INTRODUCTION

Tomato *Lycopersicon esculentum* L. (Solanaceae) is one the important vegetable crops cultivated in most parts of India including Maharashtra. It is one of the most popular and widely grown solanaceous crop in many countries.

The tomato is native to Peru. In Maharashtra it is grown under irrigated conditions mainly in Satara, Sangli, Pune, Nashik, Ahmednagar districts. During 2006-07 the total production of tomato in Maharashtra was 5,30,417 metric tones. In year 2007-08, 365.5-hector land is under cultivation of tomato in rabbi season while 47.10 hector in kharif season in Karad taluka. Karad is one of the well-known regions of satara district where more land is under the cultivation of tomato.

Tomato has special nutritive value and widespread production. It also supplies vitamin C and variety of colour and flavour to food. Green tomatoes are used to pickles and rich in medicinal value. The pulp and juice are digestible aperient, a promoter of gastric secretion and blood purifier. It is also considered to be intestinal antiseptic. Tomatoes are high in potassium and vitamins A and C and cholesterol free. In fact recent scientific studies indicate that eating cooked tomatoes reduced one's likelihood of suffering from Cholesterol related heart problems and digestive tract cancers. Cooked tomatoes releases Lycopene, a strong antioxidant from the skin. Tomato seed contains 24 per cent oil and this is extracted from the pulp and residues in canning industry.

Tomato crop requires protection from a variety of pest, including pathogens, weeds, nematodes and insects and other arthropods. Wherever grown, tomato host for many kind of insects. All parts of the plant offer food shelter and reproduction site for insects. Insects attack tomatoes from the time of seed is planted, until the fruit is

harvested and may cause unthrifty growth or death of tomato plant and damage to fruit in the form of scanning, tissue destruction, and aberrations in the shape and color. Fruit is contaminated by whole insects, insect excreta and insect parts. Insects can also introduce decay organisms into fruit or can vectors many viruses and several mycoplasmas that cause growth disorders or death of the plant. Makeup of the insect complex in tomatoes varies both within and between major production areas. The tomato agroecosystem is characterized by having few major key pests and many minor or secondary pests. A complete list of all of the insects and arthropod pests of tomato include between 100 and 200 species. Some important insects attacking tomato crop in India are tomato fruit borer (*Helicoverpa armigera* Huber) white flies (*Bemisia tabaci* Gennadius), mites (*Tetranychus* sp.) cut warm (*Agrotis ypsilon* Root) leaf miner (*Liriomyza sativa* Blanchard) trips (*Frankliniella damptii*), leaf eating caterpillar (*Spodoptera litura* Fabr), aphid (*Aphis gossypii* Golv.), mealy bug (*Ferrissia virgata* kill.) etc.

As the plant become more mature many insects such as whiteflies, cutworms, armyworms and some species of beetles either cause stunting, deformation of the plants partial or complete defoliation or other adverse effects. Whiteflies transmit viruses or mycoplasmas of tomato.

Red Spider Mites

The mite infesting tomato to phylum – Arthropoda sub – phylum Chelicerata, Class: Arachnida, Sub-Class Acari – Acariformes, Order Prostigmata, Super family: Tetranychoidea family- Tetranychidae Genus: *Tetranychus* and species – *cinnabarinus*. Earlier it was known as *Acarus cinnabarinus* Boisd (1867) lateron renamed as *Tetranychus biomaculatus* Harvey (1884) and then as *Tetranychus telarius* Linn (1931). Presently, it is re – christened as *Tetranychus cinnabarinus* (Boisduval).

It is world widely distributed and in India, it mainly occurs in the states of Maharashtra, Gujarat, Haryana, Bihar, Punjab, and Rajasthan, Orissa, Meghalaya, Kerala and Karnataka. It is a polyphagous in nature and the host range includes brinjal okra, tomato, bittergourd, cucurbits, cabbage, beans, cotton, black gram, green gram, cowpea, soybean, watermelon, sunflower, sunhemp, castor, jute, rose, hollyhock, etc. (Gupta 1985).

Very high temperature and relative humidity are detrimented for its development. While moderate temperature and relative humidity are congenial. The population starts developing during March, prevails till July and declines thereafter during monsoon season. A number of natural enemies of the mite have been recorded and the prominent predators are coccinellids, staphyhids, anthocorids, thrips, lacewings and predacious mites like phytoseiids (*Amblysein* spp/ *Phytoseilus* Spp) and *stigmacids* .

The mite *T. cinnabarinus* is soft bodied 0.5 – 0.6 mm in sized, crimson red cloloured, colony forming mite which mostly live on under surface of host plant leaves. The life cycle constitutes the sequential stages viz., egg, larva, nymphochrysalis, protonymph, deutochrysalis, durtonymph, teleiochrysalis, and adult. Larva possesses three pairs of legs while remaining subsequent developing stages possess four pairs of legs. The normal duration of egg larval, nymphal and adult stage is 5 to 7, 1 to 2, 3 to 4 and 7 to 9 days respectively. In general, the duration from eggs to emergence of adult is 9 to 12 days (Bhagat and Singh, 1999). In warmer zone of the state, the mite population stars developing during March, prevails till July and declines thereafter with the start of monsoon rains. However, under climatic conditions of Satara district, the peak infestation occurs during August – October and March – May.

The mite feed by piercing the leaf tissues with chelicerae. Injuries to epidermal and mesophyll layers cause water loss, reduces the chlorophyll metabolism and photosynthesis. Besides, the damaged cell

loose chlorophyll content as a result of which the normal cell functioning is reduced and the plant growth is affected. Due to mechanical injury, photosynthetic enzymes are influenced which change the pathway of carbon and affects CO_2 intake. All these damages impair the starch synthesis. The feeding also affects transpiration rate due to loss of protective covering and disturbance in stomatal opening, resulting in hydrolysis of protein and starch into amino acids and soluble sugars. This breakdown provides more nutrition to the mites leading to their rapid multiplication. Severely infested leaves become completely yellow to brown and fall off from the plants, plants remain stunted.

Among the insect pests, fruit borer and leaf miner are the important pest causing production and economic loss. Tomato fruit borer is most destructive polyphagus insect having cosmopolitan distribution. It has now assumed a status of 'Key pest' in all parts of world. It feeds and breeds on 181 species of host plants (Sithanantham, 1987). In India, this pest is recognized as a ' Notional Pest', since it is reported on several economically important crops and known to cause enormous losses (3.8 to 56 per cent) to tomato crop (Anonymous, 1990 – 91). Recent reports indicate that, day by day population of *H. armigera* is reaching to alarming level. The development of resistance in the pest was reported during recent past (King and Sawiski, 1990, Mehrotra and Phokela, 1991) due to tip indiscriminately used conventional insecticides and synthetic pyrethroids. Root dip with imidacloprid (Mote *et al.* 1995) and spray treatment with monocrotophos (Walunj and Mote, 1995) and application of carbofuran (Mote *et al.* 1995) at seeding stage effectively checked the just population of aphid, jassid, thrips and white files upto 60 days. Planting combination of 10 tomato rows with one row of marigold (planting as a trap crop) followed by two sprays of 0.07 % endosulfan on the intercropped tomato achieved less than 6 percent fruit borer damage (Shrinivas and Krishnamoorthy, 1993). Efficacy of neem seed extract spray (Abdul- kareem, 1980), nuclear polyhedrosis virus (NPV) (Santharam et al. 1981, Jayraj 1988) and insecticides (Hari *et al.* 1990) was reported earlier on

number of crops for control of H. armigera. Increasing susceptibility of NPV infected final instar laevae to Endosulfan, Fenvelarate and Cypermethrin was reported recently (Shrinivas 1985, Rabindra and Jayraj, 1990). Neem seed kernal extract (NSKE) 3 % + 0.035 % endosulfan + NPV @ 250 LE/ha applied 3 times at 45, 55 and 65 days after planting gave highest larval mortality, reduced fruit damage and highest fruit yield (Gopal and Senguttavan, 1997). The species of *Trichogramma* is know to parasitise the eggs of *H. armigera* (Mathur, 1970, Oatman and Planter, 1971, Stinner *et al.*, 1974a, 1974 b) giving major advantages of killing the pests at the non – destructive egg stage and thereby preventing the larval damage. The effectivenss of Endosulfan spray was reported earlier by Patel *et al.* (1991) against *H.armigera.*

White Flies

Bemisia tabaci is classified in to order – Himoptera, family- Aleyrodidae, and sub- family – Aleyrodinae. *Bemisia tabaci*, the sweetpotato whitefly and *Bemisia argentifolii*, the silverleaf whitefly, represent, either different of *B. tabaci* or the members of a species complex. Hence *B.tabaci* is known by several common names. e.g. the tobacco, cotton, or sweetpotato whitefly.

In the recent years, whitefly *(Bemisia tabaci* Genn.) has been assuming serious form in the state of Maharashtra. As regards India, it is distributed throughout the country. Earlier, it was considered as a major pest of cotton in Punjab and Rajasthan, though its occurrence was regularly noticed in Uttar pradesh, Maharashtra and Bihar (Khan and Rao 1960). Its host range includes, brinjal, tomato, cotton ornamented plants, Guava, beans, okra and tobacco Tropical and subtopical habitats and is multivoltine, producing 11 – 15 generation per year under conductive tropical, subtropical, and fringe temperate conditions.

Life Cycle: Whitefly nymphs overwinter on the leaves of host plants. In late spring adult females deposit 200-400 eggs in circular clusters on the undersides of upper leaves. The eggs hatch in 5-10 days and first

instar nymphs, which resemble small mealybugs and are called crawlers, move a short distance from the egg before flattening themselves against the leaf to feed. The remaining nymphal stages (2nd, 3rd and 4th) do not move. A non-feeding pupal stage follows and within a week, young adults emerge to repeat the cycle. There are many generations per year. Whiteflies develop from egg to adult in approximately 25 days at room temperature. Adults may live for one to two months.

Both nymphs and adults feed via stylet mouthparts with which they pierce plant tissues and suck phloem sap. These insects often produce a large amount of sugar-rich excreta, whilst extracting sufficient protein-building amino acids from the sap to facilitate body growth. These excreta, termed 'honeydew' may support the growth of sooty mould on affected plants. Large infestations of whiteflies may thus adversely affect their hosts, both by excessive sap loss and through sooty mould interfering with photosynthesis (Martin, Aguiar & Baufeld, 2001).

Whitefly borne viral diseases transmitted by the adults are one of major importance in tropical and subtropical agriculture, with more than 70 diseases and a range of symptoms being reported on cultivated and weed plants (Cohen, 1990; Bedford, Briddon, Brown, Rosell & Markham,1994). Although relatively few whiteflies are normally ant-attended, ants may be attracted to the honeydew of large colonies and their presence may interfere with natural enemies of the whiteflies and of other pests in their vicinity. Secondary damage can be caused by some whitefly species as copious production of woolly 'wax' secretion soil the plant canopies. Some whiteflies

The increasing problem encountered with insecticide use resulted in the origin of the integrated pest management (IPM) concept. Until now, the management of the pests of tomato has been restricted to chemical control. Therefore, it felt necessary to test IPM module comprising various management practices, which are specific and

environmentally friendly. *Bemisia tabaci* Genn. was first described in 1989 as a pest of tobacco in Greece and designated *Aleyrodes tabaci*, the tobacco whitefly. In 1957 this species and 18 other previously described whitefly species (Gill R.J 1992) were synonymized into a single taxon *Bemisia tabaci* feed in the phloem of its host plant, passing its stylet between host plant cells until it penetrates the phloem. Wind dispersal of adult whiteflies can occur over both short and long distance. Humans also transport immature and adult stages on plants. *B .tabaci* was reported as a sporadic pest and was the most important whitefly vector of plant viruses in subtropical, tropical and fring temperate zones where winters are mild enough to permit year round survival *B.tabaci* Genn. is primarily a polyphagous whitefly that colonizes predominantly annual, herbaceous plants.

Whitefly is one of the most outstanding problem. Damage caused by this insect to commercial tomato may be by the transmission of plant viruses such as tomato yellow leaf curl viruses. (Metha *et al.*1994). It can seriously injure plants by sucking causing, wilting, stunting, irregular, ripening of fruits. In addition, the excretion of honeydew induces the growth of the sooty mold that can block sunlight from reaching the surface thus reducing photosynthesis and fruit markability (Oliveira, Henneberry, and Anderson, 200l). Adults can also transmit several viruses from infected to healthy plants most of which are important mainly in commercial crops (Bedford *et al.*,1994; Perring 200l). Up to now, 24 biotypes of *B.tabaci* Genn. have been reported, which differed in their biological, physiological and morphological characteristics (Brown, Fohilch, and Rosell, 1995; Brown, 2000; Perring, 2001). Apparently, among the 24 known biotypes, the B biotype is the most destructive one due to its wide host range, high fecundity, rapid developmental rate, and high resistant to most of the available insecticides (Costa *et al.*, 1993; De Barro and Driver, 1997).

Heavy incidence of the pest on cotton was reported from the states of Andhra Pradesh (Reddy *et al.*, 1986) Tamilnadu, Karnataka

(Natarajan 1984), Maharashtra (Ajri *et al.,* 1986 and Thakare *et al.*, 1987) and Gujarat (Patel *et al.*, 1987) in early eighties. During this period, Brinjal crop also evidenced a heavy infestation of the pest in Maharashtra (Anonymous 1987).

Since no effective chemical control measures were available to guide the farmers confronted with the problem, it was felt necessary to undertake study to find out the most effective insecticides against the pest. During the past decade, colonization by *B.tabaci* has become a prominent problem in worldwide subtropical and tropical agroecosystems. Lot of money have been lost as a result of direct feeding damage and plant diseases caused by whitefly transmitted (WFT) geminiviruses.

The chemical control shows many disadvantages. The plant originated insecticides and acaricides are a betters way to control the red spider mites and white files. Now a days some farmers are agree with use of organic insecticides but they didn't have correct knowledge of it. So survey of plant which shows the insecticidal property is a challange infront of farmers and agricultural experts. Many weeds and hedge plants are easily available and they have the possible source of insecticids. In the pesent study some weeds and hedge plants were tested in laboratory condition to control white files and red spider mites of tomato.

Objectives

1) To study the insecticidal activity of some plants against white files.
2) To study the acaricidal activity of some plants against red spider mites.
3) To check the effective concentrations of plant part that control white flies and red spider mites.