Investigation of Coprophilous Fungi And Their Role In Degradation of Malachite Green

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Abstract- *Kavalan (meaning Police in Tamil) is an SOS app developed by the Tamil Nadu Police as part of the Tamil Nadu State Police Master Control Room initiative. The app is for the people of Tamil Nadu to seek police assistance instantly in emergency situations such as physical emergencies, eve teasing, kidnapping or natural disasters such as floods, earthquake, etc.TN a safe state, says minister aims to make reporters after the third consultative workshop on formulation of state policy for women, in which rural women, representatives of associations of domestic workers, NGOs, female panchayat presidents, and others participated. She said that the department was working closely with the police department to prevent crimes against children. All children's and old age homes were being inspected by the officials to check if they are operated with proper permission, she said. Places of work were also being inspected to prevent sexual harassment.*

Keywords- Coprophilous, Decolorisation, Dye, Fungi, Malachite Gree

I. INTRODUCTION

Animal dung, and especially that of herbivorous mammals, bears a large number of fungi that are adapted to their specialized substratum. Fungi which have survived digestion and appear on dung have been termed endocoprophilous . Coprophilous fungi embedded in a mucilaginous matrix, forms a very suitable medium for fungal growth). Coprophilous fungi have been the subject of a number of ecological investigations, including succession, interspecific antagonism, interspecific synergism, substrate specificity and degrade pollution caused by dye in relation to different dung types and autecology (Wicklow, 1981, 1992).
Malachite green is organic compound (triarylmethane) that is used as dye stuff and controversially as an antimicrobial in aquaculture. Malachite green is traditionally used as a dye for materials such as silk, leather and paper.In present studies relation between fungal growth of coprophilous fungus and water pollution caused by dye observed .

Aims and objectives of the present research are-

- Isolation of various species of coprophilous fungi from dung of herbivores viz. elephant, cow, horse, camel and goat present in Jaipur.
- Utilization of isolated species of coprophilous fungi for degrading malachite green dye of different concentrations obtained according to dye wastewater effluent from dye industries of Jaipur.
- Screening of coprophilous fungal spp for decolorization of different concentrations (ppm) of melachite green obtained according to dye wastewater effluent from textile industries of Jaipur.
- Recording the time taken (duration in days) by each fungal spp for degradation of different concentrations of malachite green.
- Comparative analysis of rate of dye degradation by different coprophilous fungal species.Isolation of the fastest coprophilous fungus as a dye degrader .

II. MATERIALS AND METHODS

The present research work has utilized dung samples of herbivores viz. Cow, Horse, Elephant, Goat and Camel from different areas in Jaipur, for inoculation in Potato Dextrose agar medium. These dung samples were inoculated in PDA to obtain coprophilous fungi during the summer season of May-June 2020.

Cow dung sample: collected from cowshed at Patrakar Colony,V.T. Road, Jaipur
Elephant dung sample: collected from tourist track in Amer, Jaipur
Horse dung sample: collected from a stable near Polo ground, Rambagh circle, Jaipur
Goat dung sample: collected from owner of goats at Moti Dungri Road, Jaipur
Camel dung sample: collected from owner of Camel at Gopalpura Bye Pass Road, Jaipur

The samples were collected by spatula from the relevant places in Jaipur in sterilized polythene bags. The samples were immediately brought to the laboratory. Each sample was diluted to 10^{-1} dilution using distilled water.

Potato Dextrose agar medium was prepared as per standard rules. Pour plate method was carried out during inoculation of all the dung samples in petriplates. The incubation of the 6 petriplates after solidification was done at 30C until the colonies appear. Observation of petriplates was done daily. Colonies initiated after 3-4 days and developed after 10 days. These were identified using slide preparation and microscopic study.

For dye degradation experiment, malachite green dye in powder form was utilized. The different concentrations of malachite green dye (ppm) was determined from the effluent of 3 textile dye industries of Sanganer . This showed the average concentrations of malachite green dye in wastewater which comes out via textile dye industries in Sanganer, Jaipur. Thus these concentrations of malachite green were used in screening experiment for degradation by coprophilous fungal spp.

III. OBSERVATIONS AND RESULTS

Table 1: Occurrence of coprophilous fungal species isolated from five herbivores in Jaipur. (+ indicate presence, -ve indicate absence)

S. no.	Dung sample	*R. stolonifer*	*M. racemosus*	*O. griesium*	*G. candidum*	*P. betae*	*C. globosum*	*M. cinereus*	*C. tropicum*	*S. brevicaulis*
1.	Cow	+	+	+	+	+	+	-	+	+
2.	Horse	-	-	+	+	+	-	+	+	+
3.	Camel	_	-	+	-	-	+	+	+	-
4.	Goat	+	+	+	-	+	+	-	-	-
5.	Elephant	-	-	-	-	-	+	–	+	+

*MG- Malachite green

Table 2: Degradation of 4ppm MG dye concentration by different Coprophilous fungi

Fungal spp	*R. stolonifer*	*M racemosus*	*O. griesium*	*G. candidum*	*P. betae*	*C. globosum*	*M cinereus*	*C. tropicum*	*S. brevicaulis*
No. of days of 4ppm MG dye degradation	3	5	6	8	11	10	12	9	8

Rhizopus stolonifer was found to be fast degrader of 4ppm MG dye concentration followed by *Mucor racemosus*. Biosorption of dye was seen to be fastest and media color changed to transparent only in 3 days in case of *Rhizopus stolonifer*, while it was 5 days in case of *Mucor racemosus.* Other coprophilous fungi were slow degraders (Table -2)
MG (4ppm) dye decolorization percentage evaluated through spectrophotometer for all the fungal species on the 12th day which also gave the potentiality of these species.

Table 3: Decolorization percent of 4 ppm concentration of MG by coprophilous fungal species on 12th day of inoculation.

Fungal species	Dye decolorization percentage (%)
R. stolonifer	98.45
Mucor racemosus	96.56
Oidiodendron griesium	80.67
Geotrichum candidum	70.56
Phoma betae	50.90
Chaetomium globosum	60.89
Microascus cinereus	42.50
Chrysosporium tropicum	67.43
Scopulariopsis bravicaulis	70.45

Table 4: Degradation of 7 ppm concentration of MG dye by different coprophilous fungi

Fungal	*R.*	*M*	*O.*	*G.*	*P.*	*C.*	*M*	*C.*	*S.*
No. of	5	9	10	14	18	19	20	15	15

The decolorization percentage of 7 ppm MG was evaluated for all the fungal species through spectrophotometer on the 20th day which also gave the potentiality of these species.

Table 5: Decolorization percent of 7 ppm MG by coprophilous fungal species on 20th day of inoculation.

Fungal species	Dye decolorization percentage (%)
R. stolonifer	97.65
Mucor racemosus	95.45
Oidiodendron griesium	78.65
Geotrichum candidum	67.67
Phoma betae	52.38
Chaetomium globosum	63.89
Microascus cinereus	40.12
Chrysosporium tropicum	69.58
Scopulariopsis bravicaulis	69.90

Here also the fungus Rhizopus stolonifer had maximum decolorization degree as compared to other coprophilous fungi. However, it was found that the decolorization percent in 7 ppm MG was lower as compared to 4 ppm of dye. thus we can prove that low concentration of dye (ppm) degrades faster than higher concentration.

Table 6: Degradation of 10 ppm MG dye concentration by coprophilous fungi

Fungal spp	*R. stolonifer*	*M. racemosus*	*O. griesium*	*G. candidum*	*P. betae*	*C. globosum*	*M. cinereus*	*C. tropicum*	*S. brevicaulis*
No. of days of 10 ppm MG dye degradation	9	15	20	Very slow	Very slow	Very slow	Very slow	Very slow	Very slow

The degradation of dye was recorded upto 20 days after which the media turns dry. The fungus *Rhizopus stolonifer* became a slow degrader due to higher concentration of dye. More time period was required for decolorizing MG of 4ppm concentration. The medium dried out after 20 days and fungi taking degradation time of more than 20 days were very slow degraders (Table 6). These were *Geotrichum candidum, Phoma, Chaetomium, Microascus, Chrysosporium* and *Scopulariopsis.* At 10 ppm concentration of dye *Rhizopus stolonifer* was again the fastest degrader as compared to other coprophilous species.

Table 7: Decolorization percent of 10 ppm MG by Coprophilous fungal spp. on 25th day of inoculation.

Fungal species	**Dye decolorization percentage (%)**
R. stolonifer	95.43
Mucor racemosus	90.87
Oidiodendron griesium	75.65
Geotrichum candidum	62.98
Phoma betae	50.45
Chaetomium globosum	60.90
Microascus cinereus	38.98
Chrysosporium tropicum	65.22
Scopulariopsis bravicaulis	64.67

In this case also 10 ppm MG decolorizes faster by Rhizopus stolonifer .In comparative analysis with all concentrations ,decolorisation is more in low concentration. i.e. in 4 ppm and 7 ppm as compared to 10 ppm .This may be attributed to a high energy required by fungus to degrade higher concentration of dye. The decolorization potential therefore slowers according to the high concentration of dye. T

IV. CONCLUSIONS

Maximum fungal composition was found in cow (*Bos primigenius indicus*)dung

The Coprophilous fungal species obtained in cowdung were *Rhizopus stolonifer, Mucor racemosus, Oidiodendron grieseum, Geotrichum candidum, Phoma betae, Chaetomium globosum, Chrysosporium tropicum*&*Scopulariopsis brevicaulis*. This accounts for the fact that cowdung provides maximum fungi which can be utilized for dye degradation experiments. Cowdung has significance in research and scientific fields.

Ninecoprophilous fungal species were isolated from 5 herbivores dung

The coprophilous fungal spp found in herbivore dung samples were *Rhizopus stolonifer, Mucor racemosus, Oidiodendron grieseum, Geotrichum candidum, Phoma betae, Chaetomium globosum, Microascus cinereus, Chrysosporium tropicum* & *Scopulariopsis brevicaulis.* These fungal spores have remained undigested in herbivores and excreted out in faecal matter .

Dye decolorization percentage calculation by spectrophotometric data

The readings were taken using spectrophotometer and the dye decolorization percentage was calculated as_The data conclude that:

Dye concentration is directly proportional to time of degradation

Dye concentration is inversely proportional to decolorization percentage

Decolorization percentage is directly proportional to the degradation time by fungal species.

Dye decolorization percentage= (Initial absorbance - final absorbance/ initial absorbance) x 100

Thus, Rhizopus stolonifer being the faster degrader had maximum decolorization percentage of 4 ppm, 7 ppm and 10 ppm MG dye.

***Rhizopus stolonifer* proved to be the most potential coprophilous fungus**

The degradation of MG was fastest by *R. stolonifer* in short time in terms of days.However when the concentration of dye was increased the fungal degradation became slower , but the degradation rate was higher as compared to other coprophilous fungal spp. *Mucor* was found to be the second potential degrader after *Rhizopus stolonifer*.

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