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

Gabriel Fornaciari¹, Edinei José Armani Borghi¹, Mayara Leite Vieira¹, Ronilda Lana Aguiar¹, Anderson Mathias Holtz¹*, Abraão Carlos Verdin Filho², Marcone Comério², José Romário de Carvalho³, Alex Sandro Xavier¹, Vergilio Borghi Neto¹, Caio Henrique Binda de Assis¹

¹Federal Institute of Education, Science and Technology of Espírito Santo (IFES), Campus Itapina, BR 259, Km 70, Mailbox 256, 29717-000, Colatina, ES, Brazil.
²Capixaba Institute of Research, Technical Assistance and Rural Extension (Incaper), Av. Dom Bôsco, 251, 29725-000, Marilândia, ES, Brazil.
³Secretaria de Educação do Estado do Espírito Santo, R. Daniel Camboni, 200, Centro, 29550-000, Jerônimo Monteiro, ES, Brazil.
* Corresponding author

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, *Planococcus scutellatus* (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 shoot 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 anonaaceae 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
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.

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
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 and Bragança [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 Phytosanity Paulista (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 *Planococcus minor* 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., *Helitropiumindicum* 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) |
|------------------------------|----------------|--------------------------------------|
| Bidens pilosa L.             | Asteraceae     | Picão-preto                          |
| Ageratum conyzoides L.       | Asteraceae     | Picão-branco                         |
| Blainvilleaacmella (L.) Philipson | Asteraceae   | Picião-grande                        |
| Sonchusoleraceus L.          | Asteraceae     | Serralha-branca                      |
| Emilia fosbergii Nicolson    | Asteraceae     | Falsaserralha                        |
| Sidastrummicranthum (A. St.-Hil.) Fryxell | Malvaceae     | Falsa-guaxima                        |
| Sidarhombifolia L.           | Malvaceae      | Guanxuma-preta                      |
| Sidaaglaziovii K. Schum      | Malvaceae      | Guanxuma-branca                     |
| Digitaria insularis (L.) Fedde| Poaceae        | Capim-amargoso                      |
| Andropogon bicornis L.       | Poaceae        | Capim-rabo-de-burro                 |
| Amaranthus spinosus L.       | Amaranthaceae  | Caruru-de-espinho                   |
| Amaranthus blitum L.         | Amaranthaceae  | Caruru-rasteiro                     |
| Cyperus esculentus L.        | Cyperaceae     | Tiririca                             |
| Solanum americanum Mill      | Solanaceae     | Maria-pretinha                       |
| Commelinabenghalensis L.     | Commelinaceae  | Trapoeraba                           |
| Talinum paniculatum (Jacq.) Gaertn. | Portulacaceae | Beldroega-grande                    |
| Momordica charantia L.       | Cucurbitaceae  | Melão-de-são-caetano                |
Fig. 2. Percentage of weed species in botanical families identified as hosts of Planococcus citri and Planococcus minor 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 Bidens pilosa 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 *Bidens pilosa* L. (A) and *Ageratum conyzoides* L. (B) attacked by Planococcus 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, Bidens pilosa 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.
ACKNOWLEDGEMENTS

To the National Council for Scientific and Technological Development (CNPq), the Coordination for the Improvement of Higher Education Personnel (CAPES) and the Foundation for Support to Research and Innovation of the State of Espírito Santo (FAPES) and the Federal Institute of Espírito Santo (IFES) for financial support and grants.

REFERENCES

[1] Companhia Nacional de Abastecimento - CONAB, “Acompanhamento da safra brasileira de café, v. 6 – Safra 2020, n.1 - Primeiro levantamento, Brasília,” 2020.

[2] M. J. Fornazier et al., Manejo da cochonilha-da-roseta em café conilon. Vitória, ES: Incaper, 2018.

[3] L. V. C. Santa-Cecília et al., Cochonilhas-farinzentas em cafeeiros: bioecologia, danos e métodos de controle, Boletim Té. Belo Horizonte: EPAMIG, 2007.

[4] R. G. Ferrão, A. F. A. da Fonseca, M. A. G. Ferrão, and L. H. DeMuner, Café Conilon, 2 ed. atua. Vitória, ES: Incaper, 2017.

[5] C. P. Ronchi, F. P. Carvalho, and A. A. Silva, “Manejo integrado de plantas daninhas,” in Café conilon, 2nd ed., R. G. Ferrão, A. F. A. Fonseca, M. A. G. Ferrão, and L. H. DeMuner, Eds. Vitória, ES: Incaper, 2017.

[6] R. G. Ferrão, A. F. A. da Fonseca, S. M. Bragança, M. A. G. Ferrão, and L. H. DeMuner, Café Conilon. Vitória, ES: Incaper, 2007.

[7] K. W., “Das geographische systemder klimate,” in Handbuch der Klimatologie, G. W. . Köppen and M. Geiger, Eds. Berlin, 1936.

[8] A. C. Verdin Filho et al., Poda programada de ciclo para o café conilon, Documento. Vitória, ES: Incaper, 2008.

[9] L. C. Prezotti, G. J. A., G. G. Dadalto, and J. A. Oliveira, “Ocorrência de Planococcus minor Maskell (Homoptera: Pseudococcidae) em algodoeiro no nordeste do Brasil,” Neotrop. Entomol., vol. 36, no. 4, pp. 625–628, Jul. 2007, doi: 10.1590/S1519-566X2007000400025.

[10] P. A. FRXYELL, “The American genera of Malvaceae-II,” Brittonia, vol. 49, no. 2, pp. 204–269, 1997.

[11] G. M. Barroso, A. L. Peixoto, C. L. F. Iachos, E. F. Guimarães, and C. A. Costa, Sistêmática de Angiospermas do Brasil, 2nd ed. São Paulo: Ed. Nacional/EDUSP, 2004.

[12] L. R. B. Correa, B. Souza, L. V. C. Santa-Cecília, E. Prado, A. P. Paulo, and D. Castellane, “ESTUDOS BIOLOGICOS DE COCHONILHAS DO GÉNERO PLANOCOCCUS (HEMIPTERA: PSEUDOCOCCIDAE) EM DIFERENTES HOSPEDEIROS,” 2011.

[13] M. J. Fornazier, “Bioecologia, dano e controle de Planococcus citri (Risso) (Homiptera: Pseudococcidae) em Coffea canephora Pierre Ex Froehner (RUBIACEAE),” Universidade Federal de Viçosa, 2016.