Sustainable and ecofriendly management of black banded disease of Mango from Kolhapur, Maharashtra

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ABSTRACT

Mango is one of the most extensively exploited fruits for food, juice, flavour, fragrance, colour and called 'super fruit'. The total area under mango cultivation in India is estimated to be 1,283,030 hectares with an estimated annual production of 10,810,957 metric tonnes (MTs). India is also the largest producer of mangoes in the world, producing over 65% of total world production. In spite of National Horticulture Mission launched in 2005-06, there is no development in the fruit production particularly in Maharashtra, one of the reasons being lack of strategies to resist pests and pathogens. Present study includes survey of *Peziotrichum corticolum* (Massee) Subramanian causing black banded disease of mango. Results of survey indicate that infection is hundred percent in the district and disease is in severe state of infection. An experimental field treatment with some fungicides, botanicals and a combination of both shows interesting results.

Keywords: *Peziotrichum corticolum* (Massee) Subramanian, black banded disease, mango, fungicides, botanicals.

Mango is one of the most extensively exploited fruits for food, juice, flavour, fragrance, colour and called 'super fruit'. India is the largest producer of mangoes in the world, producing 65% of total world production. The National Horticulture Mission launched in 2005-06, did not bring about notable development in the fruit production particularly in Maharashtra, one of the reasons being lack of strategies to resist pests and pathogens. A survey and study of black banded disease of mango was carried out in Kolhapur District in Maharashtra, India during the years 2008-2010. The pathogen *Peziotrichum corticolum* (Massee) Subramanian grows superficially on the bark of trees forming large, dark black, irregular, girdle-like infection patches, hence the name. An experimental field treatment with fungicides, botanicals and a combination of both has been done and which yielded promising results [1].

For collection of data field visits were organized covering the entire Kolhapur district. The farmers were interviewed and fields were surveyed for disease incidence and severity. Severity (S) was estimated by the number of black bands on the trees and number of affected branches [2], while Disease Incidence ($I = \Sigma x/N$) was the number of diseased plants (x) divided by the total number of plants evaluated (N) (Table 1). Biochemical analysis of healthy and infected bark of mango was carried out [3-6]. For experimental field trials 0.2% aqueous solutions of Contaf (hexaconazole - $C_{14}H_{17}C_{l2}N_3O$), Kavach (chlorothalonil - $C_8N_2C_{l4}$, 75% W.P.), sulphur (80% W.P.), himil gold (metalaxyl - $C_{14}H_{21}NO_4$, 35% W.P.) and multineem oil were used. In case of plant extracts 10% aqueous leaf extracts of *Nicotiana tabacum* L., *Lantana camara* L., *Polyalthia longifolia* (Sonner.) Thw. and *Justicia adhatoda* L. were used. For combination of fungicides and

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plant extracts equal volume of plant extract (10%) was mixed with fungicides (0.2%). In case of combination of fungicides and multineem oil, except contaf all other chemical fungicide powders were dissolved in multineem oil and were used for treatments (0.5g powder dissolved in 250 ml of multineem oil, 0.2%).

Spraying was done after 15, 30 and 45 days intervals. Size of the black bands before treatment and 15 days after treatment were measured [7-9]. All the branches selected for treatment were secondary branches, so that their growth will be similar. Still, there will be few exceptions as the number of treatments is more and in few cases there were some natural factors. The results have been classified into three categories, viz. Growth (G) - where the final size of the colony shows an increase of more than $2cm^2$; Slight Growth (SG) - where the final size of the colony shows an increase between 1-$2cm^2$ and No Growth (NG) - where the final size of the colony shows an increase of less than $1cm^2$. The growth can be easily seen at the margin of the black band in the form of white ring. In case of no growth even if the fungal mycelium is killed the black band persists on the bark.

Black Banded disease of mango was first reported from Maharashtra in 1956 after which the present survey has revealed that disease has spread to all the 12 tehsils of Kolhapur district and disease incidence is 100%. The disease is in a medium to severe state of infection (Table 1). Black banded disease has spread through the entire district and surrounding areas. Most preferred mango varieties for cultivation in the region are Hapus, Kesar, Totapuri, Neelam, Payari Lalbag, Sindhu, Vanraj, Dahshera, Ratna, Mallika, Amrapali and Baiganpalli. Black banded disease has been recorded on wild and all hybrid varieties of mango. All the farmers were not aware of the disease, its effects and remedial measures. There was decrease in the yield of mangoes every year. It was a cumulative effect of all the diseases and pest, but the severity of black banded disease shows it has also a major role to play in it. Climatic conditions of Kolhapur make it an ideal place for large scale commercial cultivation of mango. Hence, well organized programmes of collaboration between researchers and cultivators should be undertaken to utilize this potential. The visits included small, marginal and large land holders who own a few to hundreds of mango trees. But most of the farmers in this area do not consider mango as a cash crop. Hence, they were not even aware of the black banded disease. Their main focus remains on the annual food crops only. As the owners were not aware of the disease, no one has tried any remedial measure against the disease.

Many other diseases and pests were recorded on mango during the present work, viz. anthracnose, aphids, apical shoot borer, black mildew, canker of leaves and fruits, die- back, flower drop, fruit drop, hoppers red rust, sooty mould, termites, vegetative malformation, karpa leaf blight, leaf fall, leaf gall, midge leaf miners, leaf scorching, leaf Webbers, mealy bugs, parasite, powdery mildew, red tree ants, tailor ants, stem borer, thrips and wood rotting fungi [10,11]. Microscopic studies on the pathogen reveal that *Peziotrichum corticolum* (Massee) Subramanian grows superficially on the bark of trees forming extensive, spreading, dark black, irregular, girdle-like infection patches, hence the name 'Black Banded disease'. The dark brown, profusely branched, septate, repent hyphae (3-6µ) are interspersed with vertical, erect, straight or bent aggregations of hyphae which converge above. The 'aleurispores' or conidia are produced singly and terminally at the tips of branches. The conidia are 1-celled, pale brown, globose, smooth- walled; 12-18.5µ in diameter [12]. The young spreading mycelium near the periphery of the infection bands is white or nearly hyaline. Biochemical analysis of healthy and infected bark of mango showed that there was considerable decrease in the reducing sugar, non-reducing sugar, total sugars, RNA and DNA content of infected bark. While phenol content of the infected bark showed considerable increase as compared to the healthy bark (Table 2). During the present work, effect of some fungicides, plant extracts and combination of both were assessed for the control of black banded disease. Fungicides used for treatments were Contaf, Sulphur, Care, Bordeaux mixture, Himil Gold, and Kavach and Multineem oil.

Table 1. Infection and severity of *Peziotrichum corticolum* (Massee) Subramanian.

Locality visited	Number of mango plants	Varieties cultivated	Infected plants	% of infection	Severity*
Kerli, Karveer	50	Raywal	50	100	M
Kogil, Karveer	25	Hapus, Keshar	25	100	H
Kogil, Karveer	100	Hapus	100	100	H
Kanherimath, Karveer	30	Devgad Hapus	30	100	H
Padal, Panhala	250	Hapus, Payari, Lalbag, Sindhu, Vanraj Amrapali, Keshar, Totapuri, Bainganpalli	250	100	M
Rakshi, Panhala	75	Keshar, Hapus	75	100	H
Awali, Panhala	100	Raywal, Keshar, Hapus	100	100	M
Kagal, Kagal	70	Raywal, Keshar, Hapus	70	100	H
Kapshi, Kagal	25	Hapus	25	100	H
Kasari, Kagal	35	Raywal	10	28.5	M
Khindivharawade, Radhanagari	50	Hapus	50	50	M
Hattimahal, Radhanagari	1000	Keshar, Hapus	1000	100	M
Kodawade, Radhanagari	40	Raywal, Keshar, Hapus	40	100	H
Aandur, Gaganbawada	100	Hapus	100	100	H
Khokurle, Gaganbawda	30	Raywal	30	100	M
Shenawade, Gaganbawda	80	Raywal, Hapus	80	100	M
Charan, Shahuwadi	40	Raywal, Hapus	40	100	H
Bambawade, Shahuwadi	200	Payari, Hapus	200	100	H
Malkapur, Shahuwadi	100	Raywal, Payari, Hapus	100	100	M
Hatkanangale	200	Keshar, Hapus, Payari	200	100	H
Hatkanangale	300	Hapus	300	100	H
Hatkanangale	50	Hapus, Payari, Totapuri, Raywal	50	100	H
Dattanagar, Shirol	80	Lalbag, Hapus, Payari	80	100	H
Vijaysingh Patil Nagar, Shirol	80	Keshar, Ratna, Hapus	80	100	H
Herwad, Shirol	15	Raywal	15	100	L
Habble Kasba Nul, Gadhinglaj	80	Hapus, Payari, Totapuri, Raywal	80	100	H
Dhudage, Gadhinglaj	80	Hapus, Payari, Totapuri	80	100	H
Ainapur, Gadhiglaj	250	Hapus, Keshar, Neelam, Baiganpalli, Mallika,	250	100	H
Uttur, Ajara	50	Hapus, Payari	50	100	M
Kalnakwadi, Bhudargad	60	Hapus, Payari, Keshar, Totapuri, Neelam	60	100	H
Kalnakwadi, Bhudargad	50	Hapus	50	50	M
Tirawade, Bhudargad	100	Raywal, Payari, Hapus	100	100	M
Amboli Road, Ajara	100	Hapus, Payari	100	100	H
Ajara	50	Hapus	50	100	M
Shirgaon, Chandgad	350	Hapus, Keshar, Baiganpalli, Sindhu	350	100	M
Shinoli, Chandgad	100	Hapus, Keshar, Dahshera, Payari Baiganpalli, Mallika, Totapuri,	100	100	H
Dhamne, Chandgad	70	Raywal, Keshar, Hapus	70	100	H

* L - Low; M - Medium; H - High

Out of these Sulphur, Care, Contaf, Multineem oil + Kavach and Multineem oil + Himil gold had shown promising results in arresting the growth of the pathogen. Extracts of plants used were *Nicotiana tabacum* L., *Lantana camara* L., *Polyalthia longifolia* (Sonner.) Thw. and *Justicia adhatoda* L. Among these *L. camara* and *P. longifolia* show most effective control of disease. Combinations of all the plant extracts with the above mentioned fungicides were also tested. Following combination show effective results: *Nicotiana* + Contaf, *Nicotiana* + Sulphur, *Lantana* + Care, *Lantana* + Himil Gold, *Lantana* + Bordeaux, Lantana + Sulphur, *Polyalthia* + Care, *Polyalthia* + Bordeaux, *Polyalthia* + Sulphur, *Justicia* + Sulphur, *Justicia* + Himil Gold. Till date all the references related to control of *Peziotrichum corticolum* (Massee) Subramanian insist on use of only two methods, viz. gunny bag rubbing and bordeaux mixture. But as seen above sulphur had proved to be more effective than copper (bordeaux mixture) fungicide.

Table 2. Comparative biochemical contents in healthy and infected bark of mango.

Estimation	Healthy (mg/g)	Infected (mg/g)
Non-reducing sugar	0.40	0.18
Reducing sugar	0.90	0.12
Total sugar	1.65	1.12
Phenols	1.68	2.10
RNA	3.00	2.65
DNA	2.00	0.35

In experimental field trials, the results were encouraging except the application method. Hence, some practically viable method should be found for treating the affected trees. Even though some results in the present experiment were promising we doubt its applicability. A farmer who owns a large mango orchard cannot possibly manually apply the fungicides to each and every black band on the trees. It was necessary to do further research to find out the means of effective treatment methods, which were practical, less time consuming and cost effective.

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