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Cross infectivity of *Brachysporium sp.* from *Dacryodes edulis* and its associated organism on some pomaceous fruits

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ABSTRACT

Fruits of apple (Malusdomestica), avocado (Perseaamericana), bush mango (Irvingiagabonensis) and pawpaw (Carica papaya) were cross inoculated with Brachysporium sp., the pathogen of the "gullying" disease of Dacryodes edulis (African pear). Also inoculated was an unidentified isolate (designated as isolate "A") which was always associated with the pathogen. The isolates were isolated from diseased pear fruits obtained from New Benin and Oba markets both in Benin City, Oredo Local Government Area of Edo State, Nigeria. Lesion diameter (cm) was measured over a period of five days and data obtained was analysed in a 2 x2 x 4 factorial design. Both isolates produced lesions on test fruits.Brachysporium sp. caused significantly smaller lesions on all inoculated fruits than isolate "A" which exhibited more virulence on the fruits. The mean lesion diameter (cm) for Brachysporium sp. on the test fruits ranged between 0.00 – 2. 00 for pawpaw; 0.16 -2.53 for apple, 0.00 – 1.26 for avocado and 0.12 -0.82 for bush mango. For isolate "A", the values ranged between 2.86 – 5.36 for pawpaw; 1.08 - 3.68 for apple, 0.53 -3.70 for avocado and 0.36-1.40 for bush mango. The observed variations in the above values for organisms and fruits were highly significant (P<0.001). Irrespective of the market source of the isolates, the trend of their effect on the test fruits was similar. Results confirm the cross infectivity potential of the "gullying" pathogen and its associated organism and thus their host range which is informative for pre- and post- harvest disease control. In addition, findings show the pathogenic and more virulent nature of isolate "A" on some pomaceous fruits even though it is non- pathogenic on Dacryodes edulis.

Keywords: Cross infectivity, *Dacryodes, Brachysporium*, Apple, Avocado, Bushmango, Pawpaw

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INTRODUCTION

Post-harvest diseases of fruits and vegetables are a major expense in food production with loses of about 10 to above 30% especially in developing countries (19, 1, 4). The fruits and vegetables may also show symptoms of disease which start as latent infections on the field before harvest to when the products are actually consumed or used by the consumer. The postharvest management of the above commodities in most developing countries is far from satisfactory. This is due to inefficient handling and transportation, poor technologies for storage, processing and packaging, involvement of too many diverse factors and poor infrastructure (21).

During this period, cross infectivity of products by inoculum from various sources is quite feasible. Cross inoculation potential of *Colletotrichum spp.*have been reported. *C. acutatum*from strawberry caused lesions on fruits of anemone, apple and peach (7). Isolates from avocados and mangoes produced lesions on strawberries, peppers, guavas and pawpaw which were cultivated in adjacent orchards (24). Studies with isolates from cashew, mango, pawpaw and passion fruits produced lesions on all test fruits except passion fruits which were susceptible to its isolates only (14).

Fruits of the African pear, avocado, pawpaw, apples and bush mango are important as they are consumed for their nutrients, potential health related functions, economic and industrial purposes (20, 18, 2, 15, 3, 5, 22, 23, 17). However, these good attributes of the fruits are militated against by postharvest diseases. Prominent amongst these diseases is anthranose caused by *Colletotrichumgloeosporioides*on pawpaws, apples, avocados and bush mango (16, 10, 24, 11). Others are stem end rots of avocado pawpaw (9, 26); *Phytophthora* rot of pawpaws (13) and grey molds of apples by *Penicilliumexpansum* and *P. solitum*(25).

In Nigeria, with the exception of apples which are imported, pawpaws, African pear, avocados and bush mangoes are mainly cultivated in home gardens. Thus cross infectivity of the "gullying" pathogen and its associated isolate from *Dacryodes* to other fruits becomes important as it has implication on postharvest storage of the fruits with a ready source of inoculum. With previous reports on cross infectivity of *Colletotrichum spp*.on a variety of fruits, this study was conducted on this pathogen of *Dacryodes edulis*and its associated organism with a view of finding out more of their hosts.

MATERIALS AND METHODS

Diseased fruits (Plate 1) of *Dacryodes edulis* were obtained from two popular markets i.e. Oba and New Benin markets in Benin City in Oredo Local Government Area of Edo State, Nigeria. Isolation from the "gullying" symptoms on fruits produced two isolates irrespective of the market source. These were an identified white isolate i.e. *Brachysporium sp.* (6) and a black unidentified isolate designated Isolate "A" (Plate 2). *Brachysporium sp.* had earlier been identified as the pathogen of the disease (12).

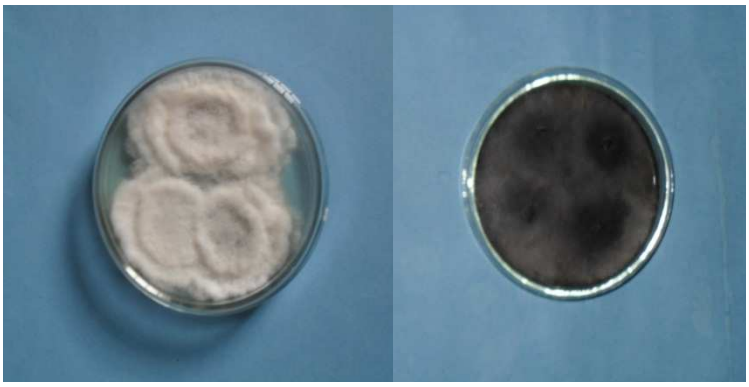


Plate1: Diseased fruits of *Dacryodes edulis* with the "gullying" symptoms

Plate 2: Light Micrograph of 7 –day old cultures of *Brachysporium sp.* (left) and Isolate "A" (right)

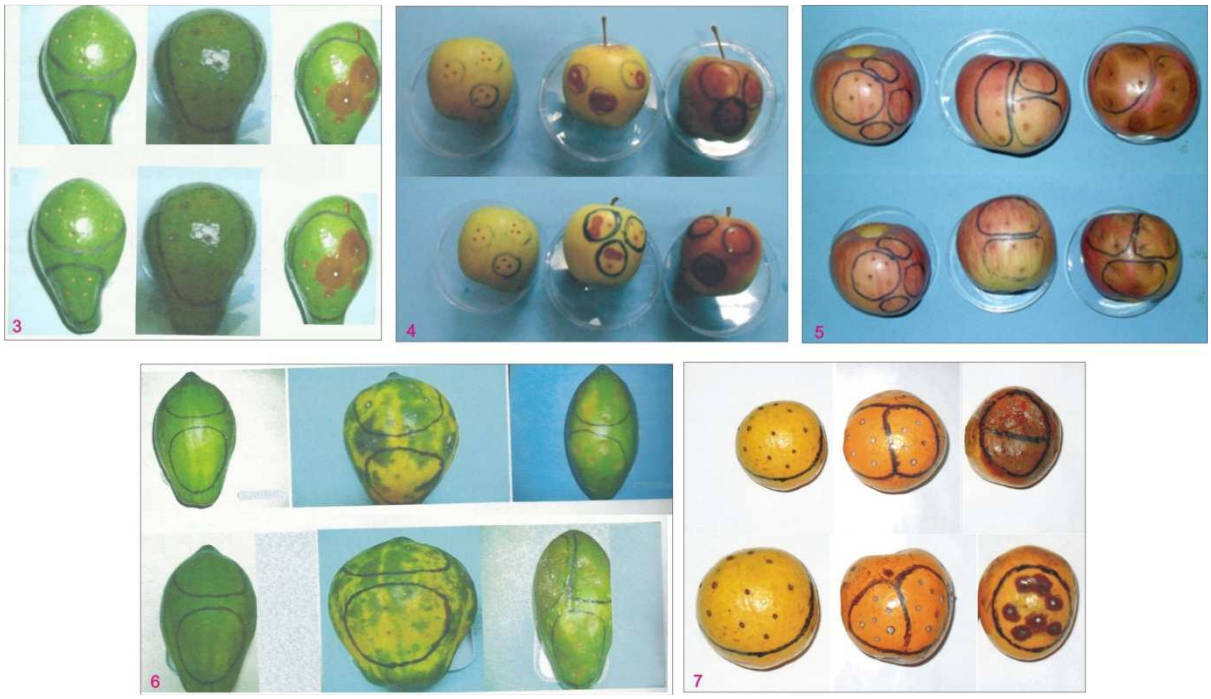
Cross-infectivity Studies

Healthy fruits of avocado (*Perseaamericana*), apples (*Malusdomestica*) i.e. green and red varieties, pawpaw (*Carica papaya*) and bush mango (*Irvingiagabonensis*) were surface sterilised with 70% ethanol. Humid moist chambers and Petri-dishes were also surface sterilised. Sterile filter papers were placed in the moist chambers and moistened with sterile water. The Petri-dishes were also placed in the moist chambers. Humid, sterile, transparent polythene bags were prepared for larger fruits.

Using a sterile inoculating needle, inoculum from 7-8 day old cultures of the isolates were inoculated into wounds created on test fruits. Control fruits had wounds created on them without inoculum. Control and inoculated fruits were incubated at room temperature (30+2^{o}C) and observed for symptom development. Lesion diameter was measured over a period of five days. Data obtained was subjected to statistical analysis in a 2x2x4 factorial design. Means were compared using the Duncan Multiple Range Test. Virulence of the isolates on the test fruits was also determined on a rating scale of 0-4 i.e. 0-2 cm (low), 2.1-4.0 cm (moderate) and > 4.0 cm (high).

RESULTS AND DISCUSSION

Cross inoculation of the test fruits with *Brachysporium sp.* gave positive pathogenicityresults. However, the isolate "A" which does not produce symptoms on *Dacryodesedulis*, produced rot symptoms on test fruits (Plates 3, 4, 5, 6 and 7).



Plates 3-7. Light micrographs of test fruits with symptoms after inoculation with *Brachysporium sp.* and Isolate "A". From left to right are control, *Brachysporium sp.* and Isolate "A" while top and bottom rows are isolates from New Benin and Oba markets respectively. Plates 3 = Avocado; 4-5 =Apple (green and red); 6 = Pawpaw and 7= Bushmango.

The mean lesion diameter (cm) for *Brachysporium sp.* on the test fruits ranged between 0.16 – 2.53 for apple; 0.00 – 1. 26 for avocado; 0.00 – 2.00 for pawpaw and 0.12 – 0.82 for bush mango. For Isolate "A" the values ranged from 1. 08 – 3.68 for apple; 0.53 – 3.70 for avocado; 2.86 -5.36 for pawpaw and 0.36 -1.40 for bush mango (Table 1). The above variations for organisms and fruits were highly significant ($P < 0.001$). It was also observed that the trend of results on the effect of the organisms on the test fruits were similar irrespective of their market source. Thus the market source of the organisms did not affect their aggressiveness or virulence.

On the virulence scale, *Brachysporium sp*. exhibited a generally low virulence on the fruits except on apple where it was moderate. Isolate "A" however showed a moderate to high virulence on most of the fruits except on bush mango where it was low (Table 3). The incubation period for Isolate "A" was also observed to be shorter (24 hours) than that of *Brachysporium sp.* (48 – 72 hours) on the test fruits.

Table 1: Mean Lesion diameter (cm), produced on test fruits by isolates from the 'gullying' symptom on *Dacryodes* fruits in New Benin Market

	Isolates		
Fruits	*Brachysporiumsp.*	Isolate 'A'	**LSD**
Pawpaw	0.00^{B}_{c}	2.86^{A}_{a}	0.00032
Apple	0.16^{B}_{a}	1.08^{A}_{b}	0.00078
Avocado	0.00^{B}_{c}	0.53^{A}_{c}	0.001
Bush mango	0.12^{B}_{b}	0.36^{A}_{d}	0.00078
SEM	**0.0003**	**0.00045**	**SEM**
Pawpaw	0.00^{B}_{d}	3.78^{A}_{a}	0.001
Apple	0.83^{B}_{a}	2.64^{A}_{b}	0.00078
Avocado	0.82^{B}_{b}	1.66^{A}_{c}	0.00078
Bush mango	0.16^{B}_{c}	0.50^{A}_{d}	0.00078
SEM	**0.00045**	**0.00055**	**SEM**
Pawpaw	0.92^{B}_{b}	4.44^{A}_{a}	0.00078
Apple	1.46^{B}_{a}	3.05^{A}_{b}	0.00078
Avocado	0.91^{B}_{c}	2.66^{A}_{c}	0.00078
Bush mango	0.44^{B}_{d}	0.71^{A}_{d}	0.00078
SEM	**0.00055**	**0.00055**	**SEM**
Pawpaw	1.40^{B}_{b}	4.94^{A}_{a}	0.00078
Apple	1.54^{B}_{a}	3.37^{A}_{c}	0.00078
Avocado	0.98^{B}_{c}	3.33^{A}_{b}	0.00078
Bush mango	0.55^{B}_{d}	1.10^{A}_{d}	0.00078
SEM	**0.00055**	**0.00055**	**SEM**
Pawpaw	2.00^{B}_{b}	5.36^{A}_{a}	0.00078
Apple	2.39^{B}_{a}	3.68^{A}_{c}	0.0072
Avocado	1.00^{B}_{c}	3.70^{A}_{b}	0.00063
Bush mango	0.58^{B}_{d}	1.40^{A}_{d}	0.00078
SEM	**0.00045**	**0.00036**	**SEM**

Column (a,b,c) and row (A,B) means with common scripts for each variable do not differ significantly (P>0.05). SEM - Standard error of mean difference. LSD – Least significant difference.

Table 2: Mean Lesion diameter (cm), on test fruits produced by isolates form the 'gullying' symptom on *Dacryodes* fruits in Oba Market

	Isolates		
Fruits	*Brachysporium sp.*	Isolate 'A'	**LSD**
Pawpaw	0.00^{B}_{c}	2.12^{A}_{a}	0.001
Apple	0.19^{B}_{a}	1.20^{A}_{b}	0.0577
Avocado	0.00^{B}_{c}	0.41^{A}_{c}	0.001
Bush mango	0.16^{B}_{b}	0.34^{A}_{c}	0.00078
SEM	**0.0003**	**0.029**	
Pawpaw	0.00^{B}_{d}	3.71^{A}_{a}	0.001
Apple	0.85^{B}_{a}	2.44^{A}_{b}	0.00078
Avocado	0.66^{B}_{b}	1.56^{A}_{c}	0.00078
Bush mango	0.20^{B}_{c}	0.45^{A}_{d}	0.00078
SEM	**0.00045**	**0.00555**	
Pawpaw	0.66^{B}_{c}	4.42^{A}_{a}	0.00078
Apple	1.60^{B}_{a}	3.25^{A}_{b}	0.00078
Avocado	0.67^{B}_{b}	2.36^{A}_{c}	0.00105
Bush mango	0.59^{B}_{d}	0.62^{A}_{d}	0.00078
SEM	**0.00055**	**0.0006**	
Pawpaw	1.22^{B}_{b}	4.90^{A}_{a}	0.00078
Apple	1.64^{B}_{a}	3.36^{A}_{b}	0.00078
Avocado	0.68^{B}_{c}	3.17^{A}_{c}	0.00078
Bush mango	0.65^{B}_{d}	0.70^{A}_{d}	0.00078
SEM	**0.00055**	**0.00055**	
Pawpaw	1.70^{B}_{b}	5.22^{A}_{a}	0.00078
Apple	2.53^{B}_{a}	3.50^{A}_{c}	0.0577
Avocado	1.26^{B}_{c}	3.67^{A}_{b}	0.00078
Bush mango	0.82^{B}_{d}	0.91^{A}_{d}	0.00078
SEM	**0.00055**	**0.0289**	

Column (a,b,c) and row (A,B) means with common scripts for each variable do not differ significantly (P>0.05). SEM - Standard error of mean difference. LSD – Least significant difference.

Table 3: Virulence of *Brachysporiumsp*. and Isolate 'A' on test fruits

Test fruits	Isolates	Lesion Diameter (cm)	Virulence
Pawpaw	*Brachysporium sp*.	0.00 – 2.00	Low
	Isolate 'A'	2.86 – 5.36	High
Apple	*Brachysporiumsp*.	0.16 – 2.53	Moderate
	Isolate 'A'	1.08 – 3.68	Moderate
Avocado	*Brachysporiumsp*.	0.00 – 1.26	Low
	Isolate 'A'	0.53 – 3.70	moderate
Bush mango	*Brachysporiumsp*.	0.12 – 0.82	Low
	Isolate 'A'	0.36 – 1.40	Low

Results obtained confirm the cross-infectivity potential of the "gullying" pathogen from *Dacryodes edulis.* It has also shown that its associated organism is capable of spoiling other fruits even though it is non-pathogenic on *Dacryodes edulis.*These resultsare similar to those reported on *Colletotrichumacutatum* from strawberry by (8, 7, 14, 24). The results which have shown a possible host range of the organisms are informative for pre- and post-harvest disease control.

The import of this is in the spread of inoculum and a continuous build-up of inoculum in and around the home gardens, and where they are *raised* in close proximity in orchards. In addition, packing the fruits together at post-harvest will also result in loses. With the cross infectivity implication when the test fruits are grown together, it may be controlled by growing various crops with different fruiting patterns. This will provide a disease escape for the fruits i.e. while *Dacryodes* is fruiting in season, the others will be off season and so inoculum transfer will be prevented.

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