CHAPTER-I
INTRODUCTION

Vegetable crops occupy a prominent position in human diet owing to their richness in vitamins and minerals. The role played by the vegetables as a protective food in human diet needs no advocacy. More than seventy types of vegetable crops are grown in India but maximum emphasis has been laid on tomato, brinjal, chilli, cauliflower, cabbage, pea and important cucurbitaceous vegetable crops. The area under vegetable cultivation in the country is about 9.5 million hectares with a total production of 167 million tonnes having average productivity of 17.6 tonnes per hectare (Anonymous, 2014-15).

Among them, tomato (*Lycopersicon esculentum* Mill.) belonging to the family *solanaceae* is one of the most popular and widely grown vegetable crops. Tomato is considered as important commercial and dietary vegetable crop. The origin of tomato is Peru in South America and Mexico in North America for exotic and cultivated type, respectively (Luck will -1943). From America it spread to other parts of the world in 16th century. It was introduced in India by Vasco-De-Gama, a traveler and native of Portugal.

The tomato popularly called as “Poormans Orange” is an important solanaceous vegetable fruit originated from Tropical America (Thompson and Kelly, 1957). Tomato is also known as Love apple, Tomate, Tomat, Tomatar, Rangam and Tomati in different parts of the world. It is important to human diet because of its high nutritive value and low market price. It is consumed as fresh ripe fruit, cooked vegetable and also as processed food products like soup, ketchup, sauce, etc. It is also consumed as raw fruit in vegetable salad. Hence, there is a great demand of tomato in market as fresh fruit. Having good source of vitamin ‘A’, ‘B’ and excellent source of vitamin ‘C’, tomato plays an important role in our daily diet. In addition, it is rich in medicinal value too, as its pulp and juice helps in digestion by promoting gastric secretion and also acts as purifier. It is said to be useful in treating mouth cancer and sore mouth. Besides, it also stimulates torpid liver and is useful in chronic dyspepsia.

It plays a major role in human nutrition as an excellent source of phosphorus, iron, vitamin A, B, C, E and lycopene, which collectively may lower the risk and occurrence of some cancers and heart disease (Giovannucci *et al*., 2002). It contains
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moisture (94 %), protein (0.9 %), fat (0.2 %), mineral matter (0.5 %), fiber (0.8 %) and carbohydrates (3.6 %). In case of minerals it contains (20 mg/100g), potassium (146 mg/100g), calcium (48 mg/100g), iron (0.64 mg/100g), sodium (129 mg/100g), copper (0.9 mg/100g), manganese (0.26 mg/100g), zinc (0.41 mg/100g), sulphur (11 mg/100g), chlorine (6 mg/100g) and chromium (0.015 mg/100g) weight of tomato fruit. Hence, tomato is a typical versatile vegetable and universally treated as ‘Protective food’. Tomato is also used for beauty purpose, it acts as anti-tanning agent and having high anti-oxidant property.

In India, Tomato is one of the most important vegetable crops due to its immense commercial and nutritive value and wide range of climatic adaptability. It ranks second to potato. Andhra Pradesh, Bihar, Karnataka, Uttar Pradesh, Orissa, Maharashtra, Madhya Pradesh and Assam, are the largest producer of tomato in our country. The highest productivity of tomato is incurred by Spain having 66.8 t/ha while India has only 17.50 t/ha. When we focus, on national scenario we get that, Madhya Pradesh contributed maximum production 2177 thousand million tonnes but the highest productivity was occupied by Himanchal Pradesh (41.663 t/ha) (Anonymous, 2014-15b). The estimated area under tomato in India is 6.33 lakh hectares with 124.25 lakh tonnes of fruit production. In India tomato is cultivated in an area of 8.79 lakh hectares with production of about 182.26 lakh tonnes and productivity of 20.7 tonnes/ha. In Gujarat, this crop occupied 44000 ha area with production of 11.57 lakh tonnes and productivity is 26.3 tonnes/ha (Anonymous, 2014).

With increasing quest of higher demand of this vegetable crop in India and elsewhere, there is considerable increase in its area which had earlier no history of its cultivation. Due to this, there is considerable upsurge in the already reported pests and record of new invasive pest like tomato leaf miner south American tomato moth, *Tuta absoluta* (Sridhar et al., 2014). Amongst various pests reported in India, as many as sixteen have been observed feeding from germination to the harvesting stage which not only reduce its yield but also deteriorate the quality (Butani, 1977). The important insect pests of tomato are fruit borer (*H. armigera*), whitefly (*B. tabaci*), leaf hopper (*Amrasca devastans*), leaf miner (*L. trifolii*), potato aphid (*M. persicae*) and hadda beetle (*Epilachana dodecastigma*) (Sharma et al., 2013a). The most common and serious insect pest of tomato is fruit borer, (*H. armigera*) due to its direct attack on
fruits, high mobility, voracious feeding habit, high fecundity, multivoltine and overlapping generations.

The tomato crop is attacked by several sucking pests causing appreciable damage to crop the major sucking pest infesting the tomato crop are as under (Butani and Jotwani, 1984 and kaloo, 1986).

1) Aphid : *Aphis gossypii* Glover
   : *Myzus persicae* Sulzer

2) Jassid : *Amrasca biguttula biguttula* Ishida
   : *Impoasca punjabensis* Pruthi

3) Whitefly : *Bemisia tabaci* Gennadius

4) Thrips
   : *Caliothrips indicus* Begnall
   : *Frankliniella schultzai* Trybam
   : *Haolothrips ganglbaueri* Schmuts
   : *Scirtothrips dorsalis* Hood
   : *Thrips tabaci* Lindemann

Among the various insect pest listed above, aphid, *Aphis gossypii* Glover commonly known as plant lice or cotton aphid; whitefly, *Bemicia tabaci* (Genedius), commonly known as cotton whitefly and thrips, *Haolothrips ganglbaueri* Schmuts, commonly known as blossom thrips; jassid, *Amrasca bigutula bigutula* Ishida, commonly known as leaf hopper are major sucking pest limiting profitable cultivation of tomato in Gujarat state.

According to Butani and Jotwani (1984) whitefly is a polyphagous pest, found in most of the countries in tropics and sub tropics. Its main host are cotton, tobacco and some winter vegetables, including tomato. The infestation on this crop is sporadically severed. This pest sucks the cell sap from the various plant parts. The affected plant parts become yellowish, the leaves wrinkle and curl downwards and are ultimately shed. Besides the feeding damage, this insect also exudes honey dew which favours the development of sooty mould. In sever infestation, this black coating is so heavy that it interference with the photosynthetic activity of the plant resulting in stunted growth. The incidence and spread of the Tomato Leaf Curl Virus (TLCV) was directly correlated with whitefly population on tomato field (Gupta et al, 2007).

Aphid is also phytophagous pest. Though cotton and okra are its main hosts, it also cause severe damage to tomato, brinjal, beans and potato. Both nymph and adult suck the cell sap and secret honey dew. Which not only attract the black ants but also
favours the growth of sooty mould, giving the plants a sticky appearance (Butani and Jotwani, 1984). The aphid transmitted yellowing virus reduced yield and quality of tomato. Early infection (2-3 week after transplanting) caused the greater plant stunting 8-15 per cent and reduction in yields 60-83 per cent (Zitter and Everett, 1982).

The thrips occasionally appear in large number and damage tomato plant by lacerating the leaf tissues and imbibing the oozing sap. As a result of damage, the tender foliage becomes spotted and pale and silver strip appear on the affected leaves. The thrips also infest flowers, which when severly damaged wilt, fade and drop prematurely without bearing any fruit (Butani and Jotwani, 1984).

In spite of the fact that insect pests have been an issue in agriculture as the centuries progressed, phenomenon of pest outbreaks have expanded with the change of pest complexities during the recent four decades. Pest richness and distribution changes with abiotic elements and meteorological parameters assume an urgent part in upsurge and biology of any pest. Temperature is the most pivotal abiotic element affecting the rate of growth, development of insect and is particularly critical for insect as pest control measures must be timed precisely. Relative humidity, precipitation, wind velocity and temperature are the major climate parameters that generally coordinate the action of a specific insect. Relationship between pest migration and abiotic components helps in inferring at precision models that supports estimate of pest occurrence.

In tomato, where pest management plays an important role in harvesting its maximum potential, numbers of insecticide applications though increases the yield, but are economical up to a certain extent. The increased insecticide applications coupled with high cost result in escalation of cost of cultivation which further makes the crop uneconomical due to non-remunerative price of the crop produce. Their massive overuse and frequent misuse has led to the problems of three Rs viz.; resistance of pesticides, resurgence of pest and residues as well as toxicity hazards to non-target animals. The present study was planned and undertaken to evaluate efficacy and economics of various insecticides such as imidacloprid, spinosad, acetamiprid, clothianidin, thiacloprid, dinotefuran, difenthiuron, fonicamid and dimethoate for the management of major sucking pests of tomato viz; whitefly, aphid, jassid and thrips.
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Looking to the importance of sucking pest, viz; *B. Tabaci, A.gossypii, A. bigutula bigutula* and *T. tabaci* and *S. dorsalis* on tomato crop, the following aspects were studied during the course of investigation.

1. Seasonal incidence of major sucking pests infesting *kharif* tomato.
2. Estimation of yield losses due to the major sucking pests infesting *kharif* tomato.
3. Bio-efficacy of insecticides against major sucking pests infesting *kharif* tomato.