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***Research article***

# EFFECT OF PLANT EXTRACTS ON RADIAL GROWTH OF *SCLEROTIUM ROLFSII* SACC. CAUSING STEM ROT OF GROUNDNUT

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**ABSTRACT:** To evaluate certain plant extracts on development of *Sclerotium rolfsii* causing stem rot in groundnut, we conducted an *in vitro* experiment in Department of Plant Pathology, Agricultural College, Bapatla. For this, we selected eight plant species *viz.,* Ashoka (*Polyalthia longifolia*), Garlic (*Allium sativum*), Ginger (*Zingiber officinalis*), Neem (*Azadirachta indica*), Seetha Phal (*Annonas squamosa*), Tulasi (*Ocimum sanctum*), Milk weed (*Calotropis gigantean*) and Peri Winkle (*Vinca rosea*) and are tested at 10% concentration. Among these plant extracts, clove extract of garlic was most effective and recording lowest mycelial growth (0.0 cm) and highest per cent inhibition (PI) (100%) in both sterilized and un-sterilized conditions. In sterilized condition, garlic followed by tulasi (4.62 cm, 48.70 PI) and neem (7.38 cm & 17.9 PI) were recorded the lowest mycelial growth and highest per cent inhibition over control, respectively. In un-sterilized condition, garlic followed by ginger (2.43 cm & 72.96 PI) and tulasi (2.52 cm & 72.04 PI) were recorded the lowest mycelia growth and highest per cent inhibition over control, respectively.

**Key Words:** Groundnut, *Sclerotium rlfsii*, Groundnut and Plant extracts

## INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is one of the important oilseed crops of the world. In total agricultural production in India, groundnut's contribution is 11.6%. Groundnut kernel is a rich source of energy, because of its high oil and protein content. In addition, it contains 18% carbohydrates. It is also a very good source of minerals (calcium, magnesium and iron) and vitamins (B1, B2 and niacin). Groundnut productivity is affected by several abiotic and biotic stresses, which include poor soil fertility, leaf spots, virus diseases, collar rot and stem rot. Stem rot caused by *Sclerotium rolfsii* Sacc. is an important groundnut disease affecting yield (Mayee and Datar, 1988). The pathogen is known to occur in many groundnut growing areas of India including Andhra Pradesh (Durga Prasad, 2008). Management of the plant diseases incited by soil borne pathogens is not achievable chemically, due to the widespread host range, abundant growth of the pathogen and its capability of producing excessive sclerotia that may persist in soil for several years. Therefore, plant extracts may be used as an alternative source for controlling soil-borne diseases since they comprises a rich source of bioactive substance. Plant extracts are eco-friendly, display structural diversity and complexity and infrequently contain halogenated atoms. The present study was ascertain to investigate the inhibitory effect of leaf, bulb and rhizome extracts of various plant species on the mycelial growth of *S. rolfsii* under *in vitro* conditions.

## MATERIALS AND METHODS

**Effect of Plant extracts on radial growth of Sclerotium rolfsii**

**Plant species and plant part selected:**

In order to know the effect of plant extracts on mycelia growth of *S. rolfsii*, eight plant species were selected for *in vitro* evaluation and those plant species and the part of the plant used for this study were presented in the Table 1.

**Preparation of plant extracts:**

Used fresh plant materials (leaf, bulb or rhizome) were washed separately with fresh water and finally with sterilized water. They were ground with a pestle in mortar with sterile water at the rate of one ml/g. The extract was obtained by squeezing the macerate with cotton wool. It was strained through muslin cloth, finally through Whatman No. 1 filter paper and passed through Zeitz filter to free it from bacterial contaminants. This formed a standard plant extract solution (100%).

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### Evaluation of plant extracts on mycelia growth of *S. rolfsii:*

The effect of plant extracts on the growth of *S. rolfsii* was studied using poisoned food technique (Nene and Thapliyal, 1982). From the crude extract ten per cent concentration was prepared separately by adding the required quantity of plant extract to the molten potato dextrose agar (PDA) medium and poured into sterilized Petri dishes. A mycelial disc cut from the periphery of five days old colony of *S. rolfsii* grown on potato dextrose agar medium was centrally placed in each of the Petri plates containing the potato dextrose agar medium having different leaf/bulb extracts at different concentrations under aseptic conditions. The Petri dish containing potato dextrose agar medium inoculated with the pathogen alone served as control. All the Petri dishes were incubated at room temperature (25 $\pm$ $2^0$C). Three replications were maintained for each treatment. The diameter of the colony was measured in two directions and average was recorded. The inhibition of growth of the *S. rolfsii* was calculated by using the formula given below.

$$I = \frac{100\ (C - T)}{C}$$

## RESULTS

### Effect of Plant extracts on radial growth of *S. rolfsii:*

The results of the present study (Table 2) revealed that, among these plant extracts, clove extract of *Allium sativum* at 10% concentration was most effective and recording lowest mycelial growth (0.0 cm) and highest per cent inhibition (100%) were recorded in both sterilized and un-sterilized conditions. In sterilized condition, garlic followed by tulasi (4.62 cm, 48.70 PI) and neem (7.38 cm & 17.9 PI) were recorded the lowest mycelia growth and per cent inhibition over control, respectively. Whereas, ginger and seeta phal were statistically on par with each other and recording mycelia growth of 7.57 cm and per cent inhibition of 15.93%.

**Table 1. List of plant species, used for studying the effect of their leaf extracts on mycelial growth of *S. rolfsii*.**

| S.No | Common Name | Scientific Name | Family | Plant Part Used |
|---|---|---|---|---|
| 1 | Neem | *Azadirachta indica* | Meliaceae | Leaf |
| 2 | Tulasi | *Ocimum sanctum* | Lamiaceae | Leaf |
| 3 | Garlic | *Allium sativum* | Amaryllidaceae | Clove |
| 4 | Ginger | *Zingiber officinale* | Zingiberaceae | Rhizome |
| 5 | Milkweed | *Calotropis gigantea* | Apocynaceae | Leaf |
| 6 | Seetha Phal/ Sugar apples | *Annona squamosa* | Annonaceae | Leaf |
| 7 | Ashoka | *Polyalthia longifolia* | Annonaceae | Leaf |
| 8 | Madagascar Periwinkle | *Vinca rosea* | Apocynaceae | Leaf |

**Table 2: Effect of plant extracts on radial growth of *Sclerotium rolfsii***

| S. No. | Plant Species | Growth (in cm) | |
|---|---|---|---|
| | | Sterilized | Un-sterilized |
| 1 | *Azadirachta indica* | 7.38 (2.90) | 2.88 (1.97) |
| 2 | *Ocimum sanctum* | 4.62 (2.37) | 2.52 (1.88) |
| 3 | *Allium sativum* | 0.00 (1.00) | 0.00 (1.00) |
| 4 | *Zingiber officinale* | 7.57 (2.93) | 2.43 (1.85) |
| 5 | *Calotropis gigantea* | 9.00 (3.16) | 3.62 (2.15) |
| 6 | *Annona squamosa* | 7.57 (2.93) | 3.42 (2.10) |
| 7 | *Polyalthia longifolia* | 8.40 (3.07) | 2.72 (1.93) |
| 8 | *Vinca rosea* | 5.45 (3.06) | 2.83 (1.95) |
| 9 | Control | 9.00 (3.16) | 9.00 (3.16) |
| | **SEM** | 0.014 | 0.039 |
| | **CD** | 0.029 | 0.083 |

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The highest mycelia growth and lowest per cent inhibition were recorded in leaf extract of milk weed (9.00 cm & 0.00 PI) which was statistically on par with control (9 cm) and this was followed by ashoka (8.40 cm & 6.67 PI) and peri winkle (8.37 cm and 7.04 PI). In un-sterilized condition, garlic was recorded the lowest mycelial growth (0.00 cm) and per cent inhibition (100%). This was followed by ginger (2.43 cm & 72.96 PI) and tulasi (2.52 cm & 72.04 PI) were recorded the lowest mycelia growth and per cent inhibition over control, respectively. The highest radial growth (3.62 cm) and lowest per cent inhibition (59.81%) were recorded in milk weed treatment and this was followed by seethe phal (3.42 cm & 62.04%) and neem (2.88 cm & 67.96%). In case of *Calotropis*, in sterilized conditions it has recorded 0.00 PI, whereas in unsterilized conditions it was recorded 59.81%. This indicates sterilization induces inactivation of antimicrobial compound present within the plant.

**Table 3: Per cent inhibition over control and number of sclerotia produced**

| S. No. | Plant Species | Per cent Inhibition | |
|---|---|---|---|
| | | Sterilized | Un-sterilized |
| 1 | *Azadirachta indica* | 17.96 | 67.96 |
| 2 | *Ocimum sanctum* | 48.70 | 72.04 |
| 3 | *Allium sativum* | 100.00 | 100.00 |
| 4 | *Zingiber officinale* | 15.93 | 72.96 |
| 5 | *Calotropis gigantea* | 0.00 | 59.81 |
| 6 | *Annona squamosa* | 15.93 | 62.04 |
| 7 | *Polyalthia longifolia* | 6.67 | 69.81 |
| 8 | *Vinca rosea* | 7.04 | 68.52 |
| **9** | Control | -- | -- |

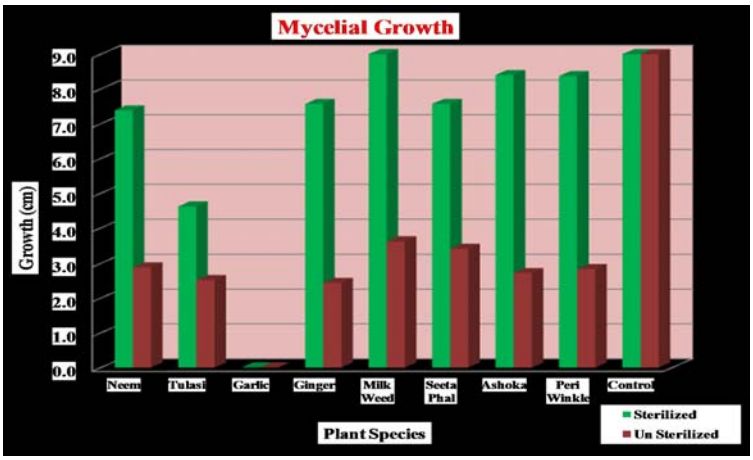


**Fig. 1: Effect of plant extracts on radial growth of *Sclerotium rolfsii* (Mycelial growth)**

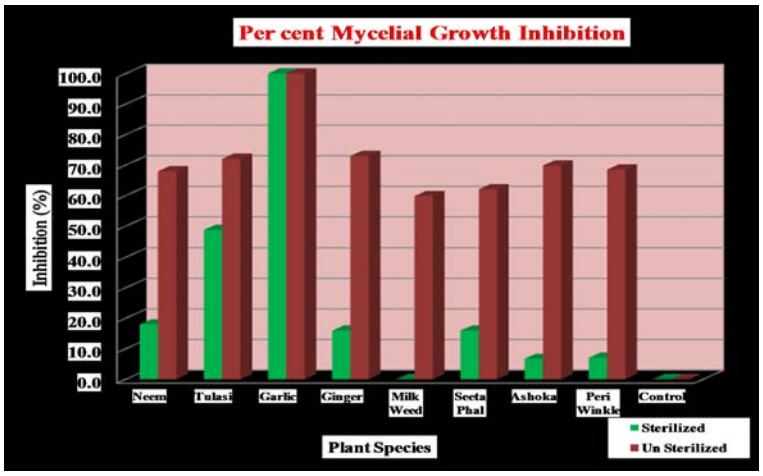


**Fig. 2: Effect of plant extracts on radial growth of *Sclerotium rolfsii* (Per cent Inhibition)**

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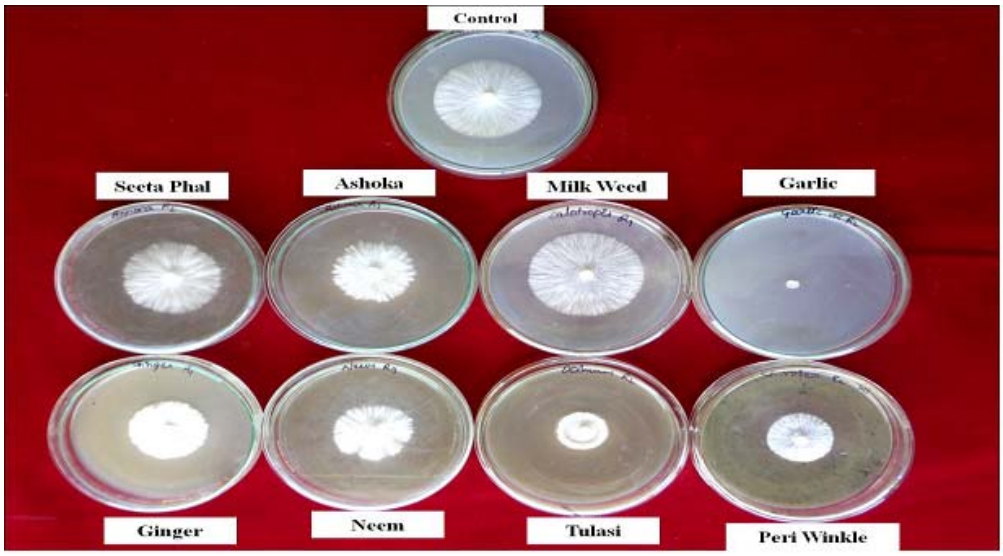


**Plate. 1. Effect of plant extracts on radial growth of *Sclerotium rolfsii* (Sterilized)**


**Plate. 2. Effect of plant extracts on radial growth of *Sclerotium rolfsii* (Un-sterilized)**

## DISCUSSION

Our results are in conformity with earlier workers. Antifungal properties of *Allium sativum* are well known, especially against human pathogens and also against plant pathogens. It contains different antimicrobial components like allicin, E-and Z-ajoene, iso-E-10-devinylajoene, and so forth, which are effective against bacteria, yeasts and phytopathogenic fungi (Prithiviraj *et al.*, 1998; Yoshida *et al.*, 1999). Kurucheve and Padmavathi (1997) found that, *Allium sativum* (garlic) bulb recorded the minimum mycelial growth (176 mg). Mahfuzul (1997) evaluated plant extract like garlic (*Allium sativum*), ginger (*Zingiber officinale*), nisinda (*Vitex negundo*), dolkalmi (*Ipomoea fistulosa*) and marigold (*Tagetes erecta*) against major seed borne fungal pathogens of chilli. Among these plant extracts, garlic was found to be most effective followed by neem leaf. The strong fungi toxicity exhibited by the root and stem bark extracts of *A. indica* and the stem bark extracts of *Ocimum gratissimum* can be attributed to their chemical constituents including tannins, glycosides, alkaloids, saponin and flavonoid that were found to be present. Okereke and Wokocha (2006) reported that, the inhibition of damping-off disease of tomato incited by *S. rolfsii* was highest with soil drenching with neem seed (62.4%) followed by ginger (57.4%). Volatile fraction of two medicinal plants; *Azadirachta indica* and *Eucalyptus globules* were more effective in suppressing the sclerotial germination of *Macrophomina phaseolina* than non-volatile fractions (Dubey & Kishore, 1990).

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Aslam *et al.* (2010) also observed 44.73% mycelial growth inhibition of important damping-off pathogen, *Rhizoctonia solani in vitro* when neem leaf extracts was supplemented in potato dextrose agar medium. Farooq *et al.* (2010) reported the maximum inhibition of mycelial growth of *Sclerotium* (*Athelia*) *rolfsii* causing southern *sclerotium* rot in sugar beet, was recorded by *Azadirachta indica* (73.8%) followed by *Cassia fistula* (73.5%) and *Cannabis sativa* (67.1%). Sallam (2011) reported that, the leaf extracts of *Datura stramonium*, *A. indica* and *A. sativum* at 5% concentration caused highest reduction of mycelial growth of *A. solani* (44.4, 43.3 and 42.2% respectively), while *O. brasilicum* at 1 and 5% and *N. oleander* at 5% caused the lowest inhibition of mycelia growth of the pathogen. Suleiman and Emua (2009) reported 55% growth inhibition of *Pythium aphanidermatum* with neem leaf extract and followed by ginger rhizome extract (70%).

Jalal and Ghaffar (1992) studied antifungal characteristics of *Ocimum sanctuml* L. and found that its leaf extract completely inhibited the growth of *S. rolfsii* and other fungi. Ethanol extracts of *Aframomum melegueta* and *Ocimum gratissimum* at 3 to 5% concentration showed total inhibition (100%) on the mycelia growth of *S. rolfsii*. In field experiment, plants treated with *O. gratissimum* extract performed better in reducing southern blight severity and besides this, it gave highest fruit weight at 5% extract concentration.

Yeni (2011) reported 80% aqueous extract of *Z. officinale* inhibited *Fusarium oxysporum* to 66.70%, 80% aqueous extract of *O. gratissimum* inhibited *Botrydioploidia theobromae* to 60.00% also 73.33% inhibition of *Aspergillus flavus* was recorded using 30% ethanol extract of *Z. officinale*, the same concentration of *Ocimum gratissimum* inhibited *A. niger* to 70.00%.

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