World Journal of Agricultural Sciences 8 (5): 464-467, 2012
ISSN 1817-3047

DOI: 10.5829/idosi.wjas.2012.8.5.1673

In Vitro Evaluation Certain Plant Extracts Against *Glomerella cingulata* Causing Brown Blight Disease of Tea

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Abstract: Brown blight a foliar disease of tea caused by the fungus *Glomerella cingulata.* An ecofriendly approach and alternative to chemical control measures of this disease, various plant extracts and efficient biocontrol agents are being involved to minimize the disease pressure. In the present study, aqueous crude extracts of 50 plants were tested against *G. cingulata* under *in vitro*. Results revealed that the extract of *Pongamia pinnata* was found to provide 100% growth inhibition of *G. cingulata* at the concentration of 10% followed by S*yzigium aromaticum* (81.87%), *Acorous calamus* rhizome (80.62%), *Parthenium hysterophorus* (78.75%), *Citrus melon* (78.12%), *Ageratum conyzoides* (78.75%), *Allium sativum* (73.10%) and *Abutilon indicum* (71.15%). Whereas the extracts of *Piper nigrum*, *Cinnammoum xanthocarpum* and *Acorous calamus* leave at 10% were ineffective against the pathogen.

Kew words: Brown blight · Biocontrol · Botanical extracts · Tea

INTRODUCTION

Tea is the most popular and inexpensive beverage crop. It has been cultivated in more than 50 countries. Tea being a perennial crop is prone to attack by many pests and diseases. The majority of the diseases in tea are of fungal origin. More than 400 pathogens cause various diseases in tea [1] viz., foliage, stem and root. Among the tea diseases, brown blight is a foliar disease caused by *Glomerella cingulata* (sexual) (STONEMAN) Spauld. et SCHRENK (*Colletotrichum gloeosporioides*-anomorph). Brown blight has been noticed in all southern tea districts. It's a weak parasite which is harmless unless it can gain entrance through a wound or into tissues, the two main reasons responsible for invasion of brown blight pathogen through leaf damage due to scorch and hail. Blister blight and the punctures of capsid bugs are also prevalent cause of brown blight infection [2]. Severe infection causes defoliation, resulting in considerable damage [3]. Chemical control measures are effective in controlling tea diseases so far [4]. Continuous use of chemical fungicides in the management of disease also brought new problems with them. More alarming amongst them are pollution of air, water, soil, residual toxicity, development of resistance in pathogen against chemicals and harmful effects on non-targeting organisms. Consequently, there has been alarming development of harmful environment for human beings. Contrary to the problems associated with the use of synthetic chemicals, botanical and biocontrol are environmentally non pollutive, renewable, inexhaustible, indigenously available, easily accessible, largely non phytotoxic, systemic ephemeral, thus readily biodegradable, relatively cost effective and hence constitute as suitable plant protection in the strategy of integrated disease management. Hence, screening of plant products for its effective antifungal activity against the pathogen is essentially required to minimize the use of fungicides and to consider as one of the component in the integrated disease management [5, 6]. Bioagents, of late, have been known against several plant diseases [7]. In present investigation fifty plant extracts were evaluated under *in vitro* condition against *G. cingulata* to know the fungi toxic nature of their extracts and antagonistic activity.

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Table 1: Growth inhibition of *Glomerella cingulata* in response to various plant extract at 10% concentration

S. No.	Botanical plant	Family	Extracted parts	Growth inhibition%
1	*Leucas aspera*	Lamiaceae	Leaf	73.75
2	*Eucalyptus citriodora*	Myrtaceae	Leaf	34.16
3	*Datura metel*	Solanaceae	Leaf	73.12
4	*Parthenium hysterophorus*	Astereceae	Leaf	78.75
5	*Abutilon indicum*	Malvaceae	Leaf	71.15
6	*Adhatoda vasica*	Acanthaceae	Leaf	65.0
7	*Phyllanthus amarus*	Euphorbiaceae	Leaf	76.25
8	*Cleome viscosa*	Capparaceae	Leaf	53.78
9	*Achyranthes aspera*	Amaranthaceae	Leaf	53.78
10	*Allium sativum*	Liliaceae	Bulb	73.10
11	*Azardirachta indica*	Meliaceae	Kernel	32.46
13	*Citrus limon*	Rutaceae	Peel	11.94
14	*Mentha arvensis*	Lamiaceae	Leaf	57.46
15	*Solanum anguivi*	Solanaceae	Leaf	41.79
16	*Bidens pilosa*	Astereceae	Leaf	38.80
17	*Physalis minima*	Solanaceae	Leaf	29.10
18	*Ocimum canum*	Lamiaceae	Leaf	43.50
19	*Piper nigrum*	Piperaceae	Dried fruit	9.0
20	*Cinnamomum xanthocarpum*	Lauraceae	Bark	5.1
21	*Capsicum annum*	Solanaceae	Fruit	25.97
22	*Acorus calamus*	Acoraceae	Rhizome	80.62
51	*Persea Americana*	Lauraceae	Leaf	11.18
24	*Acorus calamus*	Acoraceae	Leaf	6.42
25	*Cinchona officinalis*	Rubiaceae	Leaf	40.12
26	*Zingiber officinalis*	Zingiberaceae	Rhizome	36.87
27	*Citrus melon*	Rutaeae	Peel	78.12
28	*Ocimum purpurascens*	Lamiaceae	Leaf	39.84
29	*Zingiber officinalis*	Zingiberaceae	Dried rhizome	66.16
30	*Citrus sinensis*	Rutaceae	Peel	69.07
31	*Syzigium aromaticum*	Myrtaceae	Bud	81.87
32	*Ocimum tenuiflorum*	Lamiaceae	Leaf	76.25
33	*Polygonum chinense*	Polygonaceae	Leaf	15.62
34	*Murraya koenigii*	Rutaceae	Leaf	33.89
35	*Coriandrum sativum*	Apiaceae	Leaf	11.45
36	*Allium cepa*	Liliaceae	Bulb (Big)	54.19
37	*Allium cepa*	Liliaceae	Bulb (Small)	43.51
38	*Crassocephalum crepidioides*	Astereceae	Leaf	51.87
39	*Cassia auriculata*	Caesalpiniaceae	Leaf	64.0
40	*Prosopis juliflora*	Fabaceae	Leaf	30.62
41	*Lantana camara*	Verbenaceae	Leaf	5.0
42	*Curcuma longa*	Zingiberaceae	Rhizome	50.0
43	*Vitex negundo*	Verbenaceae	Leaf	22.05
44	*Morinda coreia*	Rubiaceae	Leaf	59.55
45	*Artemisia nilagirica*	Astereceae	Leaf	43.15
46	*Azadirachta indica*	Meliaceae	Leaf	13.97
47	*Pongamia pinnata*	Fabaceae	Leaf	100
49	*Ageratum conyzoides*	Astereceae	Leaf	78.75
50	*Citrus limetta*	Rutaceae	Leaf	1.24

MATERIALS AND METHODS

Isolation of Pathogen: *Glomerella cingulata* was isolated from infected leaves of tea plants by using potato dextrose agar (PDA) medium. The fungus was purified by single spore isolation technique and identified based on the morphological and cultural characterization [8] Koch's postulates were established through pathogenicity test and the culture was maintained on PDA.

Plant Extract Preparation: Total fifty plants were collected and their various parts (Leaves, bark, buds, root, rhizome and fruit) were taken from Athikulam, Mugavoor and Valparai in Tamil Nadu. These samples were washed thoroughly with tap water, surface sterilized water and later cut into small pieces. Stock solution of all the plant species were prepared by soaking the crushed plant materials in sterilized water for 24h at room temperature (28-32°C), passing through three layer of muslin cloth and finally through whatman filter paper No.1. The concentrations of 10% W/V were prepared by adding appropriate quantity of sterile distilled water into the stock solution. For bioassay, 5ml of extract was mixed with 20ml/plate sterile PDA medium. The without plant extract medium was served as control. For each treatment three replications were maintained. These plates were inoculated with 5mm disc of freshly grown cultures of *G. cingulata* and incubated at 28±1°C. Observation for antifungal activity was recorded 72 hours after incubation. Fungal growth inhibition was calculated as average of the growth diameter in each treatment relative to its growth in control.

RESULTS AND DISCUSSION

Among the fifty plant extracts tested against *G. cingulata*, *Pongamia pinnata* at the concentration 10% (100% inhibition) was significantly superior over all other plant extracts the results were presented in Table 1. Next best was *Syzigium aromaticum* (81.87%) followed by *Acorous calamus* rhizome (80.62%), *Parthenium hysterophorus* (78.75%), *Citrus melon* (78.12%), *Ageratum conyzoides* (78.75%), *Allium sativum* (73.10%) and *Abutilon indicum* (71.15%). Least growth was observed in case of *Piper nigrum*, *Cinnamomum xanthocarpum* and *Acorous calamus* leaves 10%. In present investigation, the mycelial growth of fungus was inhibited to greater extent by *Pongamia pinnata*. Leaf extracts of *Delonix regia, Pongamia glabra* and *Acacia nilotica* significantly inhibited spore germination, mycelial growth and spore production of *A. helianthi, M. phaseolina* and *F. solani* from sunflower seeds [9]. *Allium sativum* exihibited strong fungitoxicity even at lowest concentration against the pathogen *R. solani* [10]. *Ocimum basilium* and *Allium sativum* exhibited total inhibitory effects on the mycelial growth of *C. gloeosporioides,* whereas the growth inhibition of the mycelial growth of the pathogen was found very less in the *Ageratum conyzoides* (56.83%), *A. indica* (34.68%) and *Solanum tarvum* (46.54%) [11]. Tandel *et al*., [12] observed the maximum growth inhibition of *M. phaseolina* at 98.14% by onion bulb (*Allium cepa*) extract followed by *Acasia nilotica* (82.97%), but the mycelial growth was very less in the *Zinger officinalis* (44.44%), neem (39.63%), garlic (33.33%), *Pongamia globra* (31.11%) and *Eucalyptus citridora* (28.14%). The fungicidal spectrum of *Azadirachta indica* has been attributed to Azadiractrachin which belong to C25 terpeniodes [13]. Effectiveness of *Azadirechta indica* is well supported by Rahejha and Thakore [14]. In effectiveness of tulsi leaf extract against *C. gloeosporioides* is supported by the work of Patel and Joshi [15], wherein they reported that tulsi leaf extract was ineffective in inhibiting the mycelial growth of the fungus *Colletrotrichum gloeosporioides*. Nwachukwu and Vmechuruba, [16] reported the inhibition of soil borne pathogenic fungus *Aspergillus niger, Aspergillus flavus, Botryodiplodia theobromae* and *Fusarium moniliforme* by *Azadirechta indica* and *Ocimum* extracts William [17], who reported that sprays made from aqueous garlic extracts have antibiotic and antifungal properties and will suppress a number of plant diseases, including powdery mildew on cucumbers and to some extent black spot on rose leaf extracts from *C. limon* and *P. americana* totally inhibited growth of *C. gloeosporioides in vitro* [18]. Though complete inhibition of the pathogen was observed in some of the plant extracts agent tested but considerable amount of inhibition was noticed in some of them.

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