CARBO VEGETABILIS HOMEOPATHY FOR CONTROLLING ANTHRACNOSE IN ORGANIC CHIVES

HOMEOPATIA DE CARBO VEGETABILIS NO CONTROLE DA ANTRACNOSE EM CEBOLINHA ORGÂNICA

HOMEOPATÍA CON CARBO VEGETABILIS PARA EL CONTROL DE LA ANTRACNOSIS EN CEBOLLINOS ORGÁNICOS

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Katiherlen da Silva Menezes[1], Sebastião Elviro de Araújo Neto[2], Regina Lúcia Félix Ferreira[3], Geazi Penha Pinto[4], Eliza Nayonara da Silveira Maruí[5], Adonias de Albuquerque Pinheiro[6]

ABSTRACT

The organic cultivation of chives is on the rise due to the demand from health-conscious and sustainability-minded consumers. However, anthracnose, caused by fungi, has been harming the productivity and quality of the plants, with no registered fungicide options. Organic alternatives such as neem oil and sulfocalcic broth are insufficient. Homeopathy, permitted in organic farming, is a promising approach to strengthen plants against diseases and detoxification. This study, conducted in Rio Branco-Acre, at the Seridó ecological site, from December 2022 to March 2023, in covered beds fertilized with 15 t ha-1 of organic compost on a dry basis, involved the application of dynamizations of Carbo Vegetabilis at different concentrations (CH6, CH12, CH18, CH24, and CH30). It did not show a significant impact on productivity or anthracnose control. Leaf losses were high, reaching 65.3%, due to local conditions favorable to Colletotrichum. Anthracnose, challenging due to the lack of specific control methods, may not be adequately addressed by homeopathy in all situations, especially in unfavorable locations. In summary, the study highlights the need to explore disease management strategies specific to the organic cultivation environment. Despite inconclusive results with homeopathic Carbo Vegetabilis, ongoing research can improve the application of homeopathy and other techniques to promote sustainable organic chive production.

Keywords: Organic Farming. Homeopathy. Colletotrichum Gloesporioides.

RESUMO

O cultivo orgânico de cebolinha está em ascensão devido à demanda de consumidores preocupados com saúde e sustentabilidade. No entanto, a antracnose, causada por fungos, tem prejudicado a produtividade e qualidade das plantas, sem opções de fungicidas

[1] Master's student in Plant Production. Universidade Federal do Acre. E-mail: katym491@gmail.com
[2] Dr. in Plant Science. Universidade Federal do Acre. E-mail: sebastiao.neto@ufac.br
[3] Dr. in Plant Science. Universidade Federal do Acre. E-mail: regina.ferreira@ufac.br
[4] Dr. in Plant Production. Universidade Federal do Acre. E-mail: geazi.pinto@ifac.edu.br
[5] Master's student in Plant Production. Universidade Federal do Acre. E-mail: nayonara.marui@gmail.com
[6] Agricultural Engineer. Universidade Federal do Acre. E-mail:adonias.pinheiro.ac@gmail.com

registrados. Alternativas orgânicas como óleo de nim e calda sulfocálcica são insuficientes. A homeopatia, permitida na agricultura orgânica, é uma promissora abordagem para fortalecer as plantas contra doenças e desintoxicação. Este estudo feito em Rio Branco-Acre, no sítio ecológico Seridó, no período de dezembro de 2022 a março de 2023, em encanteiramento coberto e adubado com 15 t ha-1 de composto orgânico em base seca, sendo utilizada a aplicação das dinamizações de Carbo Vegetabilis em diferentes concentrações (CH6, CH12, CH18, CH24 e CH30) não mostrou impacto significativo na produtividade ou controle da antracnose. As perdas de folhas foram altas, chegando a 65,3%, devido às condições locais favoráveis ao Colletotrichum. A antracnose, desafiadora devido à falta de métodos de controle específicos, pode não ser adequadamente combatida pela homeopatia em todas as situações, especialmente em locais desfavoráveis. Em resumo, o estudo destaca a necessidade de explorar estratégias de manejo de doenças específicas para o ambiente em cultivos orgânicos. Apesar de resultados não conclusivos com o Carbo Vegetabilis homeopático, a pesquisa contínua pode aprimorar a aplicação da homeopatia e de outras técnicas para promover uma produção sustentável de cebolinha orgânica.

Palavras-chave: Agricultura Orgânica. Homeopatia. Colletotrichum Gloesporioides.

RESUMEN

El cultivo orgánico de cebollino está en auge debido a la demanda de consumidores preocupados por la salud y la sostenibilidad. Sin embargo, la antracnosis, causada por hongos, ha estado perjudicando la productividad y la calidad de las plantas, sin opciones de fungicidas registrados. Las alternativas orgánicas como el aceite de neem y el caldo sulfocálcico son insuficientes. La homeopatía, permitida en la agricultura orgánica, es un enfoque prometedor para fortalecer las plantas contra enfermedades y la desintoxicación. Este estudio, realizado en Rio Branco-Acre, en el sitio ecológico Seridó, de diciembre de 2022 a marzo de 2023, en camas cubiertas fertilizadas con 15 t ha-1 de compost orgánico en base seca, implicó la aplicación de dinamizaciones de Carbo Vegetabilis en diferentes concentraciones (CH6, CH12, CH18, CH24 y CH30). No mostró un impacto significativo en la productividad ni en el control de la antracnosis. Las pérdidas de hojas fueron altas, alcanzando el 65,3%, debido a las condiciones locales favorables para Colletotrichum. La antracnosis, un problema debido a la falta de métodos de control específicos, podría no ser abordada adecuadamente por la homeopatía en todas las situaciones, especialmente en zonas desfavorables. En resumen, el estudio destaca la necesidad de explorar estrategias de manejo de enfermedades específicas para el entorno de cultivo orgánico. A pesar de los resultados no concluyentes con el Carbo Vegetabilis homeopático, la investigación en curso puede mejorar la aplicación de la homeopatía y otras técnicas para promover la producción sostenible de cebollino orgánico.

Palabras clave: Agricultura Orgánica. Homeopatía. Colletotrichum Gloesporioides.

1 INTRODUCTION

Chives (*Allium fistlosum)* are well known in Brazil, classified as a spiced vegetable with cylindrical and fistulous leaves. Belonging to the Alliacea family, it is one of the most consumed condimentary vegetables in cooking, its parts that can be consumed are the leaves and bulb of the plant, which are rich in vitamins A, C and Fe, they also act as an appetite stimulant, aid in digestion and fight flu and other diseases that affect the respiratory tract (PINHEIRO et al., 2020).

The demand for chives is constant with an increasing trend, especially when it comes from an organic system, becoming the preference of a niche population conscious of a healthier life. In this context, we can essentially identify two groups of consumers of organic products. The first group consists of consumers who have a long experience in this segment, demonstrate a high level of motivation, are well-informed and have demanding criteria when it comes to the biological quality of products. These are the individuals who regularly visit organic produce fairs. On the other hand, the second group, which is more recent and still lacks detailed studies, is formed by consumers who choose to purchase organic products in large supermarket chains (BRASIL, 2007).

According to Matos et al. (2017), several pathogens are responsible for infections in chives, thus causing losses to several producers, *Colletotricum gloesporioides and Colletotrichum circinans,* are the cause of anthracnose in this crop. For the control of these pathogens in this species, there are still no fungicides registered (OLIVEIRA et al., 2019). In consultation with MAPA's AGROFIT, the products recommended for control are those used in head onions, with records of copper oxychloride and cuprous oxide (BRASIL, 2023).

The recommendation for an organic system that provides efficient control in times of moderate temperatures in the state of Acre is the application of neem oil (91.9%), lime sulfur solution (95.2%) and alternate application of these products (90.8%), including Bordeaux mixture, which alone presented the lowest control efficiency (79.9%) (SILVA et al., 2017).

To reduce the losses caused by anthracnose of chives in an organic system, it is necessary to increase the "repertoire" of solutions, one of which is the use of homeopathic remedies. According to what was stated by Bonato (2007), there is a significant increase in the use of highly diluted substances in agriculture, with a particular focus on their use in plantations.

The basis of homeopathy is the cure by the similar, pathogenic experimentation is carried out on the healthy individual and its increased resistance to diseases and pathogens is observed, homeopathic medicine works with the process of dynamization that consists of increasing the homogeneity and therapeutic power of a medicine by dilution. The more

dynamized, that is, the more diluted, the more potent the drug. This type of control has been taking several branches of organic agriculture due to its potential in controlling pests and diseases of plants, in addition to increasing the active defense principles and assisting in the detoxification of the plant (DEBONI et al., 2019).

Leaf anthracnose has been causing concerns for horticulturists because it is one of the diseases that causes the greatest losses, as its damage makes plants unviable both in seed and bulb production. And because of its difficult control and lack of specific products for the treatment of the disease. This disease is also known as mal-das-sete-voltas, cigar, hot dog, among other names (WORDELL FILHO; BOFF, 2016)

According to Santana et al. (2015), fungi of the genus *Colletotricum* are phytopathogens that spread widely and survive by parasitizing plants or decomposing organic materials such as saprophytes. The fungi that cause anthracnose develop everywhere in the world, but the places with the best development conditions for the species are tropical and subtropical regions. The symptoms observed in the plants are circular lesions on the depressed leaves with a halo of light brown coloration.

Although it has been proven that it does not completely exterminate the disease, the use of fungicides to control anthracnose continues to be the most used, but the incorrect use of these can favor the selection of resistant variants, have a harmful effect on human health, cause environmental degradation and pollution (SILVA et al., 2017; TRIACA et al., 2018). According to these authors, the use of pesticides would be harmful to the health of consumers, as chives have a short cycle, which could imply that residues of the product remain on the plants and present high doses at the time of consumption.

This work is established considering that homeopathy is one of the techniques allowed in organic agriculture for the management of diseases and pests of plants (CARNEIRO et al., 2011). And its general objective is to reduce anthracnose in chives and as a specific objective to analyze the control of anthracnose in chives through different levels of concentration of Carbo vegetabilis as a homeopathic remedy.

2 MATERIAL AND METHODS

The experiment was carried out at the Seridó Ecological Site, located on Rodovia AC - 10, km 04, in Rio Branco (AC), latitude of 9º 53' 16" S, longitude of 67º 49' 11" W and altitude of 150 m, subtropical climate (hot and humid). According to INMET (2022) the average temperature is 25 °C to 34 °C, average monthly precipitation of 170 mm and relative humidity of 82%.

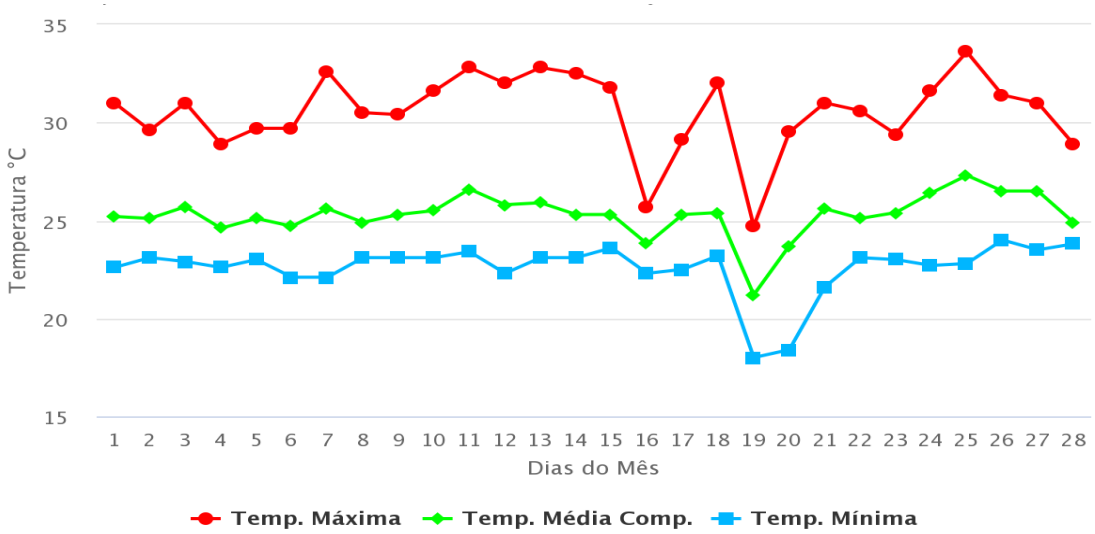
The soil of the property is classified as plintosolic alitic red-yellow Ultisol, sandy loam texture. The nutrient contents in the 0-20 cm deep layer are: pH (H2O) = 6.5; P = 49 $^{mg.dm-3}$; K = 1.1 $^{mmolc.dm-3}$; Ca = 49 $^{mmolc.dm-3}$; Mg = 11 $^{mmolc.dm-3}$; Al = 0 $^{mg.dm-3}$ and H = 11 $^{mmolc.dm-3}$; organic matter = 17 $^{g.dm-3}$; base saturation = 84.6%.

The experiment was installed in an organic system, in soil already prepared with a microtractor and manual enchantment with the help of a hoe, fertilization was made with 15 t $^{ha-1}$ of organic compost on a dry basis, which was covered with double-sided plastic containing perforations in the spacing of 0.25 x 0.10 cm.

The experiment was set up in a randomized block design. It occurred between December 13 and March 14, and the application of the homeopathic remedy began in February. The minimum, maximum and average data at the beginning of the investments are shown in Figure 1.

Figure 1

Daily temperatures- Rio Branco Station- 02/2023



Source: INMET

The cultivated chives have a white bulb of the species, *Allium fistulosum*, grow "Every year". The seedlings used were obtained from the cutting of previous harvests, the bulbs were cut so that all the seedlings were uniform with two bulbs each, the roots and leaves were cut to remove the tillers, which were 5 cm to 10 cm long (Figure 2). Irrigation was carried out by means of micro-sprinkler with daily applications of 6 mm of water. Cultivation practices are in accordance with organic plant production standards (BRASIL, 2021).

The anthropogenic inoculation of fungi of the genus *Colletotrichum* spp. in chives, as part of the experimental control process, was not necessary. This is due to the fact that

the target fungi were already readily identifiable and visibly present in the scallion plants, even before any intervention was implemented. The decision not to perform the deliberate inoculation was based on direct observation of the visible presence of the fungi in the tissues of the spring onions. This circumstance highlighted the importance of adapting control strategies to the specific situation, prioritizing approaches that considered the already existing fungal infestation. Such a targeted approach underscores the need for flexibility in management tactics, allowing for an effective and timely response to real environmental conditions.

Figure 2

Seedling of chives with 2 bulbs, cutting the seedlings between 5 and 10 cm

Source: The authors.

The preparation of the homeopathic tincture consisted first of combining charcoal and alcohol 70 in a sterilized glass jar of 300 ml (Figure 3). To prepare the medications, mother

tincture with charcoal (*Carbo activatus*) using 70% alcohol. The alcohol content at the beginning of extraction should be 60% (v/v) and at the end of extraction it should be 55% (v/v) to 65% (v/v) (BRAZILIAN HOMEOPATHIC PHARMACOPOEIA, 2011). After 15 days, the dynamization of the homeopathic remedy was manufactured by means of dilution and succussion. The Hanemanian centesimal (CH) dynamization was carried out on a centesimal scale (CH) meaning 99% of hydroalcoholic solution (30%) and 1% of the mother tincture. Soon after, the succussion was made, which is simply "hitting" the glass at the same pace 100 times (100 succussions). Thus, CH1 homeopathy was made, which was used to produce the remedy in CH2 and so on until CH30.

Figure 3

Mixture of mineral coal and alcohol 70

Source: The authors.

The The application of the dynamizations occurred twice a week for three weeks, at the contents of CH0, CH6, CH12, CH18, CH24 and CH30 along with weekly data collection, with the counting of commercial leaves and rejects (diseased leaves) to evaluate the efficiency in the control of anthracnose. It was done manually, one treatment at a time, to avoid contamination of the plants by different remedies, physical protection was used at the time of application and plant borders, using the aid of large sheets of cardboard to avoid splashing the dosage in the other treatments (Figure 4). The diseased leaves were removed and counted weekly, after which they were properly discarded.

Figure 4

Application of dynamizations in the crop with the use of cardboard sheet

Source: The authors.

The severity of the disease was quantified in percentage terms, being determined by dividing the number of affected leaves by the number of healthy leaves and then multiplied by one hundred. For the measurement of fresh pasta, an electronic scale with an accuracy of one tenth of a gram was employed, being able to weigh up to 5 kilograms. The collected data were submitted and analyzed by the assumptions of analysis of variance (ANAVA), the normality of errors by the Shapiro-Wilk test (1965) and the homogeneity of variance by the

Barttlett test (1937). After verifying the assumptions carried out at ANAVA, the means test was not applied because a non-significant F test was obtained at 5% probability of error, using the SISVAR program.

3 RESULTS AND DISCUSSIONS

The use of the homeopathic preparation based on Carbo Vegetabilis, aiming at the control of anthracnose, did not have an effect on plant productivity and disease severity (Appendix A; Table 1).

The rate of leaf loss during the experiment was significant, registering an average of 65.3%. These losses were high, reducing the commercial productivity of the plants.

Table 1

Severity, commercial mass per plant and yield by area of the experiment for biological control of anthracnose with homeopathic remedy of carbo vegetabilis

Treatments	Severity of the plant ns (%)	Commercial mass of the plant NS (G $^{Plant-1}$)	Productivity by area NS (G $^{M-2}$)
CH0	59,95	5,95	297,37
CH6	66,62	6,37	318,52
CH12	64,90	7,30	365,00
CH18	67,50	6,27	313,50
CH24	71,47	5,92	296,32
CH30	60,07	7,90	394,20

^{ns} = Numerical differences between the means in the column do not differ statistically by the F test at 5% probability of error. Source: The authors.

A justification for high loss and inefficiency of control may be linked to the environment-host-pathogen triangle, in which high temperature and humidity favor the multiplication of *colletotrichum* and plant weakness, at other times, as shown by Silva et al. (2017), where the commercial mass of chives *allium fistlosum* was 83.44 g $^{plant-1}$, in the most favorable conditions that occur between the months of June and August, it is possible to achieve better levels of control with alternative or ecological products.

In general, when rainy seasons coincide with high temperatures and there is the presence of a susceptible host and a source of the pathogen, it is common for severe epidemics of leaf anthracnose to occur, as highlighted in previous studies (LIMA; DUARTE, 2002). The productivity with an average of 330.818 (g $^{m-2}$) can make the activity economically negative, this low productivity has to do with the low yield of the mass per plant, with an average of 6.61 (g $^{plant-1}$), enhanced by the loss of the folia area caused by the fungus.

The predominant symptoms of this disease are necrotic spots of brown hue that spread along the cylindrical leaves of the scallion.

In these lesions, it is possible to observe small fruiting structures called acervules, which develop in concentric rings, corresponding to the fruiting bodies of the fungus. As the disease progresses, the plants eventually dry out completely, as described by Santana et al. (2016).

4 CONCLUSION

The use of carbona vegetabilis *homeopathic remedy* in dilutions CH6, CH12, CH18, CH24 and CH30 in the organic cultivation of chives from December to March in Rio Branco Acre, maintains the level of commercial productivity and severity of the anthracnose disease caused by the fungus *Colletotrichum gloesporioides*.

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