always study the life phase of the mite pest and which is its vulnerable stage to finely apply control measures.
3. Continuously know about the host plants or active situations of the pest, what are their substitute host plants and does it is favor by dry environment or warm climate.
4. Decide the magnitude of the problem, whether the pest's invasion is severely sufficient to cause noteworthy loss and or the control actions are economical.
5. Decide which control actions are the maximum advantageous; learn about biological control, fewer contaminating and ecologically harmless pesticides, and applicator's wellbeing.
6. Study about the suitable procedure of pesticide application and apparatus for accurate efficiency.
7. Avoid over exposure of mite pests to pesticides that might be able to decrease efficiency and build of resistance.

Pest management programs operate on two fundamental

concepts i.e., the economic injury level and the action threshold value. In the context of plant feeding mites, the economic injury level corresponds to a critical density beyond which the injury caused by mite populations to host plants translates into economic damage. An approximation of the action threshold values can be obtained from comprehensive field experiments that study the relationship between crop yield and a series of mite infestation levels. The action threshold represents the pest's density at which treatments is initiated to prevent growing mite populations from attainment of economic injury level. The action threshold values are lesser than the economic injury level and take into account multiple factors such as mite population dynamics and the time delays that may be associated with deploying specific control options. Once mite densities exceed the action threshold, the impending losses incurred from mite's feeding, if no action is taken, outweigh the costs of treatment. When this occurs, it would be appropriate to apply a control treatment (e.g., pesticide applications or natural enemy releases). When mite densities are below the action threshold, there is no need to initiate treatments because economic losses are unlikely to occur and the cost of treatment is not warranted (Jesus and Mark, 2012; Sarwar 2014 a; 2014 b).

12. Conclusion

The present overview shows some species of mites that may cause considerable damage to mango plants. This article further provides tools for management of plant-feeding mites and developing integrated mite management programs for mango emphasizing on the ecology, biology, behavior and miscellaneous means of suppressing otherwise controlling mites. It further offers a sketch of the controlling of agriculturally key mites by means of wholly accessible Integrated Pest Management (IPM) implements, together with cultural practices, biological control, host-plant resistance and usage of pesticides. Chemical and biological controls are parts of the mite's pest management program, but improvements in sampling methods are still needed to implement these control options in a timely manner. In addition, it focuses on additional information on mango mites that are pests of agricultural importance, elucidating the principles of integrated pest management. This strategy offers specific steps in case studies for addressing the problem of pest mite damage to various other orchards. It also instructs on the use of a hand lens and a microscope to identify the various life stages of plant pest mites and phytoseiidae. Finally, it can reduce the possibility of pesticide resistance in mites and provides the different management tools for detecting and delaying development of resistance.

References

[1] Abou-Awad, B.A. 1981. Ecological and biological studies on the mango bud mite, *Eriophyes mangiferae* (Sayed), with descriptions of immature stages (Eriophyoidea: Eriophyidae). Acarologia, 22: 145-150.

[2] Aghajanzadeh, S. and Mallik, B. 2007. Sampling and Distribution Pattern of Citrus Rust Mite, *Phyllocoptruta oleivora* Ashmead (Acari, Eriophyidae) Using Adhesive Tape Method. International Journal of Agriculture & Biology, 9 (2): 329-332.

[3] Al-Azzazy, M.M.A. 2005. Integrated management of mites infesting mango trees. Faculty of Agriculture - Males (Assueit). Egypt. p. 322.

[4] Ashraf, A.M., Ahmed, M.T. and Hanafy, A.R.I. 2011. Biology and control of the broad mite *Polyphagotarsonemus latus* (Banks, 1904) (Acari: Tarsonemidae). International Journal of Environmental Science and Engineering, 1: 26-34.

[5] Ben-David, T., Ueckermann, E. and Gerson, U. 2013. An annotated list of the spider mites (Acari: Prostigmata: Tetranychidae) of Israel. Israel Journal of Entomology, 43: 125-148.

[6] Gamliel, A.E., Freeman, S., Sztejnberg, A., Maymon, M., Ochoa, R., Belausov, E. and Palevsky, E. 2009. Interaction of the mite *Aceria mangiferae* with *Fusarium mangiferae*, the causal agent of mango malformation disease. Phytopathology, 99: 152-159.

[7] Hatcher, P.E. and Paul, N.D. 2001. Plant pathogen- herbivore interactions and their effects on weeds. Pages 193-218. In: Biotic Interactions in Plant-Pathogen Associations. M. J. Jeger and N. J. Spence, eds. CAB International, Wallingford, UK.

[8] Jesus, R.L. and Mark, S.H. 2012. Sampling Guidelines for Persea Mite in California Avocado Orchards. California Avocado Society Yearbook, 95: 151-173.

[9] Lo, K.C. 1999. Importance of Acarines to Agriculture. Chinese J. Entomol., Special Publ. 129-23.

[10] Marjorie, A.H. 2011. Agricultural Acarology: Introduction to Integrated Mite Management. CRC Press. 430 p.

[11] Pena, J.E. and Bullock, R.C. 1994. Effects of feeding of broad mite (Acari: Tarsonemidae) on vegetative plant growth. Florida Entomologist, 77 (1): 180-184.

[12] Sarwar M., Hamed, M., Yousaf, M. and Hussain, M. 2014. Surveillance on Population Dynamics and Fruits Infestation of Tephritid Fruit Flies (Diptera: Tephritidae) in Mango (*Mangifera indica* L.) Orchards of Faisalabad, Pakistan. International Journal of Scientific Research in Environmental Sciences, 2 (4): 113-119.

[13] Sarwar, M. 2004. Concept of integrated insect pests management. Pakistan & Gulf Economists, XXIII (46 & 47): 39-41.

[14] Sarwar, M. 2012. Frequency of Insect and mite Fauna in Chilies *Capsicum annum* L., Onion *Allium cepa* L. and Garlic *Allium sativum* L. Cultivated Areas, and their Integrated Management. International Journal of Agronomy and Plant Production, 3 (5): 173-178.

[15] Sarwar, M. 2013. Integrated Pest Management (IPM) - A Constructive Utensil to Manage Plant Fatalities. Research and Reviews: Journal of Agriculture and Allied Sciences, 2 (3): 1-4.

[16] Sarwar, M. 2014 a. Knowing About Identify and Mode of Damage by Insect Pests Attacking Winter Vegetables and Their Management. Journal of Ecology and Environmental Sciences, 2 (4): 1-8.

[17] Sarwar, M. 2014 b. Some Insect Pests (Arthropoda: Insecta) of Summer Vegetables, Their Identification, Occurrence, Damage and Adoption of Management Practices. International Journal of Sustainable Agricultural Research, 1 (4): 108-117.

[18] Sarwar, M., Ashfaq, M., Ahmad, A. and Randhawa, M.A.M. 2013 a. Assessing the Potential of Assorted Plant Powders on Survival of Caloglyphus Grain Mite (Acari: Acaridae) in Wheat Grain. International Journal of Agricultural Science and Bioresource Engineering Research, 2 (1) 1-6.

[19] Sarwar, M., Hamed, M., Rasool, B., Yousaf, M. and Hussain, M. 2013 b. Host Preference and Performance of Fruit Flies *Bactrocera zonata* (Saunders) and *Bactrocera cucurbitae* (Coquillett) (Diptera: Tephritidae) For Various Fruits and Vegetables. International Journal of Scientific Research in Environmental Sciences, 1 (8): 188-194.

[20] Sarwar, M., Ahmad, N., Rashid, A. and Shah, S.M.M. 2015. Valuation of gamma irradiation for proficient production of parasitoids (Hymenoptera: Chalcididae & Eucoilidae) in the management of the peach fruit-fly, *Bactrocera zonata* (Saunders). International Journal of Pest Management, DOI: 10.1080/09670874.2015.1018854. p. 1-9

[21] Shah, S.M.M., Ahmad, N., Sarwar, M. and Tofique, M. 2014. Rearing of *Bactrocera zonata* (Diptera: Tephritidae) for parasitoids production and managing techniques for fruit flies in mango orchards. International Journal of Tropical Insect Science, 34 (S1): 108-113.

[22] Waite, G.K. and McAlpine, J.D. 1992. Honey bees as carriers of lychee erinose mite *Eriophyes litchii* (Acari: Eriophyiidae). Experimental and Applied Acarology, 15: 299-302.

[23] Westphal, E. and Manson, D.C.M. 1996. Feeding effects on host plants: Gall formation and other distortions. Pages 231-242. In: Eriophyoid Mites- Their Biology, Natural Enemies and Control. E. E. Lindquist, M. W. Sabelis, and J. Bruin, eds. Elsevier Science B. V., Amsterdam.

[24] Zhang, Z.Q. and Lairong, L. 2000. An Illustrated Guide to Mites of Agricultural Importance. Tongji University Press, Shanghai. p. 228.

[25] Zhang, Z.W., Yuan, P.Y., Wang, B.Q. and Qui, Y.P. 1997. Litchi Pictorial Narration of Cultivation. Pomology Research Institute, Guangdong Academy of Agricultural Science, China. p. 108-139.