I REVIEW OF LITERATURE

1. Introduction

Algae parasitic on land plants are known only among the Chlorophyta. Some green algae such as *Cephaleuros* and *Chlorochytrium*, may be purely epiphytic or endophytic respectively, or their associations with plants may grade into true parasitism (Joubert and Rijkenberg, 1971). Parasitic green algae occur mainly on noncultivated plants and, by virtue of their inconspicuous nature, are often overlooked. Furthermore, superficial examination of infected material may lead to misidentification, as some of these parasites closely resemble the lower fungi in gross morphology. In the tropics and sub-tropics the epiphytic alga *Cephaleuros* may assume economic importance as a troublesome hemiparasite on cultivated plants such as tea, guava and citrus. The literature on *Cephaleuros* is widely scattered over numerous and frequently obscure publications.

2. Taxonomy of Genus *Cephaleuros* :

This genus belongs to the exclusively aerophilic family, Trentepohliaceae. Most species of this genus occur in the tropics, although a few are found in temperate regions. Several transitional forms between epiphytes and parasites are found in this family, suggesting that the parasitic forms have been derived from epiphytic forms. It is noteworthy that remains of *Phycopeltis* have been found on fossilized leaves from Tertiary strata in Germany (Dilcher, 1962). These and other fossilized epiphyllous algae have been reviewed by Kirchheimer (1942).

The first taxonomic work on the genus *Cephaleuros* was compiled in 1891 by Karsten, who recognized six species. Printz (1939) revised the taxonomy of the genus and recognized additional seven species.

C. virescens Kunze is cited in most publication as the species parasitizing plants of agricultural importance. Other *Cephaleuros* spp. That have been reported to occur on cultivated plants include. *C. parasiticus* Karst on tea, *C. minimus* on cacao (Butler 1934), and *C. coffeae* on coffee (Went, 1895).

Most reports on *Cephaleuros* species contain little detailed information beyond mentioning the occurrence on a specific host or in a particular locality.

3. Occurrence and Disease Caused by *Cephaleuros* :

The available information indicates that *Cephaleuros* spp. are limited in occurrence to all continents and probably all islands between 32°N and 32°S, provided the temperature and humidity are suitable for their growth and reproduction. According to Joubert and Rijkenberg (1971) till to date no studies have been undertaken to ascertain the exact climatic requirements of *Cephaleuros*; most authors state rather vaguely that warm and moist conditions favour infection and spread. More detailed information on the climatic factors that are conducive to algal development and spread, is needed to clarify these aspects.

The diseases caused by species of *Cephaleuros* is commonly referred in the literature as "red rust" – and unfortunate choice for a malady caused by an alga. Cunningham (1897), identified *Cephaleuros* as the causative agent of a serious tea disease in India. Mann and Hutchinson (1907) stated that there is no doubt that the so called "red rust" of tea, caused by the alga

Cephaleuros virescens Kunze is the most serious blight of cryptogamic origin to which this plant is subject in North-East India. According to Butler (1918), the disease is found in nearly all the Indian tea producing areas. The infection is then recorded on numerous other hosts in this sub-continent (Bhargava *et.al.* 1966; Paily-Menon, 1960; Safeeulla and Govindu, 1948 and Yadava, 1953, 1955).

Since 1970s, after establishment of the fact that the *Cephaleuros* has a wide range of hosts, much more focus was paid to work on this alga which causes disease in most horticultural trees and fruit plants. To name the contribution made by various authors with respect to research on *Cephaleuros* is as follow –

Yadava (1953) reported some hosts of *Cephaleuros*, new to Bihar. Considering the damage of the alga caused to the horticultural crops. Vidhyasekaran and Parambaramani (1971) have studied the physiology of the alga infected leaf tissue and reported decrease in glucose and sucrose level as compared with fructose. Further in 1972 they have reported that the increase or decrease of minerals in the algal infected tissues cannot be attributed only to the nutrition of the algae. The algal thallus may also contribute to the mineral status. Algal infection also exhibited effect on nitrogen metabolism of alga infected plants (Vidhyasekaran and Parambaramani, 1971a). Chapman (1976) studied ultrastructure of *Cephaleuros virescens* and performed scanning electron microscopy of zoosporargia with a view in mind that the observation will be useful for interspecific and intergeneric comparisons in parasitic algae. Effect of three nitrogen sources on the growth of *Cephaleuros* has also been studied by Jose and Chowdary (1979). Joshi *et.al.* (1978) reported a threat to grape

cultivation by brown rust caused due to *Cephaleuros parasiticus.* Chowdary and Jose (1979) studied seasonal variation on the occurrence of *Cephaleuros* alga on seven local hosts from Varanasi and reported severe attack of the alga on these hosts during rainy season. Further they have reported that the stalked sporangia which were abundant during rainy season disappeared during March-April. Some enzymatic studies in the leaves of *Mimusops elengi* after infection with parasitic alga *Cephaleuros _parasiticus* was also been studied by Nagaraja (1988). The chemical control of *Cephaleuros* as well as the chlorophyll level in healthy and algal infected plant tissue was studied by Dalvi and Sardeshpande (1993). The occurrence of epiphytic and parasitic algae Trentepohliaceae on oil palm (*Elaeis guineensis*) has been reported by Eesvelde *et.al.* (1993). Agnihothrudu specialist consultant, Agrochemicals and plantation crops, Bangalore in his personal communication in the year 1996 mentioned that *C. parasiticus* and *C. virescens* are very common on hosts like *Tephrosia candida.* Further he is of the opinion that the disease caused by algal parasite was very severe once in Southern India on tea and at that time it was associated very intimately with the lack of potash nutrition.

Ref. not cited

Besides foregoing literature survey with respect to the parasitic algae *Cephaleuros,* an excellent review article was written by Joubert and Rijkenberg (1971) on a parasitic algae *Cephaleuros.* According to them the genus *Cephaleuros* include the only plant parasitic green algae that have attained economic importance. Few comprehensive accounts of this genus have been published, and virtually nothing is known about its physiology and degree of host dependence. Injury is most severe on debilitated plants,

consequently most control measures against *Cephaleuros* aim at improving plant health and vigour.

The foregoing literature survey thus indicated that most of the work is mainly confined to survey report, seasonal variations in the occurrence of parasitic algae *Cephaleuros* on different hosts at different locality, some aspects of physiology *viz.* sugar and nitrogen content in the alga infected host tissue. In addition, a little attention has also been paid in studying mineral nutrients and chlorophyll content. As such the obligate epiphytism and sub-cuticular habitat of *Cephaleuros* may indicate a physiological dependence on the host. Moreover it has no host specificity and the reason why it appears to grow on diverse hosts. With this view in mind, in the present study the maximum efforts have been paid to investigate physiological parameters such as estimation of chlorophylls, carotenoids, polyphenols, carbohydrates, mineral constituents. Besides the enzymes *viz.* polyphenol oxidase and phenylalanine ammonia lyase were assayed. Coupled with it paper chromatography of amino acids, organic acids and polyphenols was performed. Since no/little work on parasitic algae was carried out in Kolhapur region which comes under Western Ghats, the survey of occurrence of parasitic algae on different hosts was undertaken and the dominant host plants were selected for the study mentioned above.