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# Survey of Potentially Host Weeds of *Planococcus* spp. in Coffee Crops

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***Abstract*** *-Planococcus spp. can cause losses close to 100% of the conilon coffee production in highly infested crops. It is a polyphagous pest that affects several cultures and can be present in host plants that appear spontaneously in the cultivation areas. In this context, the objective was to carry out the survey of weed hosts for mealybug in conilon coffee crops relating to the phenological stage of the culture. For this, the survey was carried out in two areas cultivated with conilon coffee in the northwest region of the state of Espírito Santo, Brazil. Weed collections were carried out monthly, in both locations, for a period of 12 months. 17 weed species were found, distributed within 9 different botanical families, being: Asteraceae, Malvaceae, Poaceae, Amaranthaceae, Cyperaceae, Solanaceae, Commelinaceae, Portulacaceae e Cucurbitaceae. Thus, Planococcus spp. it can stay and complete its cycle in weeds, being a source of inoculum that can contribute to infestations in the reproductive phase of the conilon coffee.*

***Keywords*** *- **Alternative hosts, Coffeacanephora, Planococcus spp.***

## I. INTRODUCTION

The introduction of the paper should explain the nature of the problem, previous work, purpose, and the contribution of the paper. The contents of each section may be provided to understand easily about the paper.

The Brazilian production of Conilon coffee has been growing in recent years. This advance has been favored by the increase in productivity due to the greater use of technologies in crops. According to a survey by the National Supply Company (Conab), in 2019 the Brazilian production was approximately 49 million bags benefited, with an estimated increase of 15.9 to 25.8% for the year 2020 [1]. However, the incidence of mealybugs, *Planococcuscitri* (Risso) and *Planococcus minor* (Maskell), is becoming more and more frequent in the country, mainly in the state of Espírito Santo. This causes great damage to crops, causing losses to farmers, which consequently affects the economy[2].

Damage can be caused by both nymphs and adult females of *Planococcus* spp. that suck sap from flower buds, young fruits and young shoots of the coffee tree, which can also be found in the root system of plants[3]. The attack of nymphs and adults causes flower buds, flowers and fruits to fall in the early stages of development, giving rise to the "malformed rosette". In late attacks, malformation of grains occurs and fruit development is impeded. In addition, they can cause the coffee region to rot, close to the soil, serving as an entry point for pathogenic microorganism. In highly infested crops, they can cause losses close to 100% of production [2], [3].

However, *Planococcus* spp. it is a polyphagous pest, being registered in more than 27 different families. In Brazil, its occurrence has been reported in anonacea plants, soybeans, sugar cane, cotton, citrus, guava, grapevine, banana, star fruit, coconut, macadamia, mango, pineapple, in addition to some ornamental plants. Its incidence in weed species present in coffee plantations has also been

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reported [3]. According to Ferrão et al. [4], the incidence of weeds is common in the cultivation of conilon coffee, especially in the first years after planting. This occurs due to the low degree of soil coverage provided by the crop, favoring the germination, growth and development of these plants. Thus, the knowledge of alternative host plants for this insect pest is one of the fundamental requirements for planning integrated management in coffee culture.

According to Ronchi et al. [5], among the weeds that infest coffee trees, the most frequent reported by producers are *Commelina* spp. and *Andropogonbicornis*. These plants interfere with the growth and development of conilon coffee by competing for water, light and nutrients [6]. Furthermore, pests can be alternative host, such as *Planococcus* spp. [2]. However, despite reports about the occurrence of mealybug in weeds, there is little information about host species and the relationship with the attack on coffee plants. In this context, the present work aimed to carry out the survey of host weeds of the mealybug *Plabococcus* spp. in cultivation of conilon coffee, relating to the phenological stage of the culture.

## II. MATERIAL AND METHODS

The assays for the survey of host weeds of mealybug in cultivations of conilon coffee were carried out in two locations located in the Northwest region of the state of Espírito Santo, Brazil, in order to obtain greater variability of species of these plants. The first location was at the Experimental Farm of the Capixaba Institute of Research, Technical Assistance and Rural Extension (Incaper), located in the municipality of Marilândia, with geographical coordinates of 19°24'14"S, 40º32'13"O and altitude of 202 meters, and the second in the municipality of Linhares, at Sítio Armani, with geographical coordinates of 19°39'11"S, 40°07'22"O and altitude of 285 meters. The climate of the survey sites is characterized by being Tropical Aw, according to the climatic classification of Köppen[7], with irregular rainfall and high temperatures.

The climatic conditions during the study period were monitored by means of the automatic climatological station of the Experimental Farm of Incaper in Marilândia, recording an accumulated rainfall volume of 824.40 mm and maximum, minimum and average temperature of 35.70°C, 15,52°C and 24.39°C, respectively (Figure 1).

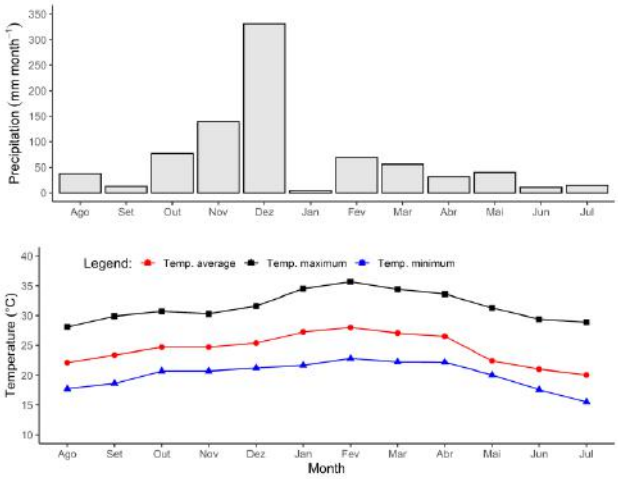


*Fig. 1: Precipitation and maximum, minimum and average temperatures for the period from August 2018 to July 2019 in the areas of cultivation of Conilon coffee in Marilândia and Linhares, ES, Brazil.*

The survey of weeds at the Experimental Farm of Incaper was carried out in a five-year conilon coffee crop implanted with nine clones of the variety Diamante ES 8112, in a 3.0 x 1.0 m spacing, totaling 3333 plants ha-1. At Sítio Armani, the Conilon coffee crop had eight years of cultivation, implanted with clone 108 of the variety Diamante ES 8112, clones 402, 404, 410 and 411 of the variety Marilândia ES 8143 and clones 306 and 307 of the variety Centenária ES 8132, in the 3.0 x 1.2 m spacing, totaling 2777 plants ha-1. In both areas, crop management was carried out according to Verdin Filho et al. [8] and Prezotti et al. [9] through Programmed Cycle Pruning (PPC) with orthotropic stem renewal every four years, fertilization and chemical control of weeds with systemic herbicide, with mechanical control of these plants sometimes being performed with a brushcutter. It is worth mentioning that during the experimental period, chemical pest control was not carried out. These areas were chosen because, in previous years, they had an incidence of mealybug during the fruiting period.

The weed survey was carried out monthly for a period of 12 months in both study sites. The collections were performed by walking in "zig-zag" between the lines of the coffee tree, manually collecting the different species of weeds present in the area. This survey was carried out from August 2018 to July 2019.

After collecting and verifying in loco the presence of mealybug in the root system and/or aerial part of the weeds, these were packed in paper bags, identified and transported to the Agricultural Entomology and Acarology

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Laboratory of the Federal Institute of Espírito Santo - *Campus*Itapina(Ifes-*Campus*Itapina). The identification of the host species was carried out by comparing the morphological characteristics of the stem, leaves and inflorescences with the descriptions and illustrations of the identification manual for weed plants proposed by Moreira andBragança[10].

The mealybugs collected from the weeds, after sorting at the Ifes-Campus Itapina Entomology and Agricultural Acarology laboratory using a stereomicroscope, were placed in microtubes containing 60% alcohol and subsequently sent to the Entomology Laboratory of the State University of PhytosanityPaulista (UNESP) for species identification through slide assembly and analysis under an optical microscope. The studied specimens are deposited in the Insect and Mite Reference Collection (CRIA) of the FCAV / UNESP Department of Plant Health.

## III. RESULTS AND DISCUSSION

The mealybug species *Planococcuscitri* and *Planococcusminor* were identified in 17 weed species, distributed in nine botanical families: Asteraceae, Malvaceae, Poaceae, Amaranthaceae, Cyperaceae, Solanaceae, Commelinaceae, Portulacaceae and Cucurbitaceae (Table 1).

Bastos et al. [11] reported in their study on P. minor in cotton in Northeast Brazil, that the pest was infesting other agricultural species such as: sesame, peanuts, watermelon, guava and some spontaneous plants such as *Sidacarpinifolia* L., Heliotropiumindicum L., Euphorbia hirta L., Amaranthus sp. and Solanum paniculatum L., which shows the great diversity of species that can host this insect pest.

Among the weeds identified as hosts, it is noted that there is a predominance of species belonging to the Asteraceae and Malvaceae families, representing 29.41% and 17.64%, respectively (Figure 2). These families are distributed in tropical and temperate regions, with South America as the center of wealth [12], [13], possibly explaining the greater occurrence of mealybug in species belonging to these families of weeds in coffee plantations.

*Table.1: Host weeds of Planococcuscitri and Planococcus minor in areas of cultivation of Conilon coffee, in the municipalities of Marilândia and Linhares, ES, Brazil.*

| **Species** | **Family** | **Common name in Brazil (in Portuguese)** |
|---|---|---|
| *Bidenspilosa* L. | Asteraceae | Picão-preto |
| *Ageratum conyzoides*L. | Asteraceae | Picão-branco |
| *Blainvilleaacmella*(L.) Philipson | Asteraceae | Picão-grande |
| *Sonchusoleraceus* L. | Asteraceae | Serralha-branca |
| *Emilia fosbergii* Nicolson | Asteraceae | Falsa-serralha |
| *Sidastrummicranthum* (A. St.-Hil.) Fryxell | Malvaceae | Falsa-guaxima |
| *Sidarhombifolia*L. | Malvaceae | Guanxuma-preta |
| *Sidaglaziovii* K. Schum | Malvaceae | Guanxuma-branca |
| *Digitariainsularis*(L.) Fedde | Poaceae | Capim-amargoso |
| *Andropogonbicornis*L. | Poaceae | Capim-rabo-de-burro |
| *Amaranthus spinosus*L. | Amaranthaceae | Caruru-de-espinho |
| *Amaranthus blitum*L. | Amaranthaceae | Caruru-rasteiro |
| *Cyperusesculentus*L. | Cyperaceae | Tiririca |
| *Solanum americanum* Mill | Solanaceae | Maria-pretinha |
| *Commelinabenghalensis* L. | Commelinacea e | Trapoeraba |
| *Talinum paniculatum*(Jacq.) Gaertn. | Portulacaceae | Beldroega-grande |
| *Momordica charantia*L. | Cucurbitaceae | Melão-de-são-caetano |

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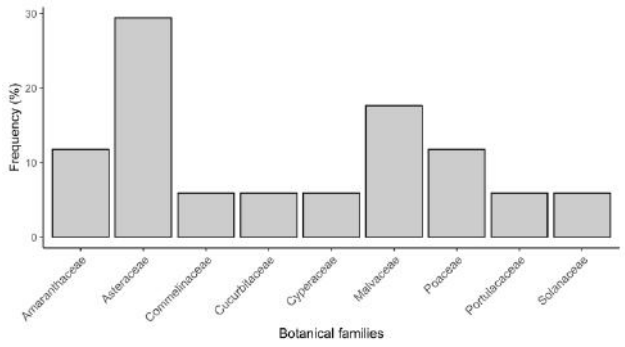


*Fig. 2. Percentage of weed species in botanical families identified as hosts of Planococcuscitri and Planococcusminor in the areas of cultivation of conilon coffee, in the municipalities of Marilândia and Linhares, ES, Brazil.*

During the survey, specifically in the Asteraceae family, it was observed that the species *Bidenspilosa* L. and *Ageratum conyzoides* L. are more susceptible to the attack of mealybug, since they are easily found with the presence of these insects, even with the diversity of species of weeds present in areas cultivated with conilon coffee. Such observations may suggest a food preference for *Planococcus* spp. for some weeds present in coffee plantations, whether due to physical or chemical attractiveness, corroborating the results obtained by Correa et al. [14].

The occurrence of mealybug in weeds was observed mainly in the root system of host plants, close to the basal region, such as *B. pilosa* and *A. conyzoides* (Figures 3A and 3B), both in the young phase (nymphs), and in the adult phase of *P. citri* and *P. minor*. Similarly, Fornazier[15] observed the presence of *P. citri* in the region of the roots of the species *B. pilosa*, *Lepidium virginicum* L. and *Cucurbita maxima* Duchesne.


*Fig. 3. Root system of Bidenspilosa L. (A) and Ageratumconyzoides L. (B) attacked by Planoccocus spp. collected in the studied conilon coffee cultivation areas, Marilândia and Linhares, ES, Brazil.*

Santa-Cecília et al. [3] highlight that in the dry season of the year, mealybugs lodge in the soil, feed on the roots of coffee plants and go up to the aerial part, at the beginning of the rainy season and during flowering of the plants, demonstrating that there is a behavior mobility of this insect depending on the time of year and stage of the plant, vegetative and/or reproductive. Fornazier et al. [16], on the other hand, point out that migration, that is, the dissemination from one plant to another, occurs especially by nymphs, walking on the ground, at short distances, or are carried by the wind, or, foretically, being disseminated by ants.

During the entire evaluation period, which culminated in all the phenological stages of coffee, the occurrence of *P. citri* and *P. minor* was observed, both in the root system and in the aerial part of the weeds, proving that this pest can complete its cycle and remain at field level throughout the year, whether in coffee plants [3] or in other host plants.

However, during the reproductive phase of conilon coffee, these insects had a preference for coffee plants, demonstrating the susceptibility of the crop to the pest at this stage. Such observations corroborate the results obtained by Correa et al. [14]. These authors, when studying the biology of scale insects of the genus Planococcus in different tree hosts, observed that the species *P. citri* and *P. minor* have a greater food preference for coffee plants. In this way, weeds with the presence of *P. citri* and *P. minor* are a source of inoculum and can contribute to mealybug infestations in coffee plantations during the flowering and fruiting phases, and the dissemination is facilitated by the proximity between the plant's weeds and the coffee tree. Thus, the presence of weeds in conilon coffee crops can be a means of survival and reproduction of rosette scale, especially in periods when the coffee tree is not in the reproductive phase, contributing to new infestations in the coffee reproductive phase. conilon.

## IV. CONCLUSION

Weeds can be hosts capable of favoring the permanence of mealybug in coffee plantations, being a considerable source of inoculum for conilon coffee crops. Among the species registered as hosts, *Bidenspilosa* and *Ageratum conyzoides* are potentially favorable to the development of *P. citri* and *P. minor*, deserving attention during the monitoring of pests and weed management, in order to minimize the infestation of these pests in crops.

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