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Bioactivity of plants gums against pathogenic fungi

[1]K. V. Badar, [2]Rajendra B. Kakde, [3]S. M. Pawar and [4]Ashok M. Chavan

[1]Department of Botany, Yeshwantrao Chavan Arts, Commerce & Science College, Sillod. Dist. Aurangabad (M.S.), India..
[2&4]Department of Botany, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad-431004 (M.S.), India.
[3]Department of Botany, Shivaji Arts, Commerce and Science College Kannad, Dist. Aurangabad-431103 (M.S.) India.

Abstract

In order to investigate the bioactivity of gum of selected plants against the economically important fungi like *Alternaria alternata, Aspergillus niger, Curvularia lunata, Curvularia pellescence, Fusarium equiseti, Fusarium oxysporum, Macrophomina phaseolina, Penicillium digitatum, Penicillium chrysogenum* and *Rhizopus stolonifer* the experiments were carried out by using different concentrations of plant gum i.e. 1%, 5%, 10%. Gum *Acacia arabica* was found to promote the growth of fungi like *Alternaria alternata, Aspergillus niger* as the function of concentration of gum. Whereas the growth of fungi like *Curvularia lunata, Fusarium equiseti, Fusarium oxysporum, Macrophomina phaseolina, Penicillium digitatum* and *Penicillium chrysogenum,* were found to be inhibited by the 1% gum of *Acacia arabica*. But on the contrary the concentration of gum increased to level of 5% and 10%, the increase in dry mycelium weight of these fungi were found. The *Rhizopus stolonifer* was found to be suppressed at 10% concentration. Gum of *Acacia chundra* was found to promote the growth of fungi like *Macrophomina phaseolina* and *Penicillium chrysogenum* with the increased concentration of gum. On the other hand the fungi like *Alternaria alternata, Aspergillus niger, Curvularia lunata, Fusarium equiseti, Fusarium oxysporum* and *Rhizopus stolonifer* were found to be inhibited at 1% concentration of gum. But at 5% concentration the fungi like *Alternaria alternata, Aspergillus niger, Curvularia pellecence, Fusarium equiseti* and *Rhizopus stolonifer* showed the increased in dry mycelial weight. At 10 % concentration all fungi except *Curvularia pellecence* and *Penicillium digitatum* showed increase in dry mycelium weight. Similarly, gum of *Azadirechta indica*, *Boswellia serrata* and *Butea monosperma* showed fungitoxic activity at variable concentrations.

Keywords: Bioactivity of gum, *Acacia arabica*, *Acacia chundra, Azadirechta indica*, *Boswellia serrata* and *Butea monosperma*

INTRODUCTION

Plants are the richest resource of drugs of traditional systems of medicine, modern medicines, nutraceuticals,food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs [1]. Medicinal plants are a source of great economic value all over the world. Nature has bestowed on us a very rich botanical wealth and a large number of diverse types of plants grow in different parts of the country [2]. Green plants appear to be reservoir of biotoxicants and constitute inexhaustible source of number of pesticides [3]. In comparison to synthetic compound, the pesticidal compounds of plant origin are more effective and have little or no side effects on human beings [4]. Whereas, [5] natural fungicides are free from environmental toxicity as compared to synthetic compound; in addition to that, natural compounds are less phytotoxic, easily biodegradable and more systematic [6]. The extensive use of agrochemicals especially fungicides, which to pose more of carcinogenic risk than other pesticides which may give rise to undesirable biological effects on animals and human beings [7]. Therefore, the development of biopesticides has been focused as a viable pest control strategy in recent years. One source of potential new pesticides is natural products produced by plants. Several workers screened the large number of leaf extract of plants against pathogenic fungi. But very little work has done on antifungal properties of medicinal plant gums. Therefore, in present investigation emphasis has been given on to study the fungitoxic properties of *Acacia arabica, Acacia chundra, Azadirachta indica, Boswellia serrata* and *Butea monosperma* plant gums.

MATERIALS AND METHODS

Fungitoxicity of plant gum was studied by the poisoned food technique [8]. Glucose nitrate medium was prepared in flasks and sterilized. To this medium, the requisite quantity of the plant gum was added. Plant gum was prepared by collecting fresh plant parts, washed thoroughly in distilled water and grinned in distilled water. The plant gum was thoroughly mixed by stirring. The medium was then autoclaved at 15 lb pressure for 20 minutes. After cooling the medium, fungi were inoculated in aseptic condition and incubated for 6 day at room temperature. Suitable checks were kept where the fungi were grown under the same conditions on glucose nitrate without plant gum. Mycelial growth and sporulation of the test fungi was measured after harvesting. The mycelial growth of the fungi compared with check, was taken as a measure of the fungitoxicity.

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*Corresponding Author

Rajendra B. Kakde
Department of Botany, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad-431004 (M.S.), India.

Email: kakde1584@gmail.com

RESULTS AND DISCUSSION

Bioactivity of *Acacia arabica* plant gum against pathogenic fungi

It is clear from table 1 that the gum *Acacia arabica* was found to promote the growth of fungi like *Alternaria alternata, Aspergillus niger* as the function of concentration of gum. Whereas the growth of fungi like *Curvularia lunata, Fusarium equiseti, Fusarium oxysporum, Macrophomina phaseolina, Penicillium digitatum* and *Penicillium chrysogenum,* were found to be inhibited by the 1% gum of *Acacia arabica*. But on the contrary the concentration of gum increased to level of 5% and 10%, the increase in dry mycelium weight of these fungi were reported. The *Rhizopus stolonifer* was found to be suppressed at 10% concentration.

Table 1. Bioactivity of *Acacia arabica* plant gum against selected fungi

Sr. No.	Name of fungi	Concentration of gum (Dry mycelial weight in mg)			
		1 %	5%	10%	Control
1)	*Alternaria alternate*	124	138	141	120
2)	*Aspergillus niger*	137	119	139	128
3)	*Curvularia lunata*	130	142	144	134
4)	*Curvularia pellescens*	128	126	129	130
5)	*Fusarium equiseti*	122	124	130	124
6)	*Fusarium oxysporum*	128	122	136	129
7)	*Macrophomina phaseolina*	130	131	136	132
8)	*Penicillium digitatum*	119	132	119	120
9)	*Penicillium chrysogenum*	130	142	139	130
10)	*Rhizopus stolonifer*	132	134	122	134

Bioactivity of *Acacia chundra* plant gum against pathogenic fungi

Gum of *Acacia chundra* was found to promote the growth of fungi like *Macrophomina phaseolina* and *Penicillium chrysogenum* with the increased concentration of gum. On the other hand the fungi like *Alternaria alternata, Aspergillus niger, Curvularia lunata, Fusarium equiseti, Fusarium oxysporum* and *Rhizopus stolonifer* were found to be inhibited at 1% concentration of gum. But at 5% concentration the fungi like *Alternaria alternata, Aspergillus niger, Curvularia pellecence, Fusarium equiseti* and *Rhizopus stolonifer* showed the increased in dry mycelial weight. At 10 % concentration all fungi except *Curvularia pellecence* and *Penicillium digitatum* showed increase in dry mycelium weight (Table 2).

Table 2. Bioactivity of *Acacia chundra* plant gum against selected fungi

Sr. No.	Name of fungi	Concentration of gum (Dry mycelial weight in mg.)			
		1 %	5%	10%	Control
1)	*Alternaria alternata*	099	122	126	120
2)	*Aspergillus niger*	104	136	119	109
3)	*Curvularia lunata*	129	107	137	134
4)	*Curvularia pellescens*	127	138	124	126
5)	*Fusarium equiseti*	123	135	128	124
6)	*Fusarium oxysporum*	128	117	132	129
7)	*Macrophomina phaseolina*	132	134	139	132
8)	*Penicillium digitatum*	119	116	120	118
9)	*Penicillium chrysogenum*	132	127	133	130
10)	*Rhizopus stolonifer*	130	134	136	134

Bioactivity of *Azadirachta indica* plant gum against pathogenic fungi

The gum of *Azadirachta indica* was screened for its bioactivity against selected fungi and it is revealed from table 3 that gum of *Azadirachta indica* retarded the growth of *Curvularia lunata* and *Fusarium equiseti* at 1% concentration as compared to the control. On the other hand all remaining fungi showed increase in dry mycelium weight at 1% concentration. At 5% concentration the *Curvularia pellescence, Fusarium equiseti, Fusarium oxysporum* and *Rhizopus stolonifer* were found to be inhibited by 5% concentration of gum. Whereas remaining fungi showed increase in dry mycelium weight at 5% concentration of gum. At 10% concentration the *Fusarium oxysporum* and *Rhizopus stolonifer* were the only two fungi

which showed the reduction in dry mycelium weight as compared to control.

Table 3. Bioactivity of *Azadirachta indica* plant gum against selected fungi

Sr. No.	Name of fungi	Concentration of gum (Dry mycelial weight in mg)			
		1 %	5%	10%	Control
1)	*Alternaria alternata*	119	122	126	118
2)	*Aspergillus niger*	113	121	119	110
3)	*Curvularia lunata*	122	130	138	134
4)	*Curvularia pellescence*	129	113	137	128
5)	*Fusarium equiseti*	122	116	133	124
6)	*Fusarium oxysporum*	122	105	111	119
7)	*Macrophomina phaseolina*	127	134	138	122
8)	*Penicillium digitatum*	116	142	120	109
9)	*Penicillium chrysogenum*	129	140	144	125
10)	*Rhizopus stolonifer*	131	122	120	130

Bioactivity of *Boswellia serrata* plant gum against pathogenic fungi

It is clear from the table 4 that the gum of *Boswellia serrata* at 1% concentration was found to promote the growth of *Alternaria alternata*, *Fusarium oxysporum, Penicillium chrysogenum* and on the other hand it was found to promote the growth *Aspergillus niger, Curvularia lunata, Curvularia pellecence, Fusarium equiseti, Macrophomina phaseolina, Penicillium digitatum, Rhizopus stolonifer* at 1% concentration. The gum of *Boswellia serrata* at 5% concentration was found to inhibit the growth of fungi like *Aspergillus niger, Fusarium equiseti, Macrophomina phaseolina* and *Rhizopus stolonifer*. At 10% concentration the gum *Boswellia serrata* was found to promote the growth of all selected fungi.

Table 4. Bioactivity of *Boswellia serrata* plant gum against selected fungi

Sr. No.	Name of fungi	Concentration of gum (Dry mycelial weight in mg)			
		1 %	5%	10%	Control
1)	*Alternaria alternata*	132	134	128	120
2)	*Aspergillus niger*	109	117	128	124
3)	*Curvularia lunata*	124	127	139	134
4)	*Curvularia pellescence*	122	131	137	130
5)	*Fusarium equiseti*	120	122	129	124
6)	*Fusarium oxysporum*	121	130	137	119
7)	*Macrophomina phaseolina*	129	115	139	132
8)	*Penicillium digitatum*	115	118	132	118
9)	*Penicillium chrysogenum*	128	123	135	120
10)	*Rhizopus stolonifer*	131	120	137	134

Bioactivity of *Butea monosperma* plant gum against pathogenic fungi

The gum *Butea monosperma* retarded growth of *Curvularia lunata, Curvularia pellecence, Fusarium oxysporum, Macrophomina phaseolina, Penicillium chrysogenum* and on the other hand it was found to promote the growth of *Alternaria alternata, Aspergillus niger, Fusarium equiseti, Penicillium digitatum, Rhizopus stolonifer* at 1% concentration. The gum of *Butea monosperma* at 5% concentration was found to inhibit the growth of fungi like *Fusarium equiseti, Macrophomina phaseolina, Penicillium digitatum* and *Rhizopus stolonifer* whereas at 10% concentration the gum *Butea monosperma* was found to promote the dry mycelial weight except *Curvularia pellecence* and *Fusarium oxysporum* (Table 5).

Such type of results regarding the antifungal activity of plant gum have been recorded earlier by [9], [10] and [11]. They recorded the antifungal action of gum against the *Saccharomyce cerevisicae.* The gum of *Acacia Chundra, Azadirachta indica, Cassine albens, Butea monosperma, Sterculia urens* were found to inhibit the growth of tested fungi. Among these plants the gum of *Acacia arabica, Boswellia serrata, Moringa oleifera* and *Sterculia urens* induces the growth at lower concentration of gum. Cashew tree gum inhibited the growth of 10 out of 25 fungal samples, including *Aspergillus flavus,Penicillium implicatum, Colleotrichum musae* and *Verticillium* sp [12]. Similarly, [13] tested cashew tree gum for their antimicrobial activity against bacteria, yeast and fungi. They found the only antimicrobial effect of cashew gum was against *S. cerevisiae*. Gum of *Terminalia arjuna, Acacia Arabica* and *Butea monosperma* inhibited the growth of storage fungi [14].

Table 5. Bioactivity of *Butea monosperma* plant gum against selected fungi

Sr. No.	Name of fungi	Concentration of gum (Dry mycelial weight in mg)			
		1%	5%	10%	Control
1)	*Alternaria alternata*	134	131	140	122
2)	*Aspergillus niger*	138	121	127	122
3)	*Curvularia lunata*	121	120	134	134
4)	*Curvularia pellescence*	122	127	121	130
5)	*Fusarium equiseti*	124	132	134	124
6)	*Fusarium oxysporum*	120	118	116	129
7)	*Macrophomina phaseolina*	128	137	140	132
8)	*Penicillium digitatum*	116	136	119	114
9)	*Penicillium chrysogenum*	129	133	139	134
10)	*Rhizopus stolonifer*	132	140	143	130

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