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Antifungal activity of some plant extracts on some pathogenic fungi

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The inhibitory activity of five plant extracts viz. *Artemisia absinthium* L., *Rumex obtusifolius* L., *Taraxacum officinale* Weber ex Wiggers, *Plantago lanceolata* L. and *Malva sylvestris* L. were evaluated against the mycelial growth of three fungi *Alternaria alternata* (Fr.) Keissler, *Penicillium expansum* Link ex Thom. and *Mucor piriformis* Fisher that cause rot diseases in fruits and vegetables resulting in low yield and quality of fruits and vegetables. Results revealed that all the concentrations of plant extracts brought about significant inhibition in the mycelial growth of these pathogenic fungi. However, the highest concentration caused maximum inhibition in the mycelial growth followed by lower concentrations of plant extracts. The extract of *A. absinthium* leaves at highest concentration (S) proved highly effective in inhibiting the mycelial growth of all these pathogenic fungi followed by other plant extracts. These plants thus may have potential as the new natural fungicide for management of fungal rot diseases.

Keywords: *Alternaria alternata*; *Penicillium expansum*; *Mucor piriformis*; mycelial growth; pathogenic fungi; plant extracts; concentrations

Introduction

Fruits and vegetables are attacked by wide range of fungi which are believed to cause rot diseases (Snowdon 1990; Sokhi 1994; Fontma et al. 1996; Ali et al. 2005). It is estimated that about 20–25% of the harvested fruits are decayed by pathogens during post-harvest handling even in developed countries (Droby 2006; Zhu 2006). Many pathogens including *Alternaria* species, *Penicillium expansum* and *Mucor piriformis* deteriorate the quality of fruits, reduce the market values and make them unfit for human consumption. Various chemical products have been used for the control of post-harvest fungal rots and are common for management of these diseases, but the use of chemicals has resulted in the appearance of new pathogen races which are resistant to fungicides (Spotts & Cervantes 1986) and are also harmful to environment and human health. Plant extracts are therefore believed to be more acceptable and less hazardous than synthetic compounds and can be therefore used as an alternative to synthetic antifungal chemicals (Jobling 2000). Extracts obtained from many plants have recently gained popularity and scientific interest for their antibacterial and antifungal activity (Lee et al. 2007; Verástegui et al. 2008; Santas et al. 2010). In an approach towards development of eco-friendly antifungal control strategy, different concentrations of five plant extracts,

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viz. *Artemisia absinthium* L., *Rumex obtusifolius* L., *Taraxacum officinale* Weber ex Wiggers, *Plantago lanceolata* L. and *Malva sylvestris* L. were evaluated for their anti-fungal activity in the present study.

Materials and methods

Different concentrations of aqueous extracts of leaves of five plants, viz. *A. absinthium* L., *Rumex obtusifolius* L., *Taraxacum officinale* Weber ex Wiggers, *P. lanceolata* L. and *Malva sylvestris* L. were used and evaluated for their effect on the mycelial growth of *A. alternata, P. expansum* and *M. piriformis* causing rotting in fruits and vegetables. For the preparation of different concentrations of plant extracts, 200 g of leaves of each plant were washed with sterilised distilled water, grinded in Mortar and pestle using 200 ml of double distilled water (Bhat & Sivaprakasan 1994). The material was homogenised for 5 min and filtered through double-layered muslin cloth followed by Whattman's filter paper No. 1. The filtrate was then centrifuged at 5000 rpm for 10 min and was considered as standard solutions (S). Then other concentrations such as S/2, S/10 and S/100 were obtained by adding appropriate amount of sterilised distilled water to standard concentration. Different concentrations of these extracts were mixed with potato dextrose agar medium and the mixtures were poured into sterile Petri-plates. After solidification, these Petri-plates were inoculated by placing 5 mm mycelial discs of the individual fungus in the centre of each plate. The discs were cut from the actively growing colonies of *A. alternata, P. expansum* and *M. piriformis*. The pure culture of the tested fungi was prepared in our Plant Pathology Laboratory, Department of Botany, University of Kashmir. Three replicates were maintained for each concentration. The Petriplates were incubated at 24 ± 2 °C and observations on the mycelial growth of test fungus were recorded after seven days of incubation. Plates of PDA without aqueous extracts served as control. The percent inhibition in growth due to different treatments at different concentrations was computed as follows:

$$\text{Mycelial growth inhibition } (\%) = [(dc - dt)/dc] \times 100(\%) \quad (1)$$

where dc = average diameter of fungal colony in control and dt = average diameter of fungal colony.

Results and discussion

It was observed from the results that the inhibitory activity of five plant extracts showed significant variation against the mycelial growth of all the tested fungi, viz. *A. alternata, P. expansum* and *M. piriformis*.

Effect of plant extracts on the mycelial growth of A. alternata *(Fr.) Keissler*

It was revealed from the results (Table 1, Figure 1) that different concentration of plant extract caused significant inhibition in the mycelial growth of *A. alternata.* Among the plant extracts used *A. absinthium* at highest concentration, S was found to be the most effective against *A. alternata* and caused highest inhibition in the mycelial growth (79.75%) followed by *T. officinale* (76.18%), *M. sylvestris* (72.61%), *R. obtusifolius* (71.43%) and *P. lanceolata* (63.11%).

Table 1. Effect of plant extracts on the mycelial growth of *A. alternata*.

Concentration treatment	Mycelial growth inhibition (%)			
	S	S/2	S/10	S/100
A. absinthium	79.75	67.86	46.43	30.95
R. obtusifolius	71.43	50.00	27.39	14.28
T. officinale	76.18	48.82	30.96	16.67
P. lanceolata	63.11	48.82	23.82	8.33
M. sylvestris	72.61	54.75	23.82	16.67

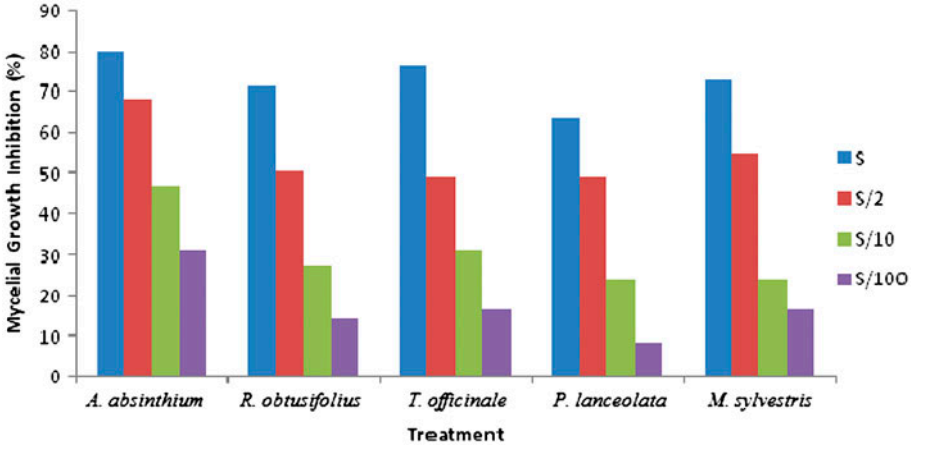

Figure 1. Effect of plant extracts on the mycelial growth of *A. alternata*.

Effect of plant extracts on the mycelial growth of P. expansum *Link ex Thom*

It was also observed from the results (Table 2, Figure 2) that different concentrations of plant extract caused significant inhibition in the mycelial growth of *P. expansum.* Among the plant extracts used, *A. absinthium* at highest concentration (S) caused highest inhibition in the mycelial growth (75.42%) followed by *R. obtusifolius* (73.68%), *M. sylvestris* (68.42%), *T. officinale* (66.68%) and *P. lanceolata* (63.16%).

Table 2. Effect of plant extracts on the mycelial growth of *P. expansum.*

Concentration treatment	Mycelial growth inhibition (%)			
	S	S/2	S/10	S/100
A. absinthium	75.42	61.41	43.84	22.79
R. obtusifolius	73.68	45.63	29.84	15.79
T. officinale	66.68	40.37	14.05	5.26
P. lanceolata	63.16	38.58	21.05	10.53
M. sylvestris	68.42	32.59	26.31	15.79

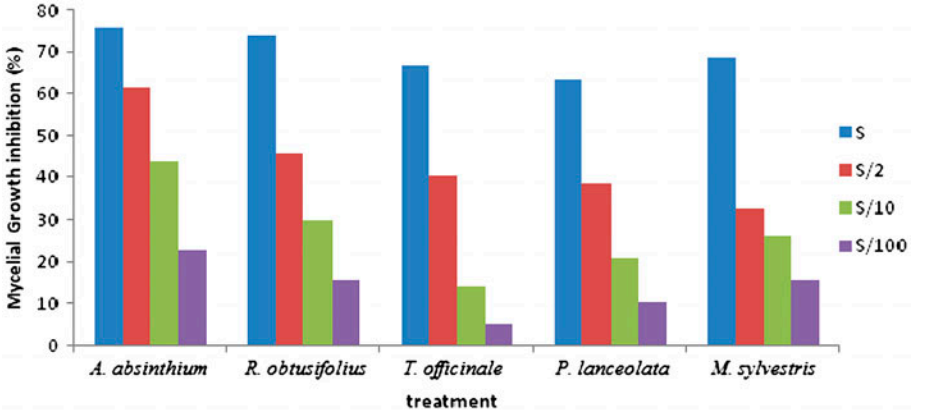

Figure 2. Effect of plant extracts on the mycelial growth of *P. expansum*.

Effect of plant extracts on the mycelial growth of M. piriformis *Fisher*

The results also indicates (Table 3, Figure 3) that different concentration of plant extracts caused significant inhibition in the mycelial growth of *M. piriformis.* Among the plant extracts used, *A. absinthium* at highest concentration (S) brought about highest inhibition in the mycelial growth (73.04%) followed by *P. lanceolata* (71.92%), *T. officinale* (69.67%), *R. obtusifolius* (65.18%) and *M. sylvestris* (62.92%).

Thus, it is clear from the above study that the plant extracts of all the tested plants proved effective against some tested pathogenic fungi in their different concentrations. In the similar studies, several reports stated that the extracts of medicinal plants play an important role in controlling many phytopathogenic fungi (Jacob & Sivaprakasan, 1994; Arya et al. 1995; Lin et al. 2001; Okemo et al. 2003; Choi et al. 2004; Mares et al. 2004; Khalil et al. 2005; Abd-El-Khair & Haggag 2007; Perez-Sanchez et al. 2007; Znini et al. 2011; Raji & Raveendran, 2013). Ogbebor et al. (2007) reported that extracts of *Ocimum basilicum* L. and *Allium sativum* L. exhibited total inhibitory effects on the mycelial growth of *Colletotrichum gloeosporioides*. Similar studies have been carried out by Misra and Dixit (1976) on the antifungal activity of *A. sativum* against 18 different fungi and they reported that crude leaf extract of *A. sativum* inhibited the mycelial growth of all the test fungi. Hossain et al. (1993) and Anwar et al. (1994) reported antifungal activity of the leaf extracts of some medicinal plants on a number of pathogens including *Alternaria* sp. and *Rhizopus* sp. Karade and Sawant (1999), Datar (1999) and Anwar and Khan (2001) observed the same results with the plant extracts of other plants. Mondall et al. (2009) reported the inhibitory effect of neem leaf

Table 3. Effect of plant extracts on the mycelial growth of *Mucor piriformis.*

	Mycelial growth inhibition (%)			
Concentration treatment	S	S/2	S/10	S/100
A. absinthium	73.04	58.44	35.96	22.48
R. obtusifolius	65.18	46.07	23.59	10.12
T. officinale	69.67	44.96	29.22	15.73
P. lanceolata	71.92	48.33	35.59	19.11
M. sylvestris	62.92	41.59	28.43	14.62

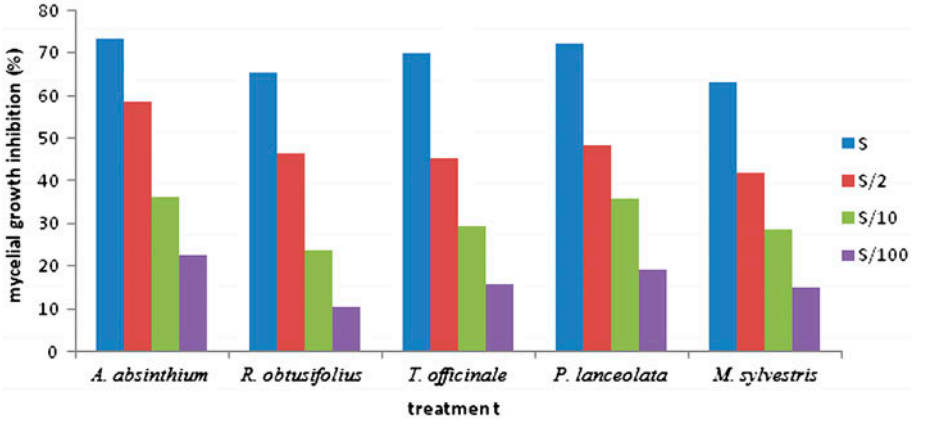

Figure 3. Effect of plant extracts on the mycelial growth of *M. piriformis*.

extracts on seed borne fungi *Aspergillus* and *Rhizopus.* Baka (2010) reported the antifungal activity of six medicinal plants *Amaranthus spinosus, Barbeya oleoides, Clutia lanceolata, Lavandula pubescens, Maerua oblongifolia* and *Withania somnifera* against five plant pathogenic fungi *A. brassicae, A. solani, Botrytis fabae, Fusarium solani* and *Phytophthora infestans.* Taskeen-Un-Nisa et al. (2010, 2011) reported the antimycotic activity of onion (*A. cepa* L.), garlic (*A. sativum* L.) and mint (*Mentha arvensis* L.) plant extracts against some pathogenic fungi. Raji and Raveendran, (2013) reported the antifungal activity of selected plant extracts against phytopathogenic fungi *Aspergillus niger*. The present study indicated that the inhibitory effect of the plant extracts on these pathogenic fungi might be attributed to the presence of some partially effective antifungal ingredients in the plant extracts of all the test plants.

References

Abd-El-Khair H, Haggag WM. 2007. Application of some Egyptian medicinal plant extracts against potato late and early blights. Res J Agric Biol Sci. 3:66–175.

Ali S, Rivera VV, Secor GA. 2005. First report of *Fusarium graminearum* causing dry rot of potato in North Dakota. Plant Dis. 89:105.

Anwar A, Khan FU. 2001. Effect of aqueous leaf extracts of medicinal plant on the growth of rhizospheric fungi of tomato cv. Pusa Ruby *in vitro*. SKUAST J Res. 3:60–63.

Anwar MN, Sing P, Begum J, Chowdhury JU. 1994. Antifungal activity of some selected plant extracts on phytopathogenic fungi. Bang J Life Sci. 6:23–26.

Arya A, Chauhan R, Arya C. 1995. Inhibition of growth of 200 pathogenic fungi by garlic extract. Mycologia. 67:882–885.

Baka ZAM. 2010. Antifungal activity of six Saudi medicinal plant extracts against five phyopathogenic fungi. Arch Phytopathol Plant Prot. 43:736–743.

Bhat NM, Sivaprakasan K. 1994. Antifungal activity of some plant extracts. In: Sivaprakasan K, Seetharaman I. Crop innovation techniques and management. New Delhi: Kalyani; p. 335–339.

Choi GJ, Jang KS, Kim JS, Lee SW, Cho JY, Cho KY, Kim JC. 2004. In vivo antifungal activities of 57 plant extracts against six plant pathogenic fungi. Plant Pathol J. 20:184–191.

Datar VV. 1999. Bioefficacy of plant extracts against *Macrophomina phaseolina* (Tassi) Goid, the incitant to charcoal- rot of sorghum. J Mycol Plant Pathol. 29:251–253.

Droby S. 2006. Improving quality and safety of fresh fruits andvegetables after harvest by the use of biocontrol agents and natural materials. Acta Horticul. 709:45–51.

Fontma DA, Nono-Worudim R, Opena RJ, Gumedzoe YD. 1996. Impact of early and late blight infections on tomato yield. IVIS, Newslett. 1:7–8.

Hossain MM, Chowdhury N, Khan AL. 1993. Effect of fungicides on the production of healthy onion seeds. Abstract 5th Biennial Conf. Bangladesh Phytopathol. Soc. p. 7.
Jobling J. 2000. Essential oils: a new idea for postharvest disease control. In: Good fruit and vegetables magazine (p. 50), Vol. 11, Australian. Available from: http://www.postharvest.com.au/GFV_oils.Pdf
Jocob CK, Sivaprakasam K. 1994. Evaluation of some plant extracts and antogonsists for the control of pre-emergence damping-off of brinjal (*Solamum melongena* L.) In: Sivaprakaasam K. Crop disease-innovative techniques and management. New Delhi: Kalayni; p. 289–294.
Karade VM, Sawant DM. 1999. Effect of some plants on the spore germination of *Alternaria alternata*. Plant Dis Res. 14:75–77.
Khalil AB, Dabaneh BF, Anfoka GH. 2005. Antifungal activity of medicinal plants from Jordan environment. Plant Pathol J. 4:130–132.
Lee SH, Chang KS, Su MS, Huang YS, Jang HD. 2007. Effects of some Chinese medicinal plant extracts on five different fungi. Food Control. 18:1547–1554.
Lin CH, Zon WX, Lin H, Tan RX. 2001. Antifungal activity of *Artemisia annua* endophytic cultures against phytopathogenic fungi. J Biotechnol. 88:277–282.
Mares D, Tosi B, Poh F, Andreotti E, Romagnoli C. 2004. Antifungal activity of *Tagetes patula* extracts on some phytopathogenic fungi: ultrastructural evidence of *Pythium ultimum*. Microbiol Res. 159:295–304.
Misra SB, Dixit SN. 1976. Fungicidal spectrum of the leaf extract *of Allium sativum*. Indian Phytopathol. 29:448–449.
Mondall NK, Mojumdar A, Chatterje SK, Banerjee A, Datta JK, Gupta S. 2009. Antifungal activities and chemical characterization of Neem leaf extracts on the growth of some selected fungal species *in vitro* culture medium. J Appl Sci Environ Manage. 13:49–53.
Ogbebor NO, Adekunle AT, Enobakhare DA. 2007. Inhibition of *Colletotrichum gloeosporioides* (Penz.) Sacc. causal organism of rubber (*Hevea brasiliensis* Muell.-Arg.) leaf spot using plant extracts. African J Biotechnol. 6:213–218.
Okemo PO, Bais HP, Vivanco JM. 2003. *In vitro* activities of *Maesa lanceolata* extracts against fungal plant pathogens. Fitoterapia. 74:312–316.
Perez-Sanchez R, Infante F, Galvez C, Ubera JL. 2007. Fungitoxic activity against phytopathogenic fungi and the chemical composition of *Thymus zygis* essential oil. Food Sci Technol Int. 13:341–347.
Raji R, Raveendran K. 2013. Antifungal activity of selected plant extracts against phytopathogenic fungi *Aspergillus niger*. Asian J Plant Sci Res. 3:13–15.
Santas J, Almajano MP, Carbo R. 2010. Antimicrobial and antioxidant activity of crude onion (*Allium cepa* L.) extracts. Int J Food Sci Technol. 45:403–409.
Snowdon AL. 1990. A colour atlas of post-harvest disease and disorders of fruits and vegetables. Vegetables BPCC Hazel Books, Aylesbury, UK. 2:53–77.
Sokhi SS. 1994. Integrated approaches in management of vegetable disease in India. Indian Phytopathol. 47:371–376.
Spotts RA, Cervantes LA. 1986. Population, pathogenicity and benomoyl resistance of *Botrytis* spp., *Penicillium* spp. and *Mucor pyriformis* in packing houses. Plant Dis. 70:106–108.
Taskeen-Un-Nisa, Wani AH, Bhat MY, Pala SA, Mir RA. 2011. In vitro inhibitory effect of fungicides and botanicals on mycelial growth and spore germination of *Fusarium oxysporum*. J Biopesticides. 4:53–56.
Taskeen-Un-Nisa, Wani AH, Mir RA. 2010. Antimycotic activity of plant extracts on the spore germination of some pathogenic fungi. Mycopath. 8:65–69.
Verástegui A, Verde J, García S, Heredia N, Oranday A, Rivas C. 2008. Species of agave with antimicrobial activity against selected pathogenic bacteria and fungi. World J Microbiol Biotechnol. 24:1249–1252.
Zhu SJ. 2006. Non-chemical approaches to decay control in postharvest fruit. In: Noureddine B, Norio S, editors. Advances in postharvest technologies for horticultural crops. Trivandrum: Research Signpost; p. 297–313.
Znini M, Cristofari G, Majidi L, Mazouz H, Tomi P, Paolini J, Costa J. 2011. Antifungal activity of essential oil from *Asteriscus graveolens* against postharvest phytopathogenic fungi in apples. Nat Prod Commun. 6:1763–1768.