CHAPTER I

INTRODUCTION

Land-use changes, whether as responses to climate change, or other (socio-economic) factors, are expected to have a greater impact on the occurrence of invertebrate pests than the direct effects of climate change alone. There is a growing consensus that climate change could lead to an overall increase in the abundance and diversity of invertebrate pests particularly phytophagous insects and mites – pest pressure – as habitats become more favourable for their establishment and development, new niches appear, stabilizing interactions are decoupled, and invasive species arrive as a result of range expansions (Fuhrer, 2003; Luedeling *et al*., 2011). Most invertebrates are expected to change their geographical distribution in response to climate change so as to remain in areas to which they are well adapted.

Mites belong to the subclass Acari under the class Arachnida of the sub-phylum Chelicerata. They are minute in size, with body length ranging from 300 to 500µm in the adult stage. They are also ubiquitous, being found in all major terrestrial and aquatic habitats with 50,000 described species worldwide (Zhang, 2003). This highly diverse group comprising of minute phytophagous, predaceous, mycophagous, phoretic and parasitic acarines is unfortunately much less known than other groups in the Arthropoda, the most diverse phylum of living organisms.

Mites constitute the most important group of non-insect pests in agriculture. They attack virtually every plant of economic importance. Field and vegetable crops in particular, are subjected to infestation by a number of mite species, leading to heavy economic loss. The average yield loss in field and vegetable crops are due to mite pests in India has been estimated to be around 25 per cent (Gupta, 1991).

India is the second largest producer of rice in the world next to China with average production of 95.32 million tonnes, grown in an area of 45.95 million ha. Across the world, rice is cultivated approximately in an area of 150 million hectares with an annual yield of about 610 million tonnes (http://beta.irri.org/). Rice is the main source of carbohydrates for almost half of the world population. Daily intake of 100 g of rice portion provides 20% of the daily energy and 15% of the daily protein for an adult (Food and Agricultural Organization, 2013).

Rice productivity in India is very low of 2,373 kg /ha due to damage caused by pests, diseases and weeds. In Tamil Nadu, rice is cultivated in an area of 1.49 million ha with a yield of about 4.05 million tonnes (Agricultural statistics, 2015).

Among different species of mites associated with rice crop, leaf mite, *Oligonychus oryzae* Hirst (Acari: Tetranychidae) is the most important species to cause appreciable damage in recent years (Gupta, 2012). Occurrence of the rice leaf mite has been noticed in Tamil Nadu due to changes in rainfall pattern, prolonged drought which provide congenial atmosphere for the multiplication of the mites.

Globally tapioca is grown in an area of 18.51 million ha producing 202.65 million tonnes with a productivity of 10.95 t/ha. (FAO, 2005). It is grown in 102 countries in the world. African continent occupies first position covering 66.21 per cent of tapioca area producing 53.37 per cent of the world cassava as it is a staple in many of the African countries. Even though area is more in Africa, its production is low due to low productivity (8.82 t/ha) which is lower than the world average productivity. Though rice and wheat form a major part of the staple for Asians, it is to be noted that Asian continent is the second largest in terms of area (19%) and production (29%) of cassava with a productivity of 16.76 t/ha. South America has 13.44 per cent of area producing 16.79 per cent (third rank) of the world production.

The tapioca is concentrated in the southern states of Kerala, Tamil Nadu and Andhra Pradesh owing to the favourable climate and efficient utilization. Among the southern states, Kerala has a major share in area (1.04 lakh ha) under tapioca (43.33 of % of tapioca area in India) and the maximum production here goes for human consumption. Tamil Nadu has an area of 95,000 ha (40 % of the total area under cassava in India) and 60 per cent of tapioca produced is utilized industrially to produce starch, sago and other value added products. Andhra Pradesh has 8.1% of the cassava area and is utilized exclusively for industrial purposes. The remaining area of tapioca is concentrated in the northeast region of the country.

Tapioca is attacked by about 50 species of mites. Of these, the most important are *Tetranychus urticae, T. cinnabarinus, Mononychellus tanajoa, M. progresivus* and *M. caribbeanae.* These arthropods cause three patterns of damage and have been shown to cause a decrease in root and stake yield of up to 87% and 82%, respectively (Byrne *et al*., 1983). It is expected that as cassava is further commercialised there will be a greater

tendency towards monocropping in large fields and towards the more frequent use of broad spectrum pesticides. As a result, mites as well as other pests will probably increase in importance.

Farmers depend mostly on synthetic acaricides for managing the mite problems because of instant spectacular knock down effect. Over the last two decades, indiscriminate application of broad spectrum pesticides/ acaricides for control of field and vegetable pests have led to many of the mite pests, which were either innocuous or of very little importance, assume major pest status. Besides, due to repeated use of organophosphorous compounds and many a times at their sublethal doses, the mites have developed resistance and cross resistance making the mite control a more difficult task (Gupta, 2002).

In cognizance of the above fact, a research project entitled "Diversity of phytophagous and predatory mite fauna (Acari), host plant resistance and management of rice and tapioca mites in Tamil Nadu" was carried out to assess the diversity of phytophagous and predatory mite species associated with major field and vegetable crops in different zones of Tamil Nadu, screening of rice and tapioca entries for resistance and the management studies were carried out on rice and tapioca. The objectives of the study include;

- To study the distribution and diversity pattern of mite species (both herbivorous and predacious) in different agro climatic zones of Tamil Nadu and identify the common and dominant species of regional importance.
- To study the population dynamics and developmental stages of rice and tapioca mites.
- To screen certain popular varieties of rice to rice leaf mite and tapioca two spotted spider mite to identify the source(s) of resistance.
- To investigate the mechanisms of resistance by studying the biochemical components in selected rice and tapioca entries.
- To study the management strategies for rice and tapioca mites.