

## A REVIEW ON GREEN ALGAE SPECIES

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### Abstract

The green algae which reside in plants as parasites are a group that comprises plant pathogenic agents that resides on different host plants causing the disease known as algal leaf spot. The symptoms like orange spots which are having circular texture tends to expand led to smooth surface get grayish-brown color, occupying large leaf extension. Here the damage occurs due to the drastic reduction in the area of photosynthetic area of the leaf. The algal diseases are economically injurious to the leaves, fruits and stem of the plant. This review is on verification of the spot disorder in algae associated with accrued contaminated sample determines the leaf spot ailment in algae infected samples.

**Keywords:** Algae, Orange spots, Parasites, Pathogen

### 1. INTRODUCTION

The green algae which reside in plants as parasites are a group that comprises plant pathogenic agents. The studies conducted in Brazil show *Cephaleuros virescens* Kunze and *C. parasiticus* Karst are the important species [1]. The microorganism *Cephaleuros* species belongs to green algae of the Archaeplastida Kingdom, Chlorophyta Phylum, Ulvophyceae Class, Trentepohliales Order and Trentepohliaceae Family, that resides on different host plants causing the disease known as algal leaf spot. The disease mainly affects the plants on tropical as well as subtropical regions of the world, between latitudes 32°N and 32°S in which the temperature and humidity suit the growth as well as reproduction [2,3,4]. The economically important crops like avocado, tea, coffee, cocoa, pepper, citrus, cashew and mango are also get affected by green algae which shows the symptoms like orange spots in circular texture, as duration passes tends to expand and smooth surface get exhibited as grayish-brown color, occupying large leaf extension [5,6]. Here the damage occurs due to the drastic reduction in the photosynthetic area of the leaf.

The other factors that limit the study of plant parasitic algae *in vitro* are especially because of the media that do not contain the nutrients required by these organisms. The medium that we use are Potato Sucrose Agar (PSA), which is widely used for the cultivation of various organisms but does not promote algal growth [7]. In contrast to this media, synthetic media such as Trebouxia and Bristol have proved effective growth for algae.

Recent studies on the characterization of *Cephaleuros*, by molecular tools, have helped the identification by sequencing of conserved genes, as few sequences pertain to the genus in databases [8]. The study was focused to carry out the molecular identification and to evaluate

techniques as well as media for isolation characterization and the physiology of *Cephaleuros* from mango (*Mangifera indica* L.) in different culture media [9].

*Cephaleuros* species, the green filamentous algae and parasites in higher plants mainly found in Hawaii are known for the significance in agricultural activities. The organisms like *Cephaleuros virescens* and *Cephaleuros parasiticus* are less harmful which cause minor diseases like leaf spotting that are negligible in certain case of crops growing in moist environmental conditions. The algal diseases are injurious to the leaves, fruits, and stem of the plant [10]. Among *Cephaleuros* species, the broadest and most frequently reported pathogen on higher plants is *C. virescens*. The favorable conditions that suit the growth of these organisms are rain and warm weather. The hosts will be suffering from infection by the algae due to the poor nutrition of the plant, drainage of soil and the air, which is stagnant [11]. The symptoms shown by the crop will vary for the damage, has great dependence over the hosts and *Cephaleuros* species combination all over the world. The *C. parasiticus* will cause spotting on the leaves of guava are intercellular, from a top portion to down. Necrosis with full thickness will destroy layers of cells in epidermis and tissues that are intervening of both upper and lower portion. After that a fairly sparse orange coloration like the bloom of algae can be seen on the forth underside of leaf lesions and this coloration is large in the case with *C. virescens* [12]. The species is traditionally harmless and subcuticular leaf parasite.



Figure 1 Algal leaf spot of avocado (*Persea americana*) by *Cephaleuros virescens*



Figure 2 Algal leaf and fruit spot of guava caused by *Cephaleuros*

## 2. PATHOGEN

For green terrestrial algae which is aerophilic and filamentous need water in order to complete their life cycle. The algae belong to Cephaleuros species include filaments that are branched with a thallus forming discs asymmetrically below the cuticle or epidermis of the host plant and also prostrate branched portion involves irregular cells with erect, unbranched hairs having fertile, sterile and cylindrical cells that protrude by means of the cuticle [13]. The asexual stage associated with infection and disease in which pathogens are carried through wind, water, etc. On leaves, the conditions for disease vary on symptoms according to Cephaleuros – host species combination. In the case of *C. virescens*, the spots will appear on the upper side of the leaf which is raised, velvet in appearance, in shades of orange or brown [14]. The spots that caused by *C. parasiticus* on guava are from the top to bottom, necrosis with a full thickness, as well as destroy the layers of epidermal and the tissues that intervein to each other as shown in figure 2. The algal blooms are pigmented brightly under the side of the leaves rather than on the upper side. In certain types of fruits like guava different types of chlorotic and halo lesions will surround the plant and on fruits it forms severe lend formations [15].

## 3. DISEASE CYCLE OF *CEPHALEUROS SPECIES*

Hosts tissues are inoculated with sporangia deposited thallus. Progress of signs and infection occurs under moist conditions when motile zoospores are released from the sporangia, penetrate the host cuticle and generate disc-like algal thalli with thread like algal filaments [16]. The effect of spots on plants will reduce the rate of photosynthesis in that area, defoliation, loss in marketability, necrosis of tissues and dieback of twigs. The pathogens will survive as well as reproduce on the spots present on leaves, stem and plant debris.



Figure 3 Algal leaf spot of magnolia (*Magnolia grandiflora*) caused by *Cephaleuros virescens*



Figure 4 Brown algal spots caused by *Cephaleuros virescens*



Figure 5 *Cephaleuros parasiticus* thallus and sporangiophores

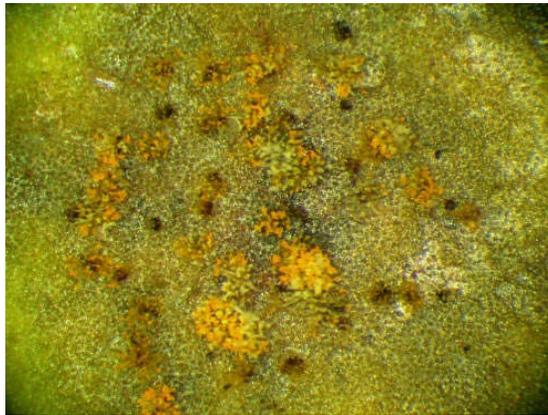


Figure 6 *Cephaleuros parasiticus* algal thallus emerging through the epidermis of the underside of a guava leaf

#### 4. HOSTS ASSOCIATED WITH *CEPHALEUROS SPECIES AND THE DAMAGE CAUSED TO CROPS*

*Cephaleuros* Species are discovered largely on the leaves of the tropical trees and shrubs which can be having fiscal importance like kava (*Piper methysticum*), *Magnolia* (*Magnolia grandiflora*), avocado (*Persea Americana*), tea (*Camellia sinensis*), vanilla (*Vanilla planifolia*), coffee (*espresso arabica*), pepper (*Piper nigrum*), cacao (*Theobroma cacao*), oil palm (*Elaeis guineensis*), mango (*Mangifera indica*), breadfruit (*Artocarpus altilis*), coconut (*Cocos nucifera*) and specific citrus fruits [17]. The species of *Cephaleuros* is not going to have an impact on the

essential key crops which is observed within the Pacific like banana (*Musa spp.*) and taro (*Colocasia esculenta*).

More often, not in many of the hosts the infection brought about by using the leaf is having best somewhat direct value economically and is confined to have their branches at low placing stage which are much close to the level of the ground. The inclined hosts like guava and all can have the tremendous necrosis of tissues, vast defoliation, profitable damage to the high-quality of fruit because of the lack of crop and vigorousness of vegetation [18]. The separation of *Cephaleuros* species is possible on the foundation of the damage that they rationale onto two groups including their mode of mechanism on parasitism as subcuticular and intercellular. The instance for a subcuticular parasite is *C. virescens* and an intercellular parasite is *C. parasiticus*. The intercellular mode of parasitism will cause more harm to the tissues than within the case of subcuticular parasitism. In Hawaii, the symptoms are shown by the greenish grey or rusty crimson areas which are roughly circular and shoot dieback [19,20]. Fruit harm is a typical result of the infection with the aid of *C. Parasiticus* and the injury to guava fruit is restrained to the skin floor of the fruit, as a consequence and no rotting will have an effect on the delicate tissues. The spots reward on the outside of fruits is moderately deep and cracked with a depressing relatively like corky aspect [21]. In case of severe damages the fruit looks like scabbed. A contemporary survey on the range of hosts of *Cephaleuros* species was discovered to be very wide which will have an impact on the crops of distinctive households.

## 5. INTEGRATED MANAGEMENT OF *CEPHALEUROS* DISEASES

Specialized remedy by the analysis of ailments is implemented via the microscopic examination of algae.

- Plant stress must be diminished: hold crops good fertilized toughen soil drainage.
- Intercropping: inter planting should be very inclined to the hosts
- Determination of varieties and the determination of sort must be tolerant where the crop will have to be in a moist environment.
- Vicinity for the alternative of planting: the susceptible crops require a common reasonable rainfall, with good-drained soil and pleasant air circulation
- Administration area should be furnished with thinning of the plant for the development of airing and of sunshine

## 6. DISCUSSION

To verify the spot disorder, in algae associated with accrued contaminated sample determines the leaf spot ailment in algae infected samples. The main symptom was the spot of orange color which is on the upper part of the leaf surface where the algae constitute is green. Exact lesion spots are raised with no change in color on the upper facet of the leaf. The cells of epidermal and palisade are fitting brown as good as dark brown beneath the because of the necrosis. On the skin of the leaf having slender filaments that are open the neighborhood of subcuticular and subepidermal thalli progress. Ramuli which might be filamentous will be customarily compacted

that may lift a skinny layer on the upper aspect of the leaf having a diameter of surface 1-5 mm and cells tiers from cylindrically quick to these cells which are filamentous will be shaped irregular 7.5 - 42.5  $\mu\text{m}$  long and 5-17.5  $\mu\text{m}$  large. The ratio of width and length (W/L) used to be 1 - 6, which is irregular with open filamentous progress turns into congested and for higher extension of filaments, where the smaller cells have been raised the setae the irregular and open filamentous growth becomes congested the greater cells expanded from the filament even at the small cells raised the setae, initial gametangia and sporangiophores. Particular cells will produce the dense, small and often formed dichotomies having one or two-celled setae of 75  $\mu\text{m}$  vast with two flagella of size 15-25  $\mu\text{m}$  lengthy. The sporangiophores have been moderately produced on the highest facet of the surface being cylindrical erect and solitary or in a tuff of three or more 250-440  $\mu\text{m}$  lengthy and 10-12.5  $\mu\text{m}$  broad. The developed having a measurement of three to five which is terminal to the sporangiophores with each solitary have four lateral sporangia. The sporangia vary from spherical to elliptical 12.5-27.5  $\mu\text{m}$  lengthy and 10-20  $\mu\text{m}$  vast with yellow to darkish orange. The various types of key species have been found within the monograph of Thompson and Wujek (1997); the fifteen accumulated algal samples have been recognized as *Cephaleuros diffuses*. A *Cephaleuros* species with a huge range of hosts is *C. virescens*. The thalli of *C. Diffuses* shaped raised spots, whereas *C. Virescens* types round discs without gaps crenate or entire margin. The progress habit of *C. Diffuse* was open and filamentous, whereas for *C. virescens* is pseudoparenchymatous. Each species bear head cells terminally.

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