# Chapter I

# INTRODUCTION

Fig. 1 Plantation of grapevine

**Introduction:-**

Grape (*Vitis vinifera* L.) is one of the most important sub-tropical fruit crop grown in the world. It is cultivated in more than 60 countries, with 9 million ha. area under cultivation (Anon,1988). It is very delicious refreshing and nourishing fruit grown mainly for making wine, raisin, juice, jelly and rest for table purpose. It is well known as nutrition source of natural sugars, vitamins and fibre.

In India, it occupies about 45,200 ha. of land under its cultivation. States like Karnataka, Andhra Pradesh, Tamilnadu, Maharashtra, Punjab, Haryana and Uttar Pradesh contribute major land under its cultivation. Maharasthra contributes 20,000 ha. with production more than 5 lakh tones / year and approximate turnover beyond 500 crores (Singh *et al.*, 2005). The major grape growing areas are situated in the districts of Nasik, Pune, Sangli, Solapur, Kolhapur, Satara, Jalgaon, Ahmednagar, Amravati, Nagpur, Parbhani and Aurangabad.

As grape is important commercial fruit crop it faces attack of several diseases and pests, which is a great problem in India. The fungal diseases such as downy mildew, powdery mildew, Anthracnose etc. are major, while, pests such as grapevine leaf hopper, thrips, mealybug, leaf roller, beetle etc. (Atwal, 1976). To overcome these pest and disease, farmers use various chemical fungicides, pesticides which include mainly Bordeaux mixture, Sulfex, Wetasul, Bayleton, Saprol, Difolatan, Fenitrothion, Malathion, Endosulfan, Omethoate, Methomill, Monocroptophos, Acitate and Methadophos etc. (Rangaswami and Mahadevan, 1999).

Use of several organochlorine, organophosphorus and carbamate chemical pesticides and fungicides has not only resulted in the mortality of pests, but also resulted in development of resistance, resurgence and residues in harvested products and adverse effects on other non-target organisms in the ecosystem including human being (Patil *et al.,* 2003).

India is one of the large scale grapes cultivating country of the world. The grapes cultivated in India are exported in coutries like United Kingdom

(UK), Netherlands, Belgium, Germany, France, Italy, Poland, Spain, Sweden, Greece etc. According to International Plant Protection Convension, 1951, Phytosanitary Certificate should be taken for export of fruits and other food products. The Phytosanitary Certificate is given to those products wich are free from pesticide residue and diseases. In European coutries residue detection of 81 pesticides is made compulsory. If the residue is found in the grape berry above maximum residue limit (MRL) prescribed by FAO/WHO and Government of India, then it should not be exported in western countries. In India, due to climatic coditions and other factors, use of chemical pesticides is extensive. Over application of chemical control measures such as fungicides and pesticides on grape creates the residual effect on berries (De Melo Abreu, *et al.*, 2006). Such grapes are not of export quality and high commercial market value.

The residue of pesticide can be avoided by implementing Integrated Pest Management (IPM) programme. Pesticides which are less toxic to environment and easily biodegradable are preferred. Biological control of various pests is found more beneficial because it is target specific and easily biodegradable. The use of various biopesticides like *Trichoderma* spp., *Bacillus* spp., Neem (*Azadirachtra indica*), Karanj (*Pongamia pinnata*) and many are reported.

As plants and insects have co-evolved over millions of years, they have accumulated specific secondary plant chemicals (SPCs) to counteract the insect damage. More than 10,000 SPCs have been chemically defined and their total number may exceed 400,000 (Swain, 1977). These bioactive chemicals include insecticides, antifeedants, Insect Growth Regulator (IGRs), fungicides, juvenile hormones, repellents, attractants, arrestants etc. (Table 1.)

**Table 1. Type of pest control action reported in plant species**

| Sr. No | Pest control action | No. of spp. of plants | Sr. No. | Pest control action | No. of spp. of plants |
|---|---|---|---|---|---|
| 1. | Insecticidal | 1053 | 9. | Fungicidal | 100 |
| 2. | Antifeedant | 230 | 10 | Bactericidal | 4 |
| 3. | Repellent | 225 | 11 | Molluscidal | 6 |
| 4. | Growth inhibitor | 32 | 12. | Herbicidal | 14 |
| 5. | Attractant | 27 | 13. | Antiseptic | 35 |
| 6 | Rodenticidal | 29 | 14. | Fish poison | 147 |
| 7 | Acricidal | 2 | 15 | Arrow poison | 90 |
| 8. | Nematicidal | 58 | 16 | Poisonous | 69 |

Hence, plants are thought to be an important alternative source for chemical pesticides with the following distinct advantages (Kannaiyan, 1999).

- Plant origin pesticides are generally ecologically safer than conventionally used synthetic pesticides.
- Owing to its renewing ability, botanical pesticides would ultimately be cheaper than synthetic ones.
- Poor and marginal farmers who have suffered the most both by in crease in cost and hazards of synthetic insecticides can grow their own pesticide yielding plants.
- Unlike synthetic pesticides, most plants have more than one chemical possessing biological activity. These chemicals may exert a single biological effect or may have diverse biological effects. Hence, the chances of developing quick resistance to different chemicals are in likely.

Sustainable agriculture necessitates the use of eco-friendly technologies for the production as well as programmes to sustain the fragile ecosystem and to increase the productivity. The renewed public interest on environmental and eco-friendly technologies has widened the scope for the use of plant origin pesticides in IPM (Integrated Pest Management) in the future too. Despite two

decades of intensive research, remarkable achievement has not been made on these groups of pesticides except neem (Kannaiyan and Gunasekaran, 2001).

**Users of Agave leaf extract:-**

Grape cultivation is on large scale in Maharashtra, especially in the districts like, Satara, Sangli, Kolhapur, Nasik, Ahamadnagar, etc. The cultivers in Sangli and Satara districts now adopted the traditional method of Agave leaf extract spray for controlling various diseases of grape. Some of the farmers in our neighbouring area are enlisted as follows.

| Name | Address | Area (Acre ) |
|---|---|---|
| Shri. Anil Desai | A/p- Athani, Ugar, (Karnataka). | 10 |
| Shri. Jagannth Gavade | A/p- Junekhed, Tal-Walwa, Dist-Sangli. | 2 |
| Shri. Depak Desai | A/p- Takari, Tal-Walwa, Dist-Sangli. | 2 |
| Shri. Sachin Ghatage | A/p- Kundal, Tal-Palus, Dist- Sangli. | 3 |
| Shri. Subhash Patil | A/p- Kavlapur, Dist- Sangli. | 5 |
| Shri. Balu Mali | A/p- Kavlapur, Dist- Sangli. | 7 |
| Shri. Namdeo Mane | A/p- Kasegon, Tal-Pandharpur, Dist- Solapur. | 70 |
| Shri. Sunil Ghorpade | A/p- Palus, Tal-Palus, Dist-Sangli. | 16 |
| Shri. Sachin Mali | A/p-Rethare Harnakhsh, Tal-Walwa, Dist- Sangli. | 2 |
| Shri. Hanamant Mali | A/p- Malinagar, Tal-Walwa, Dist- Sangli. | 5 |

The information and experience of above farmers is promoting aspect of the present work. The disease resistance is created in the grape plants. Also, the infected plants, it sprayed with Agave leaf extract, show considerable reduction in disease development. Hence, it was an interesting to study the internal metabolism changes as well as study of degradative enzymes in the grape plants. Most of the above farms were visited and fruitful disscussions were made with the farmers. One or two farms are selected for the field experiments of present studies.

Jagannath Gavade
A/p Junekhed, Tal. Walawa
Dist. Sangali

Dipak Desai
A/p Takari, Tal. Walawa
Dist. Sangali

*Agave cantala* Roxb. and other species belong to Agavaceae and possess CAM metabolism (Landge, 1988) it is the most important fibre crop in the world with more than 25 species and in India over 8 species are reported (Chakravarty and Biswas, 1986). The *Agave* leaves are thick, fleshy and long, containing several compounds especially carbohydrates, saponins, mecogenin, hecogenin, corticosteroids, proteins, alkaloids, polyhenols, glycosides, steroid glycosides, steroid sapogenins etc. (Usher, 1991; Subramanina and Nair, 1970; Yan and Huang, 1976). Furthermore, leaves of Agave possess molluscicidal (Pant *et al.*, 1986; Shoeb *et al.*, 1986; Sukumaran *et al.*, 1994), insecticidal (Reddy, 1991; Dharmshaktu *et al.*, 1987; Consoli *et al.*, 1987, Sharma, 1988) properties. Flowers possess molluscicidal property (Kishor, 1990; Rana, 1993). The rhizomes of *Agave cantala* Roxb. possess spermicidal activity (Pant, 1998) and seeds of *A. americana* show larvicidal activity (Dharmshaktu *et al.*, 1987).

Most of the *Agave spp.* is not showing incidence of fungal diseases, insects or pests, it is possible that due to leaf contains, the species may be resistant to a particular pathogen. Hence the application of such leaf extract may play an important role in controlling the plant diseases i.e. Biological control.

In Shivaji University laboratory considerable attention has been paid to the physiology of succulents in last 40 years. Thus the carbon metabolism and enzymology of CAM in succulents like *Bryophyllum pinnatum*, *Aloe barbadensis, Portulaca oleracea* (Karmarkar 1965; Bartakke, 1977; Karadage, 1981) and seasonal variation in mineral constituents and total polyphenol contents in *Agave cantala* and *Sansevieria trifasicata* (Landge, 1988; Bansode, 1995) are studied. However, in the present studies attempts have been made with rather different angle to investigate use of Agave cantala leaf extract spray to control the grape disease, downy mildew. The investigation, are carried out to study various mineral elements, organic constituents and their related enzymes present in Grape (*Vitis vinifera* L.) leaves infected with downy mildew and controlled by application of *Agave cantala* Roxb. leaf extract. The Agave plants were raised in college garden as well as collected from hedges. The leaves were used to prepare the leaf extract. Such extracts were analyzed

for different parameters and used in the spray treatment of grape plants infected with downy mildew. The physiological studies in control, infected and Agave leaf extract sprayed grape plants were made successively for three stages of grapevine development i.e. i) flowering, ii) fruiting and iii) harvest.

The studies were also made for analysis of organic, inorganic constituents etc. some enzymes were also studied for their activities in healthy, infected and Agave leaf extract sprayed grape plants of three successive stages. The enzymes studied are catalase, peroxidase, polyphenol oxidase and invertase. The results obtained were discussed in the light of references. The possible role of Agave leaf extract to control disease incidence in grape plants infected with downy mildew are explained in the present work.

The dissertation is divided into four chapters. In order to understand basic problem involved in study, brief resume of current status of literature on Grape and *Agave* is covered in chapter I. An attempt has been made to take brief review of distribution, morphology and economic importance of Grape and *Agave*. The present literature on the side effects of chemical pesticides on cultivated plants for related disease control has been summarized in brief.

The second chapter deals with the methodology which is divided into two parts: (i) preparation of extract from *Agave cantala* leaves, its application with reference of farmers who use extract in their field, (ii) spectrophotometer determinations of organic constituents and atomic absorption spectrophotometer for determination of inorganic constituents.

The third chapter "Result and Discussion" covers the major findings of the present investigation and they have been discussed in the light of available literature.

The significant findings have been briefly summarized in the fourth chapter "Summary and Conclusions". The literature cited in the dissertation is properly presented in the "Bibliography" part of the thesis.