INT. J. BIOL. BIOTECH., 3 (3): 561-565, 2006.

RECURRING INCIDENCE OF SOOTY MOULD OF MANGO IN KARACHI AND ITS CONTROL

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ABSTRACT

The sooty mould fungi present in sooty mass on the upper leaves of mango (*Mangifera indica* L.) were studied and identified. Altogether 18 species of sooty mould fungi belonging to 8 genera were found. The mealy bugs appeared first as white specks on the under surface of mango leaves and a causal connection between sooty moulds and mealy bugs on mango leaves have been explained. The blackening of the mango foliage was found due to the growth of sooty mould fungi. Its presence in the form of black spots and blemish on mango fruits reduce the value of mango fruits. Spraying of fungicide and insecticide separately on mango foliage reduced the incidence and spraying of the two together further decreased the level of incidence when applied at an early stage of the incidence of the disease. Repeated application of liquefied coal tar around the base of the stem was found cheap and effective than mineral oil mixed with starch for preventing the female mealy bugs from crawling and climbing on mango trees before flowering and formation of mango fruits.

Key words: Mango, mealy bugs, sooty mould, management.

INTRODUCTION

For the last few years, there was a news every year about the incidence of various diseases affecting mango (*Mangifera indica* L.). Some of the major diseases of mango like anthraconose, powdery mildew, root-rot, bacterial leaf spots, and leaf blight have been reported by Kausar (1960). The occurrence of sooty mould on mango has been reported by Haq and Akmal (1960), Haque (1970), Sultana and Khan (1976), Rangasawami (1972), Stover (1975). They found a causal connection between sooty mould and mealy bug. Sooty mould of mango appears on leaves at the time of flowering and fruit formation. Due to the heavy growth of sooty moulds a sooty mass is formed on the foliage of mango trees. The sooty mass when present on mango fruits, reduce the value of fruits causing loss to mango orchard owners. It was, therefore, considered worthwhile to investigate the reason for the recurring incidence of sooty mould and mealy bugs on mango trees in successive years at the time of flowering and fruiting and to find out ways and means to control the incidence of this disease and/or to reduce the incidence.

MATERIALS AND METHODS

For the purpose of studying sooty mould fungi, affected leaves were collected. The sooty mass was scratched and placed on glass slides and examined under microscope. The characteristic features of the fungal spores were studied and identified with the aid of literature Gilman (1970), Ellis (1971) and Booth (1977). For determining the frequency of occurrence of sooty mould fungi present in the sooty mass, affected leaves were cut into 0.5 cm pieces. Each piece was suspended in 10 ml sterilized distilled water and shaken repeatedly to dislodge the spores and obtain a suspension of spores. As the sooty mould spores floated on the surface of water making a uniform suspension difficult, a detergent (Tinopal) previously dissolved in water @ 0.5 g in 100 ml distilled water was added for the submersion of spores. Thus, a uniform suspension of spores was obtained. One ml of the suspension was spread out on glass slide and the number of spores of fungal spp. on the surface of a leaf were counted. For the survey work, 3 localities of Karachi city were visited. The extent of incidence were noted as severely, mildly and slightly affected.

For controlling the incidence of sooty mould and mealy bugs, diluted suspensions of malathion and diazinon insecticides were sprayed on a series of 4-5 years old young trees to control mealy bugs and diluted suspension of Sulfur and dithane M- 45 fungicides were sprayed separately to control sooty mould fungi and in another operation both the fungicide and insecticide dithane M- 45 and diazinon were mixed together before spraying.

In another experiment 10 ml mineral oil and 10 g starch dissolved in 1000 ml water was sprayed on a series of young trees. The starch was mixed for the adherence of mineral oil in the flakes of starchy solution. In yet another experiment 1 Kg of liquified coal tar was pasted around the basal portion of mango tree trunks to refrain the mealy bugs from crawling and climbing on trees.

RESULTS AND DISCUSSION

It was observed that mealy bugs first appear as white fluffy matter on the lower surfaces of mango leaves as specks (**Fig.1**) and then increase in size and spread out rapidly infesting other leaves (**Fig.2**) of a twig. The sooty mould appear as black sooty mass on the upper surface of mango leave which increase in size gradually affecting the whole foliage of a mango tree (**Fig.3**). On examination of the white fluffy matter, female mealy bugs with eggs were visible under dissecting microscope. The female mealy bugs looked flattened (**Fig.4**) and measured 5-6 mm with numerous peripheral spines borne laterally could be discerned (**Fig.5**). The mealy bug of mango is described as *Drosicha stebbingi* Gr. in text books but the specimens of mealy bugs on mango sent from Karachi by Ausaf and Ahmed (1973) was identified as *Rastroccocus spinous* Rob. by Commonwealth Entomological Institute, London. The incidence of sooty mould was always found associated with the infection of mealy bugs on mango leaves. The causal connection between mealy bugs and sooty mould has been described by Stover (1975) on banana. The occurrence of mealy bugs and sooty mould were closely and comprehensively observed for a number of years on mango trees. It was observed that the mealy bugs on establishing themselves on the lower surfaces of mango leaves secreted sticky sugary substance which trickled downwards and got deposited on upper surfaces of leaves present immediately underneath. Air-borne fungal spores were found growing on leaves which remained stuck up in the sugary substrate. The sooty moulds grew profusely producing a black sooty mass on the upper surfaces of mango leaves. With the passage of time there was a build up in the population of mealy bugs causing severe infestation of mango leaves resulting in widespread growth of sooty moulds and formation of sooty mass on mango foliage. In extreme cases due to the heavy infection, the sticky white slimy matter mixed up with sooty mass trickled on the ground under the canopy of mango trees. The ground became littered with slimy sticky white matter mixed with black sooty mass which in turn became a source of attraction for flies, aphids, jassids and mango hoppers. The foliage of guava and custard apple growing in the vicinity of mango trees were similarly found to be affected with the black sooty mass and mealy bugs infestation due to the pervading incidence of sooty mould in heavily affected areas.

Table 1. Frequency of occurrence of sooty mould organisms indicated by the number of their spores (The numerical figures represent number of spores present in 1 ml / suspension).

Sooty mould organisms	Karachi University Campus	Pakistan Employees Cooperative Housing Society	North Nazimabad
Mango			
Aspergillus niger	80	75	70
A. flavus	72	69	70
Alternaria tenuis	30	40	35
A. humicola	70	60	80
A. alternata	65	70	62
A. tenuissima	40	52	39
Bortyodiplodia mangiferae	32	30	25
B. ribis	16	18	20
B. theobromae	12	10	16
Capnodium roseum	4	6	3
Cladosporium cladosporioides	*	*	*
C. fulvum	90	95	80
Curvularia tetramera	85	70	60
C. lunata	60	40	50
Fusarium semitectum	60	62	70
F. moniliformae	43	47	50
Helminthosporium sativum	50	40	65
H. hawaiiensis	32	35	40

* = More than 100 spores.

Altogether 18 species of fungi were identified in the sooty mass of mango and frequency of occurrence of sooty mould fungi present in sooty mass of mango leaves from 3 different places from the city of Karachi (Table 1). The qualitative and quantitative estimate of sooty mould fungi showed little differences in sooty-leaf specimens collected from 3 different places of Karachi city. Spores of *Cladosporium cladosporoides* were found to be largest in number whereas Rangaswami (1972) reported the preponderance of *Capnodium cladosporoides* in the sooty mass of mango from India. In order to examine the parasitic relationship between sooty mould fungi and mango leaves, free hand sections of mango leaves were taken and stained to determine the presence of fungal hyphae in tissues of leaves below the epidermis. However hyphae of the sooty mould fungi were not found to penetrate the tissue of the leaves. The sooty mass covered the upper leaf surfaces which interfered with the photosynthetic process by forming a dense black covering on mango leaves. The mealy bugs suck cell sap from mango leaves thus rendering the trees weak. The mealy bugs inhabit lower surfaces of mango to keep the bugs away from sunlight and also to protect from dislodgment from rain and wind blow. The affliction of mango leaves by sooty mould and mealy bugs is thus related to the sucking of cell sap by mealy bugs and interference in photosynthetic process by black sooty mass.

Table-2. Effect of insecticides and fungicides on mealy bugs and sooty moulds applied separately and in combination.

Name of the Insecticides and Fungicides	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8 – 1.7	1.8	100
Insecticides											
Malathion				+	++	+++	+++				
Diazinon				+	++	+++	+++				
Coal tar 1 kg/tree											+++
Fungicide											
Sulphur (Powder)					+	++	++	++			
Dithane M-45				+	++	++	+++	+++			
Insecticide + Fungicide											
Diazinon+Dithane M-45				+	++	+++	+++				
Mineral oil 1% + Starch										+++	

Note: Insecticides were applied to control mealy bugs and fungicides to control sooty moulds. The sign + indicates effective, ++ more

Fig.1-3: 1= Mealy bugs (whitish) on the lower surface of a mongo leaf; 2= Mealy bugs on the lower surface of leaves and on twigs of mango; 3=The blackened foliage of a mango tree heavily infested with sooty mould fungi (mealy bugs underneath).

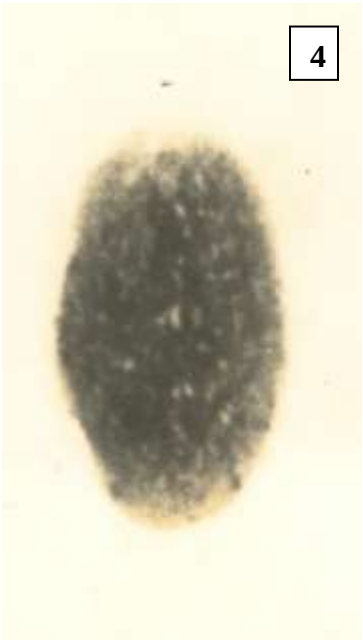

Fig.4. A mealy bug (x 10).

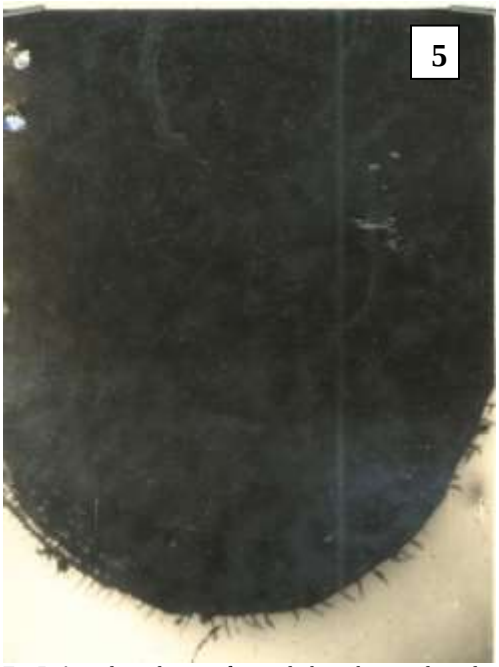

Fig.5. An enlarged view of a mealy bug showing lateral projections (x 100).

The effect of spraying of fungicides to control sooty mould had little effect and similarly spraying of insecticides did not prove much efficacious. Prakash (1982) while evaluating the effect of various fungicidal spraying did not find it much effective in the control of mango diseases in India. However, when the fungicide and insecticide were mixed together and sprayed, it proved better in reducing the incidence of the disease (Table 2). Considering the cost of the chemicals and labour involved in large scale operations, it was reckoned not to be cost effective for protection. The application of mineral oil mixed with starch had a similar ratio of cost and benefit. Moreover the starch soon dried up and got detached from the surface of the leaves as dry starch flakes and therefore the oil could not be retained. Application of liquefied coal tar around the base of mango stems as paint gave the best result in controlling the mealy bugs. It was however found necessary to make repeated applications at least after 7 days till harvesting of the fruits because on drying of the coal tar the mealy bugs could crawl on stems. If the basal part of stem are painted up to 1 ft above the ground level and tar kept in liquefied state to keep the paint sticky, it was noted that mealy bugs couldn't crawl, got stuck up, and could not climb up on mango trees. If mealy bugs are prevented from reaching the foliage of mango and settle on lower surfaces of leaves, the spores of sooty mould fungi cannot germinate and form sooty mass on upper surface of mango leaves for want of the sticky sugary substrate. The growth of sooty mould fungi and formation of sooty mass is thus directly related to the secretion of sticky sugary solution, which forms natural substrata for the growth of sooty mould fungi.

The weather condition i.e. temperature and relative humidity (RH) remain conducive for the growth and sporulation of sooty mould fungi during mango flowering and fruiting. Temperature record during the course of the observation and experiments was 20°C to 30°C and RH fluctuated between 50 to 70%.

Since mealy bugs secrete sticky sugary substances, which promote growth of sooty mould fungi on mango leaves, the prevention would be better than cure. In case of mango sooty mould disease, management of mealy bugs is utmost necessary for eradicating the incidence of this disease.

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(*Accepted for publication July 2006*)