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Disease management of powdery mildew in fennel using some soil additives and medicinal plant extracts

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Abstract
Ten different plant species' extracts were discovered to be efficient against powdery mildew on *Foeniculum vulgare* Mill. In comparison to the control, the majority of the plant extracts at various concentrations (10%, 25%, and 50%) considerably decreased the illness. In comparison to other plant extracts, *Azadirachta indica* and *Datura* leaf extracts were found to be extremely efficient. With higher concentrations, the extracts were recorded to be more effective. Additionally, some oil cakes to the soil as well as other additives greatly decreased the sickness proportion. Therefore, fennel grew more successfully when treated with Biovita, Sawdust, and Neem cake than when treated with cotton, mustard, til, or control. Neem oil cake outperformed the others in terms of thwarting crop disease.

Keywords: *Foeniculum vulgare*, disease control, powdery mildew, *Oidium sp*

Introduction
The fennel plant, *Foeniculum vulgare* Mill., is a member of the Apiaceae (Umbelliferea) family and is thought to have originated in the Mediterranean and Near East. Fennel production and growing places are widespread in Rajasthan, Malhotra [1]. Fennel seeds are used as a seasoning or condiment in pickles, curries, and other dishes. Additionally, fennel seeds have various therapeutic qualities, Singh *et al*. [2]. In our country, powdery mildew is a significant disease causing higher crop losses to fennel Maharishi *et al*. [3]. The use of resistant sources in plant breeding programmes is the most well-known and efficient method of controlling plant diseases. In the current study, powdery mildew disease control was achieved using bio-control techniques, such as the use of soil additives and plant extracts on fennel.

Materials and Methods
To ascertain the impact of soil organic amendments on the emergence of disease, field tests were conducted. Twenty days prior to seeding, various oil cakes and additives were mixed into the soil. The amount of oil cakes and additives utilized per hectare was 25 quintals each. The soil was completely combined with the powdered oil cakes. Cakes treated without oil were used as a check. Without the use of inoculum, seeds were planted in a pot. The onset of the disease at various stages was noted.

The purpose of the experiment was to assess the effectiveness of 10 different plant species' extracts in preventing fennel powdery mildew. 50 grams of fresh leaves from several plants, including Neem, *Aloevera, Bouguainvillia, Lantana depressa, Calatropis procera, Datura, Vinca rosea, Riccinus communis,* Citrus lemon, and *Nerium indicum*, were gathered and repeatedly rinsed with fresh water after being first cleaned with 70% ethanol. In a pestle and mortar, the leaves were thoroughly crushed with 50 cc of sterile distilled water. Through a two-layered muslin fabric, this macerate was strained. The extracts were centrifuged at a modest speed (1000 rpm for 15 minutes). The resulting filtrate or supernatant was regarded as 100 percent, and to acquire the necessary concentrations (10%, 25%, and 50%), clear supernatants were diluted with sterile distilled water. The plants were sprayed for the first time when they were 45 days old, again at the beginning of the disease, and again 15 days later. The percentage of illness intensity for each spray was calculated using the method by Wheeler [4].

Results and Dicussion
The percentage of illness was dramatically lowered by soil amendments (oil cakes and various chemicals). Neem oil cakes stood out among them as the most effective at thwarting crop disease. Then came saw dust and biovita in close succession. Compared to plants cultivated without soil amendments, all of these changes to the soil caused the plants to grow well. Thus, as compared to cotton cake, mustard cake, til cake, and control, neem cake, saw dust, and biovita produced better outcomes. The fennel plants grew better overall as a result of the addition of the amendment. Additionally, it was discovered that neem cake reduced the effects of *Alternaria* blight in potatoes Singh *et al*. [5].

Extracts from 10 different plant species were found to be beneficial. The majority of plant extracts lower the disease by 10%, 25%, and 50% when compared to the control, respectively. *Azadirachta indica* and Datura leaf extracts were shown to be quite efficient. With higher concentrations, the extracts became more effective. While *Vinca rosea, Bougainvillia, Nerium indicum, Lantana depressa, and Calatropis procera* leaf extracts were less effective than the previously listed leaf extracts in reducing the powdery mildew of fennel, they were nevertheless determined to be fairly beneficial. Many other workers also found similar outcomes for powdery mildew in many plants,

such as Kam, PCA *et al*. [6] evaluated plant extracts for controlling pea powdery mildew in grapevine, while Shukla *et al*. [7], Krzyzaniak, Yuko, *et al*. [8] also reported on their findings. Rettinassababady *et al*. [9] observed the effects of plant extracts on black gram (*Erysiphe polygoni* DC.) infected with powdery mildew, while Bahadur, A. *et al*. [10] demonstrated the effectiveness of natural products against pea powdery mildew.

Table 1: Effect of oil cake and some additives on powdery mildew

Oil cakes additive	Effect on control of powdery mildew
Til cake	+
Mustard cake	+
Saw dust	++
Cotton cake	+
Biovita	++
Neem cake	+++

Table 2: Efficacy of some plant extracts against powdery mildew of fennel (*Foeniculum vulgare* Mill.)

S. No.	Plant extract	Conc. %			Disease intensity %					
		10	25	50	2007-08			2008-09		
1.	*Datura*	10	25	50	55	52.5	50	53	51.50	49.0
2.	*Calotropis procera*	10	25	50	62	61.5	60	60.5	60	59
3.	*Lantana depressa*	10	25	50	60	60	59	60	59.5	59
4.	*Citrus lemon*	10	25	50	59	56.5	55	59.5	56	55
5.	*Aloevera*	10	25	50	59.5	56	54.5	58	55	53.5
6.	*Nerium indicum*	10	25	50	61.5	61	59.5	61	60	60
7.	*Vincarosea*	10	25	50	62	61	59.5	62	59.5	59
8.	*Neem*	10	25	50	51	50	48	52.5	50	48
9.	*Bogunvillia*	10	25	50	63	62.5	61	62.5	61	61
10.	*Riccinus communis*	10	25	50	58	55.5	54	58.5	54	53

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Conflict of Interest
None

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