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An Experimental Study to Establish the Role of Salicylicum Acidum 30CH in Controlling Anthracnose Fungal Infections in Phaseolus Vulgaris

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ABSTRACT

Aim: To evaluate Salicylicum acidum 30CH anti-fungal effectiveness against anthracnose-infected Phaseolus Vulgaris plants.
Study design: Experimental study.
Place and Duration of Study: MNR Homoeopathic Medical College and Hospital – Green House, Sangareddy, Telangana, India. Between February 2024 and August 2024.
Methodology: The overall sample size is 30 plants. The study consisted of three groups (A, B, and C), each containing ten plants. Group A served as the placebo control, Group B received fungicide treatment, and Group C was treated with Salicylicum acidum 30CH. The following parameters were analyzed: pod length, shoot length, healthy leaves, seeds per pod, and number of pods. The data was statistically analyzed using a single-factor ANOVA test.
Results: Statistical analysis revealed significant variations in plant parameters (pod length, shoot length, healthy leaves, seeds per pod, and number of pods) among the three study groups, with respective variances of 9.75, 25.33, 229.3, 4, and 12.33. The calculated F-value (7.95) exceeded the critical F-value (3.47) at a 5% significance level (df = 4, 10). The resulting P-value (0.00375) was less than 0.01, providing strong evidence to reject the null hypothesis and support the research hypothesis.
Conclusion: According to the findings of this study, Salicylicum acidum 30CH is as effective as a fungicide in improving the features of Phaseolus Vulgaris that are influenced by the anthracnose.

Keywords: Phaseolus Vulgaris, Anthracnose, Salicylicum acidum *30CH, Agro Homoeopathy*

INTRODUCTION

To achieve long-term health and resilience in agroecosystems, it's essential to design them in a way that fosters dynamic equilibrium and self-regulation, allowing the ecosystem to maintain its own balance and vitality. To promote holistic health in agroecosystems, effective homeopathic preparations can be utilized to address the intricate relationships within the ecosystem. Homeopathy offers a valuable contribution to sustainable agriculture by providing an environmentally friendly approach that conserves natural resources, maintains ecosystem quality, and meets the evolving needs of agricultural systems. [(2)]

With the advent of agro-homeopathy, the use of ultra-diluted preparations in agriculture was made possible, allowing for the control of biological processes in plants by either accelerating or slowing growth. Additionally, it can aid in the eradication of pestilences and illnesses, directly encouraging an increase in production and a boost in the characteristics of product quality. [3] Plants exhibit a strong response to homeopathic treatments, particularly under stressful conditions, due to their innate ability to self-regulate and adapt. [4]

Phaseolus vulgaris L, the common bean, also known as kidney bean, French bean, dry bean, field bean, etc., is one of the most precious and highly relished pulse crops used for direct human consumption globally. [5] It is a significant source of protein (22%) and calories (15%) in many underdeveloped nations throughout the world. Phaseolus vulgaris is also a valuable source of essential nutrients, providing calcium (50mg/100g), vitamin A (221 IU), and minerals (0.5g/100g).[6] India is the world's largest producer of Phaseolus vulgaris, accounting for approximately 4 million metric tons of annual production.[7] Pulses are often considered as nutritional powerhouses and an alternative part of balanced diets in households with low incomes and were once considered a "poor man's meat" across many countries.[8]The Phaseolus vulgaris crop has significant economic importance both in terms of income and food sources and has high nutritional value in developing countries in Africa, Asia, and Latin America.[9] Phaseolus vulgaris plays a vital role in ensuring national food security and contributing to the economy, generating income through foreign exchange earned from exporting white and red common bean varieties.[10]

However, a number of diseases primarily limit the production and productivity of common beans. The main causes of illness in Phaseolus vulgaris are fungus, bacteria, and certain nematodes; nevertheless, fungal pathogens are primarily accountable for crop losses. They are mostly susceptible to anthracnose disease, which is brought on by the seed-borne fungus Colletotrichum lindemuthianum and is among the worst diseases. This pathogen possesses a high degree of pathogenic variability throughout the world, including India. [11,12] Anthracnose fungus infects common bean plants, causing black-red sunken cankers on pods, seeds, stems, petioles, and leaves. As spots age, they develop black rings with red borders and pink ooze, and veins turn brick-red, purple, and black. [13] The prevalence of the anthracnose disease has placed a major threat on the output of common beans, as it is one of the most economically significant common bean diseases that decimates entire bean genotypes, causing yield losses of up to 100%. [14]

Integrated disease management is the recommended option for anthracnose control since the pathogen infects the seed and all growth stages of the crop and has high diversity. Treating seeds with mancozeb and following up with a carbendazim foliar spray has been shown to significantly decrease the severity of bean anthracnose. [15] The fungicide mancozeb has a considerable deleterious impact on soil microflora, nitrification, ammonification, soil microbial biomass, carbon mineralization, and soil enzymes, which may result in harmful effects on nutrient uptake and plant growth. [16]

In a study to assess the impact of phosphites on the defense of common beans (Phaseolus vulgaris) against anthracnose, it was discovered that K, Zn, K+ salicylic acid phosphites and salicylic acid were successful in controlling the disease. [17]

Studies on homeopathic management of Phaseolus vulgaris have demonstrated promising results, including improved stress tolerance, enhanced growth, and increased resistance to diseases like white mold. Specific homeopathic remedies, such as Calcarea carbonica, Phosphorus, Penicillium, and Arsenicum, have shown potential in promoting plant growth,

biomass production, and germination rates. (18,19,20,21)

Keeping in view the effect of anthracnose on common bean production, the deterrent effects caused by the fungicides on soil, and the potential of salicylic acid in defending the anthracnose fungal infection, this study was aimed at evaluating the ultra-diluted homoeopathic medicine Salicylicum acidum in the control of anthracnose fungal infections in Phaseolus vulgaris. The unexplored potential therapeutic role of ultra diluted homoeopathic medication Salicylicum acidum for the anthracnose fungal infections in Phaseolus vulgaris serves as the novelty for this research study.

The study conducted in the greenhouse of MNR Homoeopathic Medical College, investigated the efficacy of Salicylic Acidum 30C foliar spray against Anthracnose fungal disease in Phaseolus vulgaris. Thirty plants were divided into three groups of 10: a control group (A) receiving no treatment, a fungicide-treated group (B), and a Salicylic Acidum 30C-treated group (C). The study evaluated several key parameters, including shoot length, pod length, seed count per pod, and overall leaf health. Statistical analysis using ANOVA revealed significant differences between groups, indicating Salicylic Acidum 30C's potential as an eco-friendly alternative to fungicides in combating Anthracnose in Phaseolus vulgaris.

MATERIALS & METHODS

Study Procedure

- Three groups of infected plants with Anthracnose were created. A (without intervention), B (fungicide) and C (Salicylic Acidum 30C). Each group contains ten plants.
- Group B was administered fungicide, Group C was given Salicylic Acidum 30C, and Group A received no intervention at all.
- All three groups exhibited the onset of pod growth, but Group A showed significantly reduced pod development and more severe fungal toxic symptoms compared to Groups B and C.
- All plants exhibited fungal symptoms on leaves, pods, and shoots, but symptom severity differed among groups. Group B (fungicide) showed the mildest symptoms, followed by Group C (Salicylic Acidum 30C), while Group A (no intervention) displayed the most severe symptoms.
- The following parameters of Phaseolus vulgaris were monitored and recorded in all three groups throughout the study duration.

1. Length of the shoot
2. Length of the pods
3. Health of the leaves
4. Number of pods
5. Number of seeds in each pod

- The recorded data was analyzed statistically by using the One-way ANOVA test.

RESULTS

Fig. 1

APPEARANCE OF FLOWERS

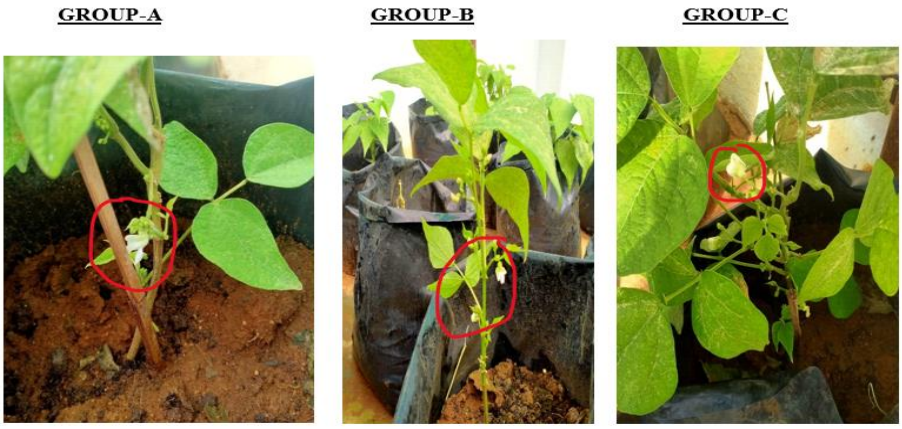

Fig. 2

APPEARANCE OF PODS

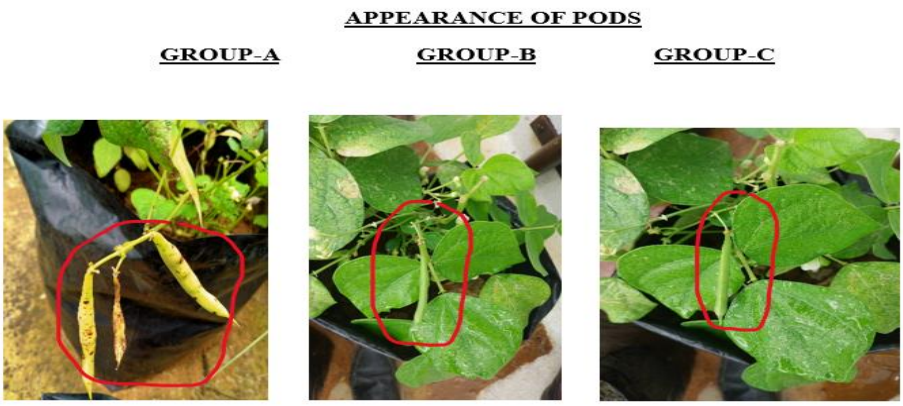

Fig. 3

HEALTH OF THE LEAVES

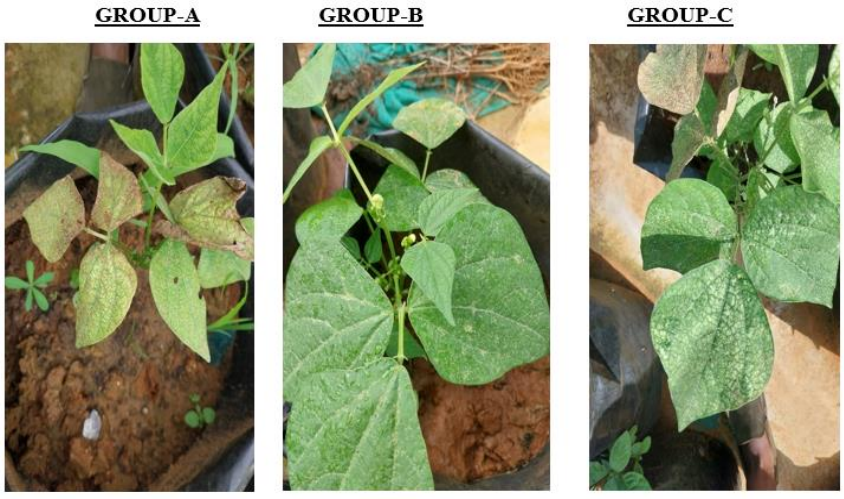

Fig. 4

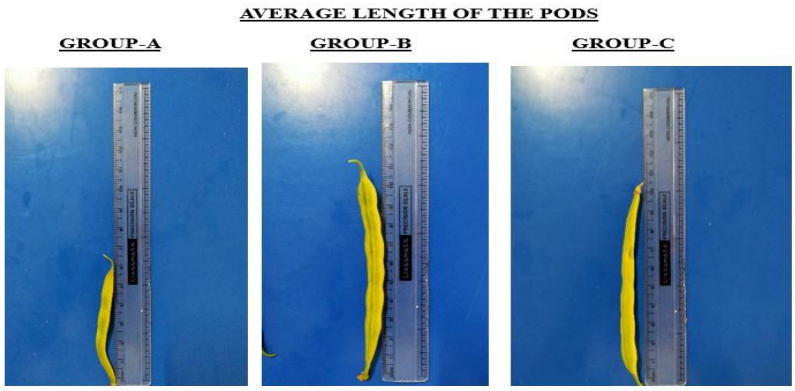

Fig. 5

Fig. 6

Fig. 7

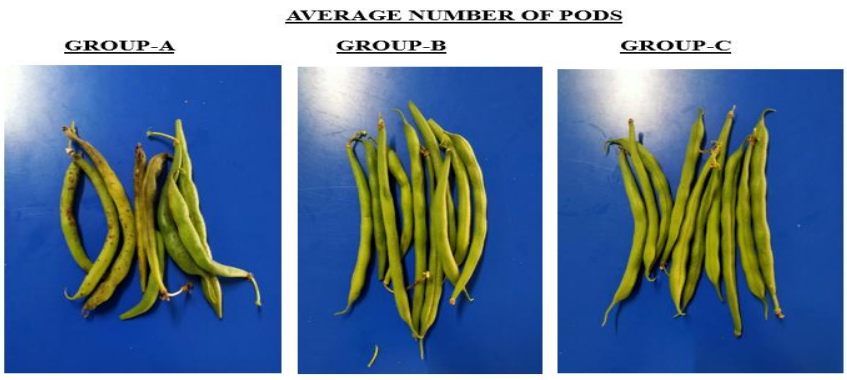

Fig. 8

Table 1. Average Length of the Shoot

Name of the group	Average Length of Shoot (cm)
No Intervention (A)	22
Fungicide (B)	32
Salicylic Acidum 30C	28

Table 2. Average Length of the Pod

Name of the group	Average Length of Pod (cm)
No Intervention (A)	6
Fungicide (B)	12
Salicylic Acidum 30C	10.5

Table 3. Average Number of Healthy Leaves

Name of the group	Average Number of Healthy Leaves
No Intervention (A)	15
Fungicide (B)	43
Salicylic Acidum 30C	39

Table 4. Average Number of pods

Name of the group	Average Number of pods
No Intervention (A)	8
Fungicide (B)	15
Salicylic Acidum 30C	12

Table 5. Average number of seeds in each pod

Name of the group	Average number of seeds in each pod
No Intervention (A)	2
Fungicide (B)	6
Salicylic Acidum 30C	4

STATISTICAL ANALYSIS

A one-way ANOVA was selected as the statistical test of choice, given its suitability for analyzing the collected data and addressing the research question.

Table 6. ANOVA – single factor

Parameters	Number of groups	Sum	Average	Variance
Length of the shoot (cm)	3	82	27.3	25.33
Length of the pods (cm)	3	28.5	9.5	9.75
Number of Healthy leaves	3	97	32.3	229.3
Number of pods	3	35	11.6	12.33
Number of seeds in each pod	3	12	4	4

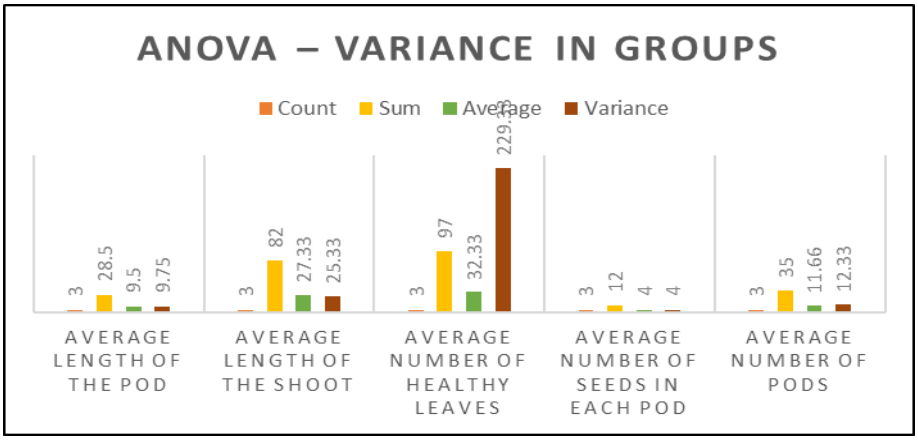

Fig. 9

ANOVA SINGLE FACTOR RESULT

Source of Variation	Sum of squares (SS)	Degree of freedom (d_f)	Mean Square	F calculated ratio	F crit	P-Value
Between the Groups	1786.733	4	446.6833	7.95	3.47	0.003756
Within the Groups	561.5	10	56.15			

The table reveals that the calculated F-value (7.95) exceeds the critical F-value (3.47) at a 5% significance level with 4 degrees of freedom between groups (v1 = 4) and 10 degrees of freedom within groups (v2 = 10). These results show a significant difference among the groups, confirming a statistically significant effect.

DISCUSSION

Systemic agro-homeopathy views a farm as a single, interconnected organism comprising living and non-living components. This approach uses highly diluted natural substances to regulate agricultural processes, promoting equilibrium in the agroecosystem and enhancing plants' innate resistance. Homeopathic remedies are selected based on metabolic similarities to treat Phyto pathological disorders. [1]

Phaseolus vulgaris (kidney bean) is a highly valued pulse crop, providing 22% protein and 15% calories in underdeveloped countries. Rich in calcium, vitamin A, and essential minerals, it's a nutritional powerhouse and staple in low-income households. India leads production with 4 million metric tons annually, contributing to food security and foreign exchange in Africa, Asia, and Latin America. [6,7,9]

Common bean production is severely impacted by anthracnose disease, caused by the fungus Colletotrichum lindemuthianum. The disease causes black-red cankers on plants, leading to significant yield losses (up to 100%) and threatening global common bean output. [11,13,14]

Considering the devastating impact of anthracnose on common bean production, the environmental concerns associated with fungicides, and the potential of salicylic acid in combating fungal infections, this study was aimed to investigate the efficacy of ultra-diluted homoeopathic Salicylicum acidum in controlling anthracnose in Phaseolus vulgaris. Thirty plants were divided into three groups: control, fungicide-treated, and Salicylic Acidum 30CH-treated. Group A (no intervention) was more severely affected when it came to managing the Anthracnose fungal disease in Phaseolus vulgaris in terms of parameters such as shoot length, pod length, number of pods, health of leaves, and number of seeds in each pod, while Groups B (fungicide) and C (Salicylic Acidum 30C) showed almost equal competence with minimal differences.

CONCLUSION

The growth and yield parameters of Phaseolus vulgaris, namely shoot length, pod length, pod number, leaf health, and seed count per pod, exhibited significant variations among the three treatment groups. Salicylicum Acidum 30CH shows equivalent effectiveness to fungicide, providing a credible alternative for controlling Anthracnose. Homeopathy offers a valuable solution, providing a cost-effective and ethical approach to farming. By empowering farmers with knowledge and practical skills, homeopathy can help address complex agricultural challenges, optimize outcomes, and improve livelihoods.

Declaration by Authors

Ethical Approval: Approved

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Conflict of Interest: The authors declare no conflict of interest.

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