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RESEARCH ARTICLE

BIODIVERSITY OF DEUTEROMYCETES IN RICE FIELD SOIL OF GONDIA DISTRICT OF EAST VIDARBHA (M.S.) INDIA

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Abstract

Soil is one of the most varied environments for microbial biodiversity including deuteromycetes. The fungal population is maximum close to the soil surface and reduced with soil depth. Inorganic matter and aeration are limiting factors for fungal growth. Cultivated soils contain many organisms in common, but cultivation may change the proportion of different species of soil fungi. Deuteromycetes are microscopic organisms that grow in long threadlike structures called hyphae, which are branched and septate. They are either saprophytic or parasitic. Deuteromycetes hold great economic importance as they act as decomposers of organic matter and play an important role in mineral recycling. They are known as 'second class fungi' or 'fungi imperfecti' because they do not reproduce sexually. Deuteromycetes are accountable for various plant diseases and cause a shortage of food. Climate of the Gondia district is tropical hot and favorable for the growth of fungi with suitable soil for rice cropping. Altogether biodiversity of 33 species of deuteromycetes belonging to 12 genera was recorded through the study from rice field soil.

Introduction:-

Soil is one of the most diverse habitats on earth and contains the most wide-ranging assemblages of living organisms. Biological activity in soils is largely intense in the topsoil. Depending on the size and class organisms may be divided into macro, meso, and microfauna. Beyond that, bacteria, fungi, protozoa and algae are grouped as microorganisms in soil biodiversity. Soil fungi are microscopic plant-like cells that grow long threadlike structures or hyphae that make a mass called mycelium. The mycelium fascinates nutrients from the roots on which they colonized. It produces special hyphae that create the reproductive spores. Deuteromycetes colonize the dead or decaying plant residues in soil by their mycelial growth and also cause various diseases as pathogens. The effect of a particular crop on soil exposes the changes in microflora, especially on those microbes, which cause various diseases like leaf spot, wilt, purple blotch, early blight, etc. These diseases reduce the quality, quantity, and productivity of crops (Vilas V. Thakare and Sanjay M. Pawar, 2021)

The fungal population is constantly changing not only in numbers but also concerning the dominant species. In their capability to decompose organic residues, deuteromycete fungi are the most versatile and the determined group to decompose cellulose, starch, gums, and lignin as well as proteins and sugars.Gondia is well known as "Rice city" and famous for grain marketing, situated at 200.451 to 210.301 north latitude and 800 to 800.301 east longitudes. It

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is the eastern part of Maharashtra known as Vidarbha. On the north of Gondia, the state Madhya Pradesh; on the east of Gondia, the state Chhatisgarh; on the south of Gondia, the district Gadchiroli; on the west of Gondia, the district Chandrapur and Bhandara are connected. The general elevation above the sea level is 333.755 meters. Soil of Gondia district is different, black 38.62 % red 31 %, sandy 20.12 %, and other 10.25%. Soil is fertile; it is suitable for rice crops. Soil is deficient in nitrogen and phosphorus and crack occurs heavily in summer. The climate of the Gondia district is tropical hot because it is away from the sea. The average rainfall is 140 cm. Normally monsoon commences in the second week of June and continues till the first week of October. Temperature was found maximum of 46.8^0C in May and June and the normal range is between 21^0C to 36^0C. Winter season is comparatively dry, similarly December and January are the coldest months.

Materials and Method:-

Collection of samples:

Soil samples were taken with a surface-sterilized trowel per month during the rice crop season from different areas. Samples were taken after scraping away one inch of surface soil, from a depth of 10-15 cm, then soils were poured and shaken directly into fresh polythene bags. Five samples were collected at random from each sampling site. The collected soil samples were mixed and kept in a cool place during transportation to the laboratory.

The soil samples were transported to the laboratory for the assessment of soil mycoflora. Under aseptic conditions the stones and organic debris were removed, then spread on the sterile tray for air-drying. After drying it was gently crushed with the help of mortar and pestle. The crushed soil was then passed through the 2 mm sieve. The soil obtained after sieving was ready for the plating.

Isolation of fungi from soil:

Fungi in soil might be obtained by using various methods simultaneously, along with direct microscopic examination of the soil being assayed. The technique for isolating fungi from soil has been reviewed (Watson, 1960; Marta Cabello and Angelica Arambarri, 2002; and Anderson et al., 1978). Usually, isolation from soil is done by indirect method means dilution plating methods (Waksman, 1922b).

Isolation of soil fungi is performed by the 'dilution plate method'. The soil dilution plate method was commonly used. The soil was sieved through a 2 mm sieve. 10 grams of dry soil was suspended for 20-30 minutes in a 250 ml sterile Erlenmeyer flask with 90 ml sterile water to make a suspension. Further serial dilutions 10-2 to 10-6 were made by withdrawing 1ml into additional dilution blanks having 9 ml sterile water in flasks respectively.

Finally, 1 ml aliquot of the desired dilution was aseptically pipetted out into a sterile petri dish and 12-15 ml of appropriate cooled, melted agar medium was added to each petri dish just above the solidifying temperature. The dishes were gently swirled in a clockwise and anticlockwise direction to disperse the diluted soil suspension on the agar medium. After solidification of the medium, the petri dishes were incubated in an inverted position for 3-7 days at room temperature (25 ± 2^0C) till the colonies appeared. To get uniform results three replicate plates were prepared for each sample.

Result:-

Altogether 33 species of deuteromycetes belonging to 12 genera were recorded from the soil of rice fields. A maximum 31 number of species were recorded during the year of the study 2004-2005 followed by 27 in the year of 2005-2006 and 18 in the year 2003-2004. A greater number of species was recorded in the kharif cropping season as compared to the rabbi of all years of study (Table-1 & Fig-1). A total 9 number of species of *Aspergillus*, 7 *Fusarium*, 5 *Trichoderma*, 2 numbers of each *Phoma*, *Curvularia*, and *Alternaria* are significantly recorded during the study. Only one species from *Lemonniera*, *Cladosporium*, *Helminthosporium*, *Humicola*, *Nigrospora*, and *Myrothecium* are also recorded in the present study.

Table 1:- Seasonal variation in the mycoflora of rice field soil by serial dilution method during the 2003-2004, 2004-2005, and 2005-2006.

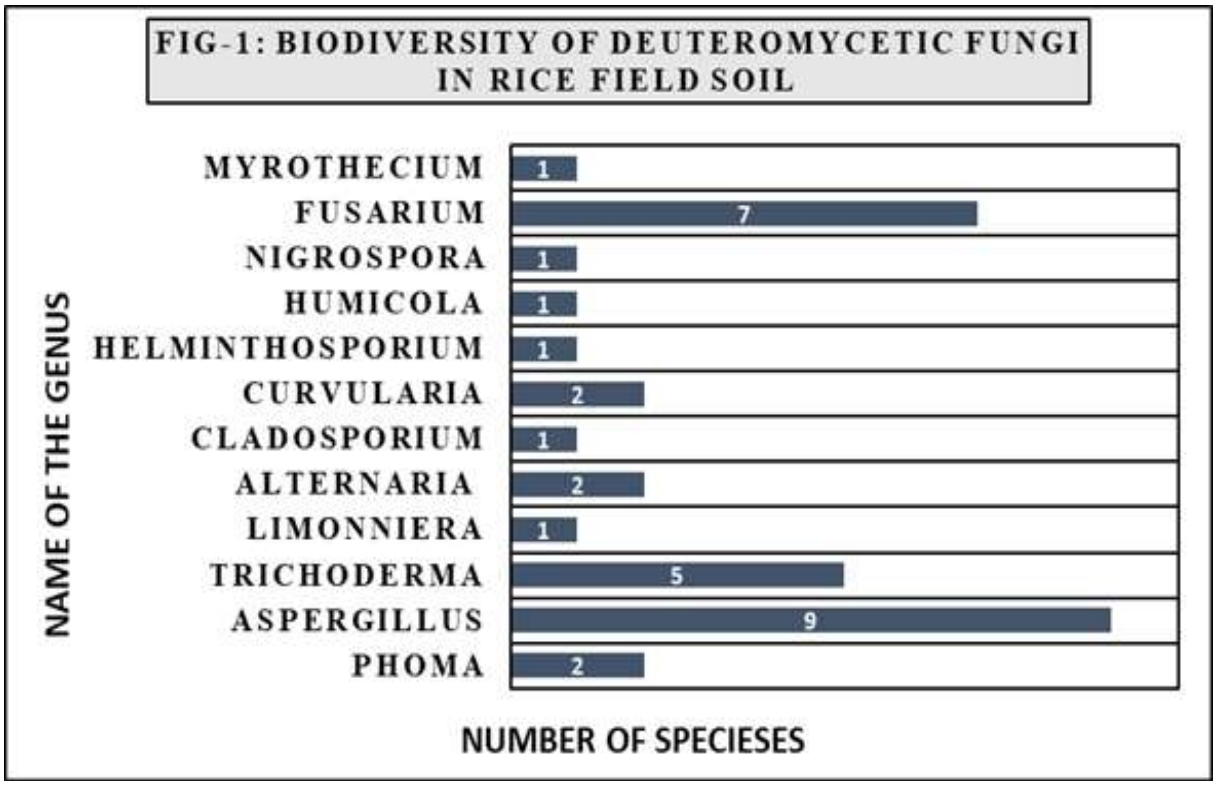
Sr. No.	Name of the Deuteromycetes	2003-2004		2004-2005		2005-2006	
		Kharif	Rabbi	Kharif	Rabbi	Kharif	Rabbi
1	*Phomahumicola*	+	+	-	-	-	+
2	*Phomahibernica*	-	-	+	+	-	-

3	*Aspergillus flavipes*	+	-	+	-	+	-
4	*Aspergillus niger*	+	+	+	+	+	+
5	*Aspergillus ochraceus*	-	-	-	-	+	+
6	*Aspergillus sclerotiorum*	+	-	-	-	-	-
7	*Aspergillus sulphureus*	-	-	-	-	+	+
8	*Aspergillus sydowii*	+	-	+	+	-	-
9	*Aspergillus ustus*	+	+	+	+	+	-
10	*Aspergillus wentii*	-	-	-	+	+	-
11	*Aspergillus terreus*	-	-	-	+	-	-
12	*Trichoderma harzianum*	-	-	-	-	+	-
13	*Trichoderma viride*	+	-	+	-	+	+
14	*Trichoderma auroviride*	-	-	+	-	-	-
15	*Trichoderma atroriride*	-	-	+	+	-	-
16	*Trichoderma citrinoviride*	-	-	-	-	+	+
17	*Lemonniera aquatica*	+	+	+	+	-	-
18	*Alternaria humicola*	-	+	-	+	+	+
19	*Alternaria tenuissima*	-	-	+	+	-	-
20	*Cladosporium herbarum*	-	-	+	+	-	-
21	*Curvularialunata*	+	+	+	-	-	-
22	*Curvulariatrifolli*	-	-	+	-	-	-
23	*Helminthosporiumgramineum*	+	-	-	-	+	+
24	*Humicolafuscoatra*	-	-	+	-	-	-
25	*Nigrospora oryzae*	-	-	-	-	+	-
26	*Fusarium chamydosporum*	-	-	+	+	-	+
27	*Fusarium semitectum*	-	-	+	-	-	-
28	*Fusarium poae*	-	-	-	-	+	+
29	*Fusarium sambucium*	+	+	-	-	+	-
30	*Fusarium dimerum*	-	-	-	-	+	-
31	*Fusarium avenaceum*	-	-	-	+	-	-
32	*Fusarium udum*	-	-	+	-	+	-
33	*Myrotheciumroridum*	-	-	-	+	-	+

All 33 Deuteromycetes fungi belong to order 1) Sphaeropsidales and 2) Moniliales as well as to families 1) Sphaeropidaceae, 2) Moniliaceae, 3) Dematiaceae and 4) Tuberculariaceae (Table 2).

Table 2:- Taxonomic account of Deuteromycetes isolated from soil of rice field.

Classes, order and family	Genera	Species
DEUTEROMYCETES:		
Sphaeropsidales		
Sphaeropidaceae	01	02
Monilales		
1. Moniliaceae	03	15
2. Dematiaceae	06	08
3. Tuberculariaceae	02	08



Discussion:-

Deuteromycetes grow, survive, and multiply in litter, and soil, and other substrates and contribute widely towards bio-degradation and recycling of organic matter, enzyme production, industrial production including antibiotics, immunoregulators, bio-control agents, besides causing profound mycoses, allergies and plant diseases. One-third of the fungal diversity of the globe exists in India. Over 27,000 fungal species have been recorded in India, making it the largest biotic community after insects in which more than 8000 Deuteromycetes are known. (C. Manoharachary et al., 2005).

The study of soil (Das, 1963) was undertaken on account of the importance of rice as an important staple food crop of the world. Food webs are ultimately based on the biodiversity of microorganisms, including Deuteromycete fungi as soil flora. Species diversity tends to be great amongst smaller organisms (May, 1988). However, it has been argued that much of this variation can be redundant (Norton, 1986b). However, such 'bootstrapping' involving fungi may be especially important in the maintenance of soils (Perry et al., 1989). Studies on the soil fungi from paddy fields were carried out by Gosh and Dutta(2018) in India. Studies on the soil from paddy fields were carried out by Kirk et al., (1998), in the Netherlands. However, the information is still insufficient to understand the complete biology of these organisms along the soil of rice fields in this region and the study was made from 2003 to 2006. Rice crops were cultivated in the field condition twice a year (Kharif and rabbi) and the mycroflora of soil was studied every year.

Fungal species were assigned to their respective group Deuteromycetes. The population of these groups at various periods of one-month intervals from soil samples were taken for study. The population of Deuteromycetes was dominated in the soil before the harvest time when the crop showed full growth as compared to the early stage of growth in all the years.

Conclusion:-

There was considerable variation in the Deuteromycetes fungal population in the rice field soil. Fungal populations varied according to the cropping seasons showing a relation with rainfall, humidity, and temperature. When there was rainfall and higher humidity the population in the soil increased considerably. Maximum temperature and dry atmosphere did not favor the fungal population. The fungal population was observed more in the kharif cropping

season than rabbi.Variation in the fungal population was observed at various growth periods of rice crop. Population was generally less at the seedling stage and at the harvesting stage of rice in all the cropping seasons. Altogether 33 species of Deuteromycetes belonging to 12 genera were recorded through the study from rice field soil.

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References:-

1. Anderson, J.P.E. and Domsch, K.H. (1978): Physiological method for the quantitative measurement of microbial biomass in soil. Biol. Biochem., 10: 215-221; doi: 0038-0717!7810601-021SW2.0010.
2. Das, A.C. (1963): Ecology of soil fungi of rice field. Trans. Brit. Mycological Soc., 46 (3): 431-433; doi: https://doi.org/10.1016/S0007-1536 (63) 80037-6.
3. Gosh, G.R. and Dutta, B.G. (2018): Soil fungi fromOrissa (India)-I. pp 915-918; doi: https://doi.org/10.1080/00275514.1960.12024965.
4. Kirk, G.J.D., George, T., Courtois, B. and Senadhira, D. (1998): Opportunity to improve phosphorus efficiency and soil fertility in rain fed, lowland and upland rice ecosystems: review. Field Crop Res. Netherland., 56(1-2): 73-92; doi: https://doi.org/10.1016/S0378-4290(97)00141-X.
5. Manoharachary C., Sridhar K.R., Reena Singh, Adholeya A., Suryanarayanan T.S., Rawat S., and B. N. Johri B.N., Fungal biodiversity: Distribution, conservation and prospecting of fungi from India, (2005): Current Science., 89(1): 58-71; Corpus ID: 52213057.
6. Marta Cabello and Angelica Arambarri, (2002):Diversity in soil fungi from undisturbed and disturbed Celtis tala and Scutiabuxifolia forests in the eastern Buenos Aires province (Argentina)**.**Microbiological Research.,157(2):115-125;doi: 10.1078/0944-5013-00138.
7. May, R.M. (1988): How many species are there on earth? Science., New York. 241: 1441-1449; doi: 10.1126/science.241.4872.1441.
8. Norton, B.G. (1986b): The preservation of species: the value of Biological Diversity, 305 pp Princetown University press; Princetown U.S.A.; doi: https://doi.org/10.1017/S0030605300026703.
9. Perry, D.A., Amaranthus, M.P., Brocher, J.G., Brocher, S.L.and Brainerd, R. E. (1989): Bootstrapping in ecosystems. Bio Science., 39: 230-237; doi:https://doi.org/10.2307/1311159.
10. Vilas V. Thakare and Sanjay M. Pawar, (2021): Study of Deuteromycetean Fungal Diseases Occurring on Some Crops Belonging to Various Families from Aurangabad District of Maharashtra. Journal of Interdisiplinary Cycle Research., 13(4):1687-1693
11. Waksman, S.A. (1922b): The growth of fungi in the soil. Soil Sci. Journal of Bacteriology;doi: 10.1097/00010694-192208000-00007.
12. Waston, R.D., (1960): Soil washing improves the valve of the soil dilution and the plate count method of estimating populations of soil fungi. Phytopathol., 50:792-794; Corpus ID: 83467801.