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In vitro evaluation of plant extracts in inhibiting the growth of the fungus *Colletotrichum gloeosprioides* causing papaya anthracnose by poison food technique

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Abstract

Carica papaya L. popularly known as tree melons, mostly get infected by a large numbers of pathogens. Among those diseases, anthracnose is one the serious post harvest disease of papaya which contribute significantly in economic losses. This is why an attempt was made & being taken in to investigation, where plant extracts of 2 different concentrations were taken i.e., 10% & 20% under *in-vitro* condition. It is recorded that 42.66% was highest inhibition which shown by *Lantana camara* followed by *Curcuma longa* (37.46%) at 10% concentration and also at 20% concentration *Lantana camara* shows highest inhibition which is 45.54% followed by *Curcuma longa* (40.73%).

Key words

Colletotrichum gloeosporioides, In-vitro, Lantana camara, Curcuma longa, Carica papaya L., Poison food technique, Anthracnose, Plant extracts

Introduction

The papaya (*Carica papaya* L.) is the most economically important fruit in the Caricaceae Family. In some parts of the world, papaya are well known as papaw or pawpaw, especially in Australia and some Islands of the West Indies, while the name pawpaw is widely recognized. A typical papaya fruit consists of: seed (8.5%), skin (12%) and pulp (79.5%). Despite of its susceptibility to natural enemies, it is widely accepted for its multipurpose, early bearing, space conserving and as a herbaceous crop.

The pawpaw is a tropical and near-tropical species, very sensitive to frost and limited to the region between 32º north and 32º south of the Equator. It needs plentiful rainfall or irrigation but must have good drainage. Flooding for 48 hours is fatal. Brief exposure to 32 ºF (-0.56 ºC) is damaging; prolonged cold without overhead sprinkling will kill the plants.

India is the largest producer of papaya, as it contributes 42% among the production of whole from 30% of the global area under papaya cultivation. The area under papaya cultivation is 1.9% of the total area under fruit cultivation nd productivity is about 6.6% of India's total fruit crops. Area under papaya cultivation is approximately 138.4(000') ha with a production of 5988.8 thousand metric tonnes and productivity about 43.3 mt/ha.

All though papaya performs best under tropical conditions where it bears fruits throughout the year, it also produces excellent crops in the milder sub tropical areas. Odisha comes among the leading papaya producing states in India with a production of 70.29 thousand metric tonnes with a productivity of 23.045 mt/ha. Area under papaya production is approximately 3.05(000') ha.

Papaya fruits are highly perishable in nature and are difficult to store for a longer period. It requires immediate marketing and utilization. Papaya post harvest losses are caused due to various factors such as mechanical damage, chilling injury, diseases and over ripening of the fruits.

The post-harvest pathogens like *Colletotrichum gloeosporioides* (Penz.) Sacc., *Botryodiplodia theobromae* Pat., *Alternaria, Phomopsis, Fusarium, Aspergillus, Stemphylium* and *Pestalotiopsis* attack the fruits and cause considerable damage to fruit production and quality . Six post-harvest diseases of papaya viz., Anthracnose, *Aspergillus* rot, *Fusarium* rot, *Penicillium* rot, *Rhizopus* rot and stem end rot were recorded. The post-harvest fruit rots bring about a big loss in fruit business which provokes price hike . Out of these diseases anthracnose is a major cause for the post harvest loss of papaya particularly when attempting to extend the storage life.

Materials & Methods

In vitro evaluation of plant extracts in inhibiting the growth of the fungus by poison food technique-

Fresh papaya fruits were collected and washed first in tap water and then in distilled water. These fruits were allowed to dry under air. Hundred grams of fresh sample was chopped and then crushed in a surface sterilized pestle and mortar by adding 100ml sterile water (1:1 w/v). The extract was centrifuged at 10,000 rpm at 26°c for 20 minutes. Finally filtrate thus obtained was used as stock solution.

To study the antifungal mechanism of plant extracts, the poisoned food technique was used in in-vitro. Fifteen ml and twenty ml of the stock solution were mixed with 90 and 80 ml of sterilized molten PDA medium respectively so as to get 10 and 20 per cent concentration. The medium was thoroughly shaken for uniform mixing of extract. Twenty ml of medium was poured into sterile petri dishes. Mycelium of 5 mm size discs from periphery of actively growing culture were cut out by sterile cork borer disc and then placed on the centre of each Petri plate. Controls were also maintained by growing the only pathogen on PDA dishes. Each treatment was replicated thrice and dishes were incubated at 28 ±1°C till control dishes reached the maximum radial growth. The per cent inhibition over control was calculated according to formula given by Vincent (1947) as described earlier.

Table 1: List of plant extracts used for poison food techniques:

SL. NO.	Common name	Botanical name	Parts used
1	Onion	*Allium cepa*	Leaf
2	Lantana	*Lantana camara*	Leaves
3	Neem	*Aradirachta indica A. JUSS*	Leaf
4	Neem	*Aradirachta indica A. JUSS*	Kernel
5	Kashmir bouquet	*Clerodendron inerme Gaertn.*	Leaves
6	Tulsi/Holybasil	*Ocium sanctum L.*	Leaves
7	Garlic	*Allium sativum*	Cloves
8	Turmeric	*Curcuma longa*	Rhizome
9	Aloevera	*Aloe vera*	Leaf

Results

Extracts of 9 plants were evaluated at 10% and 20% concentration against the fungus as per the procedure described in ‘materials and methods’. The data are presented below

Table 2: Evaluated Results of Plant extract(*In vitro*)

SL. NO.	Common name	Botanical name	Parts used	Concentrations (%)	
				10	20
1	Onion	*Allium cepa*	Leaf	35.16	38.23
2	Lantana	*Lantana camara*	Leaves	42.66	45.54
3	Neem	*Aradirachta indica A. JUSS*	Leaf	18.427	23.703
4	Neem	*Aradirachta indica A. JUSS*	Kernel	30.03	32.33
5	Kashmir bouquet	*Clerodendron inerme Gaertn.*	Leaves	15.31	22.33
6	Tulsi/Holybasil	*Ocium sanctum L.*	Leaves	10.33	12.52
7	Garlic	*Allium sativum*	Cloves	15.50	20.16
8	Turmeric	*Curcuma longa*	Rhizome	37.46	40.73
9	Aloevera	*Aloe vera*	Leaf	3.66	12.00

			SE(m)	0.453	0.382
			C.D.	1.355	1.145

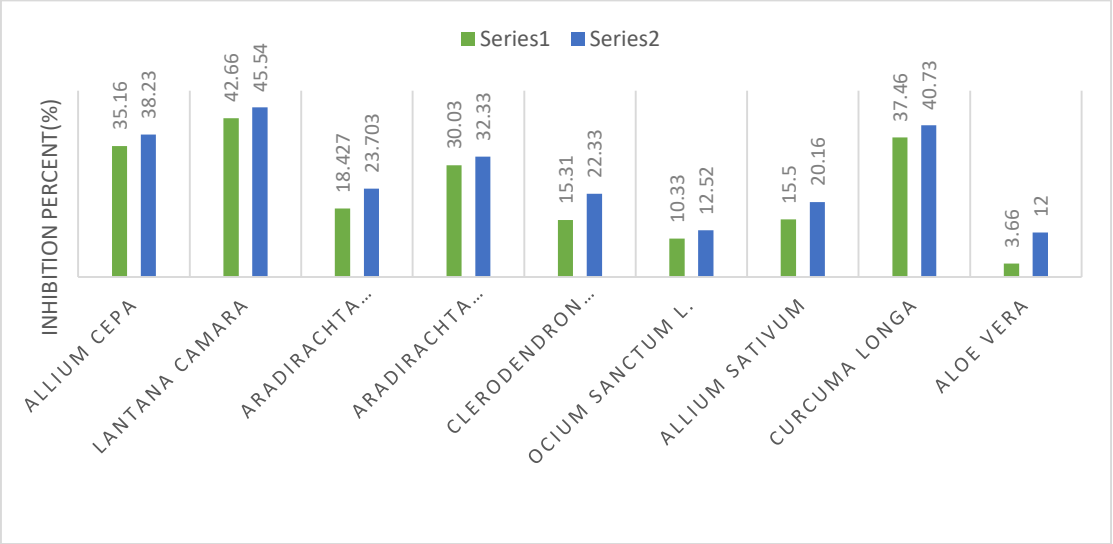

Fig. 1 : Evaluated results of plant extract (series 1 - Results at 10% concentration & series 2- Results at 20% concentration)

From the above table, it denotes that the plant extracts *Lantana camara* recorded 42.66% which shows the maximum mycelial growth inhibition followed by *Curcuma longa* (37.46%) and *Allium cepa* (35.6%) at 10% concentration. *Ocium ssanctum L.* Recorded the least inhibition of 10.33%. At 20% concentration, which is recorded in the same trend, maximum inhibition also recorded by *Lantana camara* (45.54%) followed by *Curcuma longa* (40.73%) , *Allium cepa* (38.23%) and the least inhibition showed by *Ocium sanctum L.* (2.52%).

Discussion

An *in vitro* experiment was conducted taking different plant extracts in inhibiting the mycelial growth of the fungus. *Lantana camara* recorded the maximum mycelia growth inhibition of 42.66% and 45.54% on both the concentrations,i.e. 10% and 20% respectively followed by *Curcuma longa* (37.46% & 40.73%) at both concentrations respectively. However, *L. camara* gave a significant inhibitory effect on the radial growth of *C.gloeosporioides* in in-vitro condition. The present investigation supports the findings of Ademe *et al.*, (2013).

Conclusion

In vitro evaluation by poison food technique of different plant extracts at 10% & 20% concentration revealed that at both the concentration *Lantana camara* shows highest & followed by *Curcuma longa*. At 10% concentration the inhibition percent of *Lantana camara* is 42.66% & at 20% it shows 45.54%. Similarly, *Curcuma longa* reveals inhibition at 10% 37.46% & at 20% it shows the result is 40.73%.

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Author contributions:

All authors contribute equally for the paper.

Declaration of Conflict of Interest

The authors declared that there is no conflict of interest.

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