CHAPTER I
INTRODUCTION

Soybean [\textit{Glycine max} (L.) Merrill.] is an important leguminous crop. Native of soybean is in Asia and the first known records, however, indicate that soybean emerged as a domesticated crop around the eleventh century B. C. in China (Hymowitz, 1970), where it was cultivated for its oil since centuries and they named it as a "yellow jewel" which feeds China's entire population. Soybean was introduced in India in 1870-80 (Andole, 1984). The soybean crop is one of the remarkable success stories in Indian agriculture. It was promoted in the mid 80's as one of the strategies to boost edible oil production in the country. It was introduced in Gujarat by ex Baroda State as early as 1934. In recent years, great interest has been evidenced in the cultivation and the use of soybean, mainly on account of its dietetic, industrial and agricultural importance.

It is one of the most important oilseed cash crops of India. It is a fascinating crop with innumerable possibilities of not only improving agriculture, but also supporting industries. It is a unique crop with high nutritional value, providing 40 per cent protein and 20 per cent edible oil besides minerals and vitamins. Soybean oil is used as a raw material in manufacturing antibiotics, paints, varnishes, adhesives, lubricants etc. Soybean meal is used as protein supplement in human diet, cattle and poultry feeds (Alexander, 1974). Soybean is a major oil seed crop of the world grown in an area of 113.01m ha with production of 283.79 mt and productivity of 2.51 t/ha (Anonymous, 2013). The crop is mainly cultivated in USA, China, Brazil, Argentina and India. India contributes more than 90 per cent of the world’s acreage.

In India, soybean occupies an area of 109.714 lakh ha with production potential of 114.907 lakh tons. Major production comes from Madhya Pradesh (57.168 lakh t) followed by Maharashtra (39.456 lakh t) and Rajasthan (9.499 lakh t). Other soybean producing states are Andhra Pradesh, Karnataka, Chhattisgarh and Gujarat (SOPA, 2016). In India in the year 2012-13, soybean cultivation reached to 12.03 m/ha recording production of 12.98 mt with an average of 1079 kg/ha. In
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Gujarat, the area under soybean was 14,000 hectares and the yield was 714 kg per ha with total production of 10,000 tones (Anon., 2003).

It also contains good amount of potassium, sulphur and vitamin E. Soybean protein is mainly rich in amino acids like leucine, methionine and threonine that the human body requires. For vegetarians, it is known as "poor man's meat". Owing to the absence of sugar content, it is considered to be very suitable diet for diabetic patients.

Soybean improves the soil on which it is grown. It transfers nitrogen taken from air into the soil, making it rich and fertile. Soybean is a specific remedy for proper functioning of bowels, heart, kidney, liver and stomach. A decoction of the soybean root is said to be an astringent. Also, the demand is increasing for the soya meal, which is high protein livestock feed.

Among the various insect pests infesting soybean crop, following are considered to be important pests (Vyas, 1996).

1. Gram pod borer : *Helicoverpa armigera* (Hubner)
2. Pink pod borer : *Cydia ptychora* (Meyr.)
3. Leaf eating caterpillar : *Spodoptera litura* (Fabricius)
4. Green semilooper : *Chrysodeixis acuta* (Walker)
5. Grey semilooper : *Amyna octo* (Guenee)
6. Leaf miner : *Aproerema modicella* (Deventer)
7. Whitefly : *Bemisia tabaci* (Gennadius)
8. Stemfly : *Ophiomya phaseoli* (Tryon)
9. Aphid : *Aphis glycine* (Koch)
10. Jassid : *Empoasca kerri* (Pruthi)

Soybean crop having luxuriant growth with succulent leaves attracts the number of insect pests for feeding, oviposition and shelter. About 150 insect pests cause damage to soybean in various parts of Madhya Pradesh, out of which about a dozen of insect pests cause serious damage to the crop from sowing to the harvest (Singh and Singh, 1992). Among them green semilooper, *Chrysodeixis acuta* (Walker), tobacco caterpillar, *Spodoptera litura* (Fabricius) and pod borer, *Helicoverpa armigera* are major foliage feeder insects which voraciously feeds on foliage, flower and pods causing significant yield loss.
The damage caused by this pest depends on population of damaging stage of insect, crop growth stage, cropping pattern in the area and prevailing environmental conditions. Perusal of literature reveals that insecticidal recommendation are available for protecting the crop from soybean defoliators attack. But, they are highly toxic to natural enemies and cause environmental pollution.

To overcome such problems, use of some most competent tool of IPM for the management of soybean defoliators is required. Use of bio-pesticides in management programme either alone or combination with some synthetic insecticide is one of the most effective ways to reduce the insecticidal load in agro-ecosystem. Entomopathogenic fungi are appropriate microbial agents as they infect the insect cuticle directly through contact and do not require to be ingested for infection to set in.

Correlation of pest population with different weather parameters provide valuable information on the basis of such data a predictive model can be developed which can be used for the forecast of pest population build-up and ultimately farmers can plan for plant protection strategies. The study of seasonal incidence will be useful to generate the information on population build-up of soybean defoliators. In the recent years, these pests have created a serious threat to agricultural industry due to development of resistance toward commonly used insecticides. This has resulted in complete failures and lack of confidence in insecticides. It has also drawn the attention of entomologists to develop eco-friendly and sustainable management practices. Among such eco-friendly approaches, bio-pesticides is one of the most important components, which are being employed to control of pests in soybean ecosystem. Among several bio-pesticides, Beauveria bassiana and Metarhizium anisopliae are the most important component for its control as well as in reducing the chances for development of resistance against them.

To avoid the yield loss caused by these destructive pests and to encourage the cultivation of soybean on large area, to increase the production and productivity of India as well as Gujarat, all our efforts are needed to tackle these major insect pests by knowing the peak period of infestation and application of some effective insecticides against these pests under the field conditions.
In view of importance of the soybean crop and seriousness of the soybean defoliators, it becomes necessary to have comprehensive information on different aspects of pest management. Hence the detailed studies on seasonal incidence and efficacy of insecticides against soybean defoliators, under the Junagadh conditions were needed.

The present investigations were therefore carried out with following objectives,

1. Seasonal incidence of defoliators on soybean
2. Bio-efficacy of insecticides against soybean defoliators under laboratory condition
3. Bio-efficacy of insecticides against soybean defoliators under field condition