

# Homeopathy for the control of plant pathogens

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Homeopathic science was designed by German physician Christian Fredrich Samuel Hahnemann for over 200 years and it is based mainly in the law of similar (*Similia Similibus Curantur*). Currently, this science is being used in various segments of agriculture, especially in the area of plant protection. For its contribution on the auto regulation of the soil-plant-atmosphere system, the homeopathy can assist in the maintenance process of the plants health for its tonic effect and/or by inhibition effect directly on the pathological agents. Moreover, homeopathy is a low cost alternative to chemical fungicides, easy to use by farmers and how it is used in high dilutions, presenting an irrelevant environmental impact. So, this review aims to demonstrate the potential of homeopathy as a tool to control plant pathogens and its contribution for a sustainable agriculture.

**Keywords** homeopathy; alternative control; plant pathogens

## 1. Introduction

### 1.1 The homeopathy

The homeopathy is a word of Greek origin that means “similar disease” (*homoios* = similar, *phatos* = suffering, sickness) [1]. The homeopathic science, idealized by Christian Friedrich Samuel Hahnemann (1755 to 1843), has been applied with very positive results in human beings, however the use in animals and, especially in plants, have been developed more recently [2]. Hahnemann used to say that: “if the laws of nature that I proclaimed are true, then can be applied in all life beings”. This is the major warranty given by the idealizer of homeopathy for the utilization of homeopathic science in all life organisms, inclusive in plants.

According to Sigolo [3] and Benez [4], Hahnemann in 1790, analyzing the properties of the Cinchona, arouse the interest in the use of this substance, noting that the abuse of the same entailed symptoms similar to what was fighting. Making a series of experiments on himself, found out that the cinchona produced the same fever that he intended to annihilate, when administered in healthy persons. Hahnemann conducted other experiments with mercury and arsenic, toxic substances requiring dilution and succussion. Thus, the “father of homeopathic medicine” found that the substances lost its toxic effect when diluted, but are capable of causing symptoms of the disease which intended to cure.

Based in his practices and experiments, Hahnemann left four fundamental principals, that are followed to this day: a) cure by similar; b) experiments in healthy persons; c) minimal and infinitesimal doses; d) the only medication [5, 6].

The homeopathic philosophy for human beings is very clear, but their use in plants and soil is still in the very beginning. It is common to use analogies between the human medical subject and the plant science with very promising results. However, currently the homeopathy is being used in various segments of agriculture, like: pest control [7, 8] and plant diseases [9, 10, 11, 12, 13, 14, 15, 16]; increase of active principles or secondary metabolic in plants [17]; detoxification of plants contaminated by metals such as aluminum [17] and copper [18]; and influence on plant physiology [19, 20, 21].

The homeopathy is Eco-friendly, it is essentially informational, and of systemic action, leaving no residue in the environment [20]. The homeopathic drug acts as an informational way, in the auto-regulation of the body, which favors the homeostasis of the system. This feature makes homeopathy an ecological option for field use, totally in agreement with the agro-ecological principles.

### 1.2 Homeopathic drugs

Homeopathic drugs is all pharmaceutical presentation destined to be used according to the principle of similarity, with preventive and therapeutical purposes, obtained by the method of dilutions followed by succussion and/or successive grindings [21]. The succussion consists of rhythmic and vigorous stirring of drugs dissolved in appropriate inert substance, while the dynamization or potentization is the result of the process of dilution followed by succussion and/or successive grinding of the drug, with the aim of developing medicinal power. As inert ingredients can be used distilled water and ethanol [21].

The dynamization or the amount of times that the homeopathic drug was diluted with succussion is indicated by a number, while a letter (or letters) indicates how it was prepared [22]. According to the Brazilian Homeopathic Pharmacopoeia [21], there are three basic methods of preparation for the homeopathic medicines: the Hahnemannian method, the Korsakovian method and the Continuous Flow method. The Hahnemannian began from the basic pharmaceutical substance (obtained in ethanol) and used dynamization according to decimal and centesimal scales, being the proportion of 1:10 and 1:100, respectively, and with 100 succussions made by manual or mechanical process, which received the terminology of “DH” or “CH”, respectively. As an example: 6CH means the sixth Hahnemannian dilution.

The Korsakovian method, from the drug in 30CH, in ethanol, the liquid is placed in bottle filling 2/3 of capacity used in the preparation, when then is discarded and it is made new filling to the bottle with the inert substance and made succussion for 100 times, obtaining the 31K. The continuous flow starts from the drug in 30CH also, but uses a dynamic apparatus that works through the process of dilution and turbulence, and the rotation corresponding to the succussions. In this case, the homeopathic drug receives the terminology “FC” [21].

To designate the homeopathic drug are used scientific names, according with the rules of the international codes of botanical, zoological, biological, chemical and pharmaceutical nomenclature, in addition to names recognized by the homeopathic usage and the existing pharmacopoeia, codices, medical matters and scientific works recognized by homeopathy [21]. A way to treat with homeopathy is the recommendation by isopathy, use of isotherapies or biotherapies, or also known as nosodes. In this case is used as a source of homeopathic drug the actual disease or intoxication -causing agent [22]. In the case of plant treatment the recommendation has been given by analogy to the human medical field or by the use of isopathy [23, 22].

## 2. Homeopathy in plants

The scientific works of plant homeopathy are recent. Although the pioneering occurred in 1923 with Kolisko and Kolisko [24], stimulated by the ideas of Rudolf Steiner, only from the end of the decade of 60 has news of experiments in this area. One of the earliest works that has mention is of the Nitien et al. [18] in France that demonstrated the action of homeopathic preparations of copper sulphate (*Cuprum sulphuricum* – 15CH) on the detoxification of green pea plants previously intoxicated with this salt in high dosage.

In India, Khanna and Chandra [11] obtained significant results in rot control of tomato, caused by *Fusarium roseum*, with the application of homeopathic preparations of *Kali iodatum* in 149CH and *Thuya occidentalis* in 87CH, in pre and post-harvest conditions. These authors evaluated the quality, palatability of fruits treated and cost of the treatment, concluding that there were practical and economic feasibility in the homeopathic treatment, besides the prophylactic and curative actions. Later on, these same authors, obtained significant results in the control of rot in mango, guava and tomato fruits by the application of various homeopathic drugs in pre and post-harvest conditions, with suppression of spore germination and respiration of the fungi *Alternaria alternata*, *Colletotrichum gloeosporioides*, *Fusarium roseum* and *Gloeosporium psidii* [25, 26].

The control of fungi producing aflatoxins, toxin that causes liver damage in animals and humans, responsible for various contaminations in stored products, was studied by Sinha and Singh [27], in India. These authors tested various homeopathic drugs, and verified that *Sulphur* (200CH) inhibited 100% the growth of *Aspergillus parasiticus*. The *Silicea terrea* and the *Dulcamara* reduced the growing of the fungi in 50% and the production of toxin in more than 90%. The *Phosphorus* had little effect in inhibiting the growing of the fungi (less than 10%), but reduced in almost 30% the production of aflatoxins.

Verma et al. [10], aiming to control the tobacco mosaic virus (TMV), evaluated the application of homeopathic drugs *Lachesis* and *Chimaphila* in 200CH, before and after the inoculation with the virus, and verified reduction of 50% of the virus content in tobacco leaf discs.

Saxena et al. [28] observed inhibition of 22 genera of fungi associated with okra seed treated with *Thuya occidentalis*, *Nitric acidum* and *Sulphur* in dynamization 200CH.

Betti et al. [29] divided the international works with homeopathy in three groups: germination and growth models, plant pathological assays and field assays, which were classified with respect to positive and negative effects, noting that in most studies the effects of homeopathic drugs were promising for their use in agriculture.

In recent years has been found an increase of researches for disease control and studies of metabolic processes in plants treated with homeopathy. The homeopathic drugs act in biological processes of plants without producing toxicity [30]. Rolim et al. [13] demonstrated a reduction of powdery mildew of tomato by *Kali iodatum* 100CH, in greenhouse, and increase in number of leaflets by biotherapeutic obtained from the pathogen *Oidium lycopersici*. In apple seedlings two sprays of *Staphysagria* 100CH at intervals of 12 days reduced the incidence of powdery mildew caused by *Podosphaera leucotricha* [14]. Rolim et al. [31] concluded that *Kali iodatum* 30CH and hydro-alcoholic solution at 30% are effective in reducing incidence of tomato soft rot in post-harvest. Rolim et al. [32] demonstrated that *Staphysagria* 30CH applied to tomato plants, in greenhouse, reduced the severity of early blight, as well as *Phosphorus* 30CH and the isotherapies of *A. solani* in 30 and 60CH, indicating the use of homeopathy as technically feasible for plant disease control in tomato.

Andrade [23] and Andrade [33] observed responses on soil microbial activity, by change on the rhythm of breathing, when applied homeopathic drugs, demonstrating that these drugs interfere directly in the biomass of soil and, consequently, in the health of the plants.

Bonato et al. [9, 34], checking the effect of *Lachesis* in 6, 12, 24 and 30CH, and isotherapies of virus SCMV (*Virus*) in 3, 6, 12, and 30CH in sorghum plants, observed improvement of the general condition of the plants in almost all the variables analyzed, concluding that the dynamization 30CH both of *Lachesis* as well as *Virus* were the ones that showed the best results.

Rossi et al. [35], in an assay with tomato, aiming to induce resistance against bacterial spot, demonstrated the decrease in disease severity with the use of biotherapy of *Xanthomonas campestris* in 6CH and 24CH when applied together with the water irrigation.

Carneiro et al. [36] observed that the biotherapies of *Alternaria solani* in dynamizations 26, 27 and 28CH reduced the severity of the early blight disease in tomato plants cultivated in greenhouse.

As we can see, the homeopathy is a tool with great potential in agro-ecosystems, however, it is necessary that the universities and organizations that propagate science and technology, take the homeopathy as a science, with impartial posture, free of preconception, thus proving the effectiveness of homeopathy in biological systems, including the protection of plants.

### 3. Homeopathy and resistance induction in plants

Various biotic and abiotic agents can affect the growth and development of the plants. In general, the plant resistance to stress depends on the species, genotype and the stage of plant development. The stress triggers a wide range of responses in plants, ranging from the alteration of gene expression and cell metabolism by changing the rate of growth and productivity. The responses of plants to the stress depends on the length, the severity, the number of exposures and the combination of stressful factors, as well as the type of organ and tissue, developmental stage and genotype [17].

In the context of plant pathology, plants have mechanisms that, depending on the virulence of the pathogen, can prevent or reduce damage caused by the same. The defense mechanisms of plants against pathogens exist in multiplicity and are extremely efficient [37], and they can be activated by treatment with an inducing agent or elicitor. This way, the induction of resistance involves activation of latent defense mechanisms existing in plants in response to treatment with biotic or abiotic agents [39]. This induction of resistance both can be used to designate a local protection, this is, the induction of defense mechanisms only in the plant tissues that received the treatment with the inducing agent, or can indicate a systemic resistance, when it manifest far from the inducing agent was applied [38].

By the homeopathic science, any disturbance caused to the plant, both by biotic and/or abiotic agents, affects their regulatory systems, so, the plant is submitted to a certain stress (biotic or abiotic), which promotes an unbalanced auto-regulation, and consequently, their natural homeostasis is lost [17]. Therefore, the principle of similar, basis of homeopathy seems to apply to plants, once the fundamental principles in which Hahnemann was guided to establish the basis of homeopathy seem to hold for all living beings.

The homeopathic drugs can act as abiotic inducers of resistance in plants, and can also act in plant detoxification [40]. Toledo et al. [41] evaluated the effect of *Sulphur* and *Ferrum sulphuricum* in the control of the early blight on tomato plants. The results showed that *Sulphur* in 12 and 30CH minimized the severity of disease in ten days after the inoculation with the fungus *Alternaria solani*, and 14 days after inoculation for 6 and 30CH. *Ferrum sulphuricum* in 12 and 60CH reduced the severity in ten days and in 12 and 30CH to fourteen days, but was not observed induction of systemic resistance.

However, in the work of Meinerz et al. [42] it was observed increase in peroxidase activity in plants of tomato treated with three applications, in intervals of 72 hours, of *Propolis*, *Sulphur* and *Ferrum sulphuricum* in 6, 12, 30 and 60CH. In this case, *Propolis* 30CH overcame the other treatments when compared the sixth leaf treated and inoculated with *Alternaria solani*, with a seventh leaf only inoculated, showing systemic character to the treatment, which was observed also in the evaluation of the severity of early blight disease [43].

The homeopathic drugs can also modify the metabolism of the plants, especially by increasing the content of secondary compounds. Fonseca et al. [44] observed significant effect on tannin content in leaves and roots of medicinal plant *Porophyllum ruderale* with only one application of *Sulphur*, *Natrum muriaticum*, *Kalium phosphoricum*, *Calcarea carbonica*, *Silicea terrea* and *Magnesium carbonicum*, an dynamization 4CH, concluding that homeopathy in plants of *Porophyllum ruderale* can reduce the tannin content, reducing the astringency and increasing the palatability of leaves. On the other hand, the use of homeopathic preparations, that increases the content of pharmacologically active compounds, including the tannin, has a great importance to phytotherapy.

Bonato et al. [45] found that *Sulphur* and *Arsenicum album* in dynamizations 6, 12, 24 and 30CH, applied weekly during 98 days, affected growth and content of peppermint essential oil (*Mentha arvensis*). With the use of these two drugs there was an increase of plant height, fresh and dry biomass, beyond the content of essential oil.

#### 4. Conclusion remarks

The present work aimed to report studies related to the control of pathogens and the maintaining the health of plants by homeopathic drugs, showing its potential as a tool for an agriculture with less environmental impact. We suggested that to work with plant homeopathy, the researcher should pay attention to three basic points: the choice of drug, the dynamization and frequency of application on plants.

For the choice of homeopathic drug, research should be directed searching elucidate the principles left by Hahnemann through studies of pathogenesis, this is, verifying the symptoms developed when the drug is applied over a healthy plant. With respect to the choice of dynamization, a fact which is important to consider in future studies, is related to a great number of dynamizations of each drug to be observed, due to the pattern of waves when we use different dynamizations.

The frequency of application is important regarding the control of disease, because is necessary a time between the treatment with inducing agent to improve changes in the plant metabolism before the infection with pathogen, to give an effective protection. At this point, biochemical and histological studies can collaborate to clarify the phenomenon.

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