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**THE HOMEOPATHIC PRODUCTS USED IN PLANT PROTECTION:
AN ALTERNATIVE CHOICE**

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ABSTRACT

The paper presents the history and trends of the homeopathic products used in plant protection. Also known as high-dilution or agrohomeopathic treatments, this method started with the pioneering work of Kolisko in 1923, on wheat germination and Junker in 1928, on growth of microorganisms. Their approaches can be mainly divided in two important types of studies: effects on crop growth and effects on crop disease/phytopathology and pests control, both on plant models and in field trials. An important contribution in the agrohomeopathic research is brought by the isopathic model, where the same substance is used for the induction of a stress and then, in a diluted form, for the cure. Our work synthesises the information gathered from previous reviews made in 1984-2015 and other various papers published in the past years.

INTRODUCTION

The medicines taken for specific symptoms cause similar manifestations in healthy organisms if taken a certain period of time (principle of similitude). The opposite is also true: the medicines that cause symptoms in healthy organisms can cure them when administered in sick individuals, in diluted, nontoxic doses.

In plants, the mechanism of action may imply metabolic changes which lead to formation of secondary metabolic products related to the mechanism of defense of plants (Lensi et al, 2010). Gangar has concluded that homeopathic medicines can influence also the genetic activity in plants, this phenomenon being explained with the help of experiments made on mungbean, gram, cotton, wheat etc.

The paper presents an analysis of the evolution of research made in agrohomeopathy, from international publications, to put in evidence the level of knowledge acquired between 1923 - 2017.

MATERIALS AND METHODS

For the present paper were used all the available online and offline bibliographical references we could find, using the following international databases: Web of Science - Core Collection (Journal Citation Reports, Derwent Innovations Index, Thomson Reuters), SpringerLink Journals (Springer), Scopus (Elsevier), ScienceDirect Freedom Collection (Elsevier), PROQUEST Central, HomBRex

(Homeopathy Basic Research experiments database). The period analysed in this study was 1923-2017.

ISOPATHIC MODELS

The first studies on agrohomeopathy were performed by Kolisko on wheat germination in 1923. Afterwards, in 1928, another researcher published a study about the effects of high dilutions on microorganisms (Junker, 1928). These two researchers were initiating a domain which lately was defined as agrohomeopathy, domain that started to develop more intensely in the end of the 60's.

One of the earliest models belongs to Nitien et al, in 1969, with homeopathic preparations of copper sulphate (*Cuprum sulphuricum* CH 15) for detoxification of green pea previously intoxicated with the same substance in high dosage, demonstrating a positive effect. Another study was performed in 2011 on wheat seedlings pretreated with high concentrations of gibberellic acid expected to facilitate the inhibitory effect of the same plant hormone in diluted doses, but the supposition was not confirmed by the experimental results (Pfleger et al).

Another model consisted of seeds of *Vigna unguiculata* pretreated with *Natrium muriaticum* and afterwards stressed with NaCl. In the pretreated group there was an increase of seed germination compared with the control group stressed with the same substance (Mondal, Sukul, 2012).

The action of *Natrium muriaticum* in dilutions 6 CH and 30 CH, in comparison with NaCl solution of 5% was also studied on *Phaseolus vulgaris*. *Natrium muriaticum* had a significative effect of increasing the vegetable growth, mainly in the 6CH dilution (Lensi et al).

A comparative study was made on two plant models: *Lemna gibba*, an autotrophic multicellular organism and *Saccharomyces cerevisiae* yeast, a heterotrophic single-celled organism, stressed with arsenic and then treated with decimal potency of *Arsenicum album*. Application of *Arsenicum album* on the *Lemna gibba* bioassay yielded the largest effects compared to control groups, confirming the hypothesis that complex organisms show stronger reactions to homeopathic treatments (Jager, Scherr, 2011).

EFFECTS ON PESTS

The preparation made with *Coccinella septempunctata* from the adult beetle gives the necessary protection against different types of pests, like *Trioleurodes vaporariorum* (whitefly). Another efficient remedies against whitefly are made from the tincture of a live parasitic wasp, *Encarsia formosa* (Kaviraj, 2012) or from *Sulphur* (CH 200), if the honeydew secretions leads to colonisation with sooty mould, turning the leaves black (Maute, 2011).

An interesting study was made with the rosy apple aphid (*Dysaphis plantaginea* Pass., considered a major pest in apple orchards) on apple seedlings, with *Lycopodium clavatum* CH 6, CH 15, CH 30 and a nosode of rosy apple aphid, in eight independent, randomized and blinded experiments in growth chambers. The number of juvenile offsprings was reduced after application of *L.clavatum* CH 15 and nosode CH 6 compared with the control group (Wyss and al).

EFFECTS ON DISEASES, GERMINABILITY AND CROP GROWTH

In most of the cases, the research of the effects on diseases was carried out on artificially diseased organisms. (Table 1)

Table 1

Summary of phytopathological bioassays (after Betti et al)

Authors	Species/pathogen	Treatment	Working variable
Aggarval et al., 1993	Wild taro/ <i>phytophthora colocasiae</i>	Homeopathic treatments**	Disease symptoms, fungal growth and spore germination
Cheema et al., 1993	Tomato/tobacco <i>mosaic virus</i>	Clerodendrum aculeatum, CH Thuja	Disease symptoms
Betti et al., 2003	Tobacco/tobacco <i>mosaic virus</i>	DH As ₂ O ₃	Virus-induced Hypersensitive lesions
Cheema et al., 1986	Papaya/papaya <i>mosaic virus</i>	Homeopathic treatments	Disease symptoms
Datta, 2006	Mulberry/ <i>m. Incognita</i>	CH <i>Cina</i>	Plant growth, nematode infection
Khanna and Chandra, 1989	Mango, guava, tomato/ <i>pestalotia spp., fusarium roseum</i>	Homeopathic treatments and adjuvants	Post-harvest losses
Khanna and Chandra, 1992	Different fungi	DH treatments	Spore respiration rate, organic acid pool in spores
Rivas et al., 1996	Wheat, tomato/ <i>Alternaria solani</i>	CH treatments***	Seed and spore germination
Rolim et al., 2001	Apple/ <i>podosphaera leucotricha</i>	CH treatments****	Powdery mildew symptoms
Saxena et al., 1987	Reed okra/ seed-borne fungi	CH <i>Thuja</i> , nitric acid, <i>Sulphur</i> , <i>Calcarea carb.</i> , <i>Teucrium Q</i>	Fungal spore germination
Sukul and Sukul, 1999	Cowpea / <i>Meloidogyne incognita</i>	CH <i>Cina</i>	Plant growth, nematode infection

D, C = decimal, centesimal potency; H = Hahnemannian potency; ** = *Kali iodatum*, *Arsenicum album*, *Blatta orientalis*, *Thuja occidentalis*; *** = *Arsenicum album*, *Calcarea*, *Cuprum*, *Ferrum metallicum*, *Lycopodium*, *Natrum*, *Phosphorus*, *Selenium*, *Silicea*, *Sulphur*; **** = *Kali iodatum*, *Lachesis trigonocephalus*, *Staphysagria*, *Sulphur*, *Oidium lycopersici*.

Khanna and Chandra, obtained good results in the control of rot in mango, guava and tomatoes, suppressing the spore germination and respiration of the fungi *Alternaria alternate*, *Colletotrichum gloeosporioides*, *Fusarium roseum* and *Gloeosporium psidii*.

Sinha and Singh obtained significant results in the control of fungi producing aflatoxins in stored products, with *Sulphur* CH 200 which inhibited 100% the growth of *Aspergillus parasiticus*. Other remedies (*Silicea terra* and *Dulcamara*) reduced the growth of the fungi with 50% and the production of the toxin with 90%. Verma et al evaluated the effect of homeopathic remedies *Lachesis* and *Chimaphila* both in CH 200, before and after the inoculation of the tobacco mosaic virus (TMV) and obtained a reduction with 50% of virus content in tobacco leaf discs. In apple seedlings, two sprays of *Staphysagria* 100 CH at intervals of 12 days reduced powdery mildews

caused by *Podosphaera leucotricha* (Rolim et al). Rolim used also *Staphysagria*, this time in the 30 CH potency for tomato plants, in greenhouse and reduced the severity of early blight, as well as with *Phosphorus* 30 CH and isotherapics of *A. solani* in 30 and 60 CH.

A three year project on the control of dark leaf spot caused by *Alternaria brassicicola* in cauliflower made by Betti et al concluded that As₂O₃ DH 35 reduced significantly the infection on cauliflower heads compared to control.

Other investigations are made on healthy plants for the determination of the stimulation of the growth and on abiotically stressed plants (table 2).

The test organism most frequently used was wheat. The most commonly used stressor was arsenic.

Table 2.

Overview of bioassays with abiotic stress (after Betti et al)

Authors	Species	Stress	Treatment	Work variable
Auquiere et al., 1988	Wheat	Ethanol Lysine	CH Ethanol, Lysine	Shoot growth, weight of shoots
Novic et al., 1990	Wheat	Dark germination	DH Aurum	Shoot growth; fresh and dry weight of shoots
Kovac et al., 1991	Wheat	NaCl, CuCl, K ₂ Cr ₂ O ₇	DH NaCl, DH CuCl, DH K ₂ Cr ₂ O ₇	Shoot growth; fresh and dry weight of shoots, grains and roots
Lehner et al., 1991	Wheat	Dark germination	DH Platinum, Mercurius, Cadmium, Plumbum, Cuprum, Aurum, Argentum nit, Sulfur	Shoot growth; fresh and dry weight of shoots, grains and roots
Lauppert, 1995	Wheat	Dark germination	DH CuSO ₄	Shoot growth; fresh of shoots; dry weight of shoots, grains and roots
Betti et al., 1997	Wheat	As ₂ O ₃	DH As ₂ O ₃	Shoot growth
Brizzi et al., 2000	Wheat	As ₂ O ₃	DH As ₂ O ₃	Germination
Binder et al., 2005	Wheat	As ₂ O ₃	DH As ₂ O ₃	Shoot growth
Brizzi et al., 2005	Wheat	As ₂ O ₃	DH As ₂ O ₃	Shoot growth
Carvalho et al., 2003	Feverfew	Adaptation	DH Arnica montana	Shoot growth, parthenolide content
Carvalho et al., 2004	Feverfew	Water shortage	CH Natrum muriaticum	Shoot growth, chlorophyll and proline content
Carvalho et al., 2005	Feverfew	Adaptation	CH Arnica montana	Shoot growth, parthenolide content
Projetti et al., 1985	Lentil	CuSO ₄	CH CuSO ₄	Root growth
Steffen, 1985	Yeast	CuSO ₄	DH CuSO ₄	In vitro growth
Tighe, 2005	Cress	NaCl	CH NaCl	Shoot growth, germination

D, C = decimal, centesimal potency; H = Hahnemannian potency; K = Korsakovian potency;

CONCLUSIONS

1. The difficulties of previous studies described in literature lies in the fact that no complete medical material has been developed with specific indications of phytopathology or pest control, although there are data reported by different authors. The methodology varies from case to case, using various treatments, various concentrations, and there is no standardization that allows identical treatments.

2. It is necessary to use new research models to properly assess the potential of the domain. In particular, we have found that there are only a few studies on fruit trees, most of the studies being made on wheat and vegetables.

3. There are only a few studies conducted in the field and no specific methodologies have been established for different cultures. Most studies were conducted in growth chambers and seedlings. New studies are needed to develop methodologies for treatments applied directly to cultures, but the development of the work strategy must first be done in laboratory conditions to control more easily the environment.

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