International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor (2018): 7.426

Fungal Diversity in Rhizosphere Soil of Banana Fields at Jalgaon District, (MS.)

Sadhana Salve[1], Suchita Rajurkar[2], Swati Gaikwad[3]

Department of Botany, Deogiri Collage, Aurangabad, India

Abstract: ***Rhizosphere soil samples were collected from eighteen banana fields of Jalgaon district during the period of 2016 to 2017 in three intervals. Rhizosphere soil fungi were isolated by two methodsSoil dilution method and Soil plate method on Potato dextrose agar and CzapeksDoxAgar. Altogether1354 fungal colonies of 35 fungal species which belongs to 21 genera were isolated and identified. Percent contributions, species diversity, species richness, species evenness of soil mycoflora were statistically analyzed*.**

Keywords: Rhizosphere soil**,** Mycoflora**,** species diversity, Banana field, Jalgaon

1. Introduction

Considering all living forms, the diversity of soil organisms in general is more extensive than any other environment. It has been found thatsoil medium is enriched with number of genera and species of fungi. The soil layer which is influenced by the plant root is called Rhizosphere. In this soil density of micro-organisms is greater thanthat of surrounding soil due to different metabolites secreted by plant roots. Plant root metabolites are used as nutrient by micro-organisms. (Sharma and Shrivastava 2017). Microorganisms in the soil are helpful in enhancing soil fertility and plant growth as well as involved in several biochemical transformations and mineralization activities in soils. Fungi are an important part of soil micro biota and it present in large quantity than bacteria, depending on soil depth and nutrient conditions (Gnanasekaran-2015).

Banana (*Musa paradisiaca*) is a popular and important commercial fruit crop grown in tropical and subtropical part of world. It is Cultivated in120 countries on 5014.06 hector area. In India, banana is the second most important cash crop and cultivated in an area of 830.5 thousand hector and total production is around 29, 779.91 thousand tons. (Gnanasekaran*et.al.*-2015) its availability, affordability, varietal range, taste, nutritive and medicinal value makes it the favorite fruit among all classes of peoples. Main banana growing states are Tamil Nadu, Maharashtra, Gujarat, Andhra Pradesh and Karnataka. In Maharashtra, Jalgaon district Ranks no.1 in banana production and it has maximum 48000 hector under this crop. The district produces more than 16% of India's bananas and thus 3% of world banana production takes place in Jalgaon. According to Mahabanana, an association of banana growers of Maharashtra, 66% of Maharashtra's land under banana crop is in Jalgaon. Hence the present investigation was focused on fungal diversity in Rhizosphere soil of banana crop field from Jalgaon district (M.S).

2. Materials and Methods

Collection of Soil Samples

Rhizosphere soil samples were collected from 18 different region of Jalgaon District [Maharashtra] during the period of 2016 to 2017 in three intervals. Rhizosphere soil dugged up to 15 cm to 20 cm depth and a mass in small sterilized bottles and brought to laboratory for further investigation.Seasons and Site of sample collection shown in (Table No. I).

Isolation of fungi from the soil samples: The Rhizosphere soil fungi were isolated by two methods i.e. Soil dilution method and Soil plate method on two different media i.e. potato dextrose agar (PDA) and CzapeksDox Agar (CZA).

Soil dilution method : (Selman A. Waksman 1921), (K. saravanakumar and V.Kaviyaeasan-2010)In this method 1 gm of soil sample was diluted in 10 ml of sterilized distilled water to make microbial suspension 10^{-1} to 10^{-5}. Dilution of 10^{-2} to 10^{-5} were used to isolate fungi 1 ml of dilution was taken from each serial dilution sample in triplicate form in petriplate and add approximately 15 ml medium. The petriplate were incubated at $28^0 \pm 2^0$C for 72 hrs.

Soil plate method: (G. Gaddeyya. et al-2012) about 0.005 g of soil was scattered on the bottom of sterile petriplate and cooled (40^0-45^0C) agar medium [PDA and CZA] was added, which was then rotated gently to disperse soil particles in the medium. Then petriplates were incubated at $28^0 \pm 2^0$C for 72 hrs.

Identification of soil fungi: The fungi were identified with the help of literature. (Hand book of soil fungi Nagmani-2006), (Manual of soil fungi-Gillman, J.C., 1957.), (The illustration of imperfect fungi- Barnet C.J. 1972), (Hypomycetes- An account of Indian species Subramanian, C.V., 1971).

Statistical analysis of isolated soil fungi:

Population density expressed in term of colony forming unit (CFU) per gram soil with dilution factors**.** The percent contribution of each isolate was calculated by

$$\%\ Contribution = \frac{total\ no.of\ CFU\ of\ an\ individual\ species}{Total\ No.of\ CFU\ of\ all\ sps} \times 100$$

CFU – Colony Forming Unit

Species diversity indices were calculated using the following formula:

Shannon diversity index: Hs = - € (Pi) (logPi) and

Simson diversity index: D = € (n / N) 2

3. Result and discussion

Rhizosphere soil samples were collected from Eighteen banana fields of Jalgaon district such as Balad (3 fields), Nagardevala (3 fields), Savada (3 fields), Hatgaon (3 fields), River (3 fields) and Vakod (3 fields). (Table no. I) during the investigation 1354 fungal colonies were isolated (Figure no.I).The isolated and identifiedfungal colonies and microscopic structure. **(**Photoplate no.1and 2).Contribution of each isolates were observed as follows *Cladosporiummusa* (7.75%), *Fusariumoxysporum* (7.38%), *Fusariummoniliformia* (6.50%), *Verticillium sp*. (6.13%), *Aspergillusnigar (*5.46%), *Fusariumverticilliods* (4.65%), *Alternariaalterneta* (4.50%), *Aspergillusnidulance* (4.28%), *Helimethosporium sp.* (3.47%), *Fusariumproliferatum* (3.40%), *Aspergillusterrus* (3.40%), *Fusarium sp*. (3.32%), *Penicillium sp.* (2.80%), *Curvularialunata* (2.51%), *Aspergillus sp*. (2.36%), *Trichodermaviridie* (2.30%), *Nigrospora sp*. (2.29%), *Aspergillusflavus (*2.14%), *Trichodermaherzanium* (2.14%), *Deshrelia sp*. (2.14%), *Aspergillusfumigatus (*2.06%), *Beltrania sp*. (1.78), *Chaetomium sp*. (1.70%), *Chaetomiumglobosum* (1.62%), *Alternaria sp*.- (1.55%), *Chaetomium sp.* (1.48%), *Cistosporella sp. (*1.48%), *Aspergillus sp*. 1.55%, *Rhizoctonia sp.* (1.55%), *Hyalopus alter corda (*1.33%), *Pythium sp.* (1.25%), *Aspergillussp* (1.03%), *Colletotricum sp*. (0.81%), *Rhizopus sp.* (0.66%), *Phytopthoramegasperma (*0.66%) (figure no. II).

In present investigations three genera were dominant i.e. *Cladosporium*, *Fusarium* and *Aspergillus. Earlier* 2015 Ratna Kumar, *et. al.*, also reported *Aspergillus*, *Fusarium* and *Penicillium was* dominant genera in soil.In 2015 Gnanasekaran, *et.al*. recorded 26 genera from banana field. Out of 26 fungal genera, *Aspergillus* genus was dominant followed by *Penicillium*, *Trichoderma*, *Absidia*, and *Fusarium*.

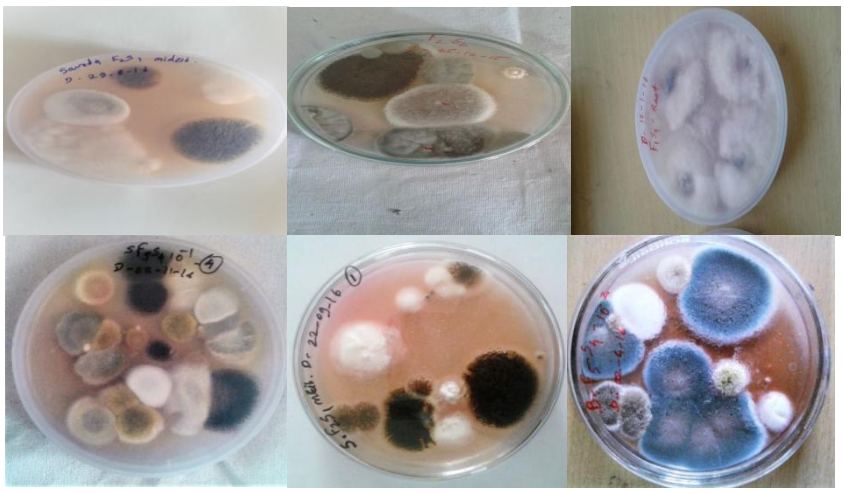
Shannon diversity index was recorded highest fungal diversity in Field no. 16 followed by field no.3 and Field no. 2 (i.e. 1.39, 1.36 and 1.34 respectively.)In field no.1, field no. 4, field no. 5 and field no. 17 were observed same diversity index.Field no.13 showed 1.32 diversity index and Field no.6 showed 1.31 diversity indexes. In Field no.7, and field no.11 were found equal diversity index as well as field no.8, field no.10 and field no.18 also observed equal diversity index. Minimum diversity index were noted in field no.14 followed by field no.12, 9 and 15 (Table No. II). In Simson diversity index, Maximum diversity index were observed in field no.9 followed by field no.12, field no.15, field no.10, field no.18, field no.14, field no.6, field no.11 and field no.8.Field no.17 and field no.7 showed equal diversity index, then it decreased in field no.4, field no.1, field no. 2, field no.5, field no. 3, field no.13 and field no.16 respectively. (Table No. II).

Species Richness: Maximum species richness was noted in field no.16 followed by field no.3, field no.4, field no.2, field no.10, field no.17, field no.12 and field no.18.Species richness was same in field no.5 and field no.11.It was minimum in field no.6 followed by field no.13, field no.1, field no.8, field no.14, field no.9, field no.15, field no.7. (Table No. II).The maximum species richness specifies high species diversity present in fields.

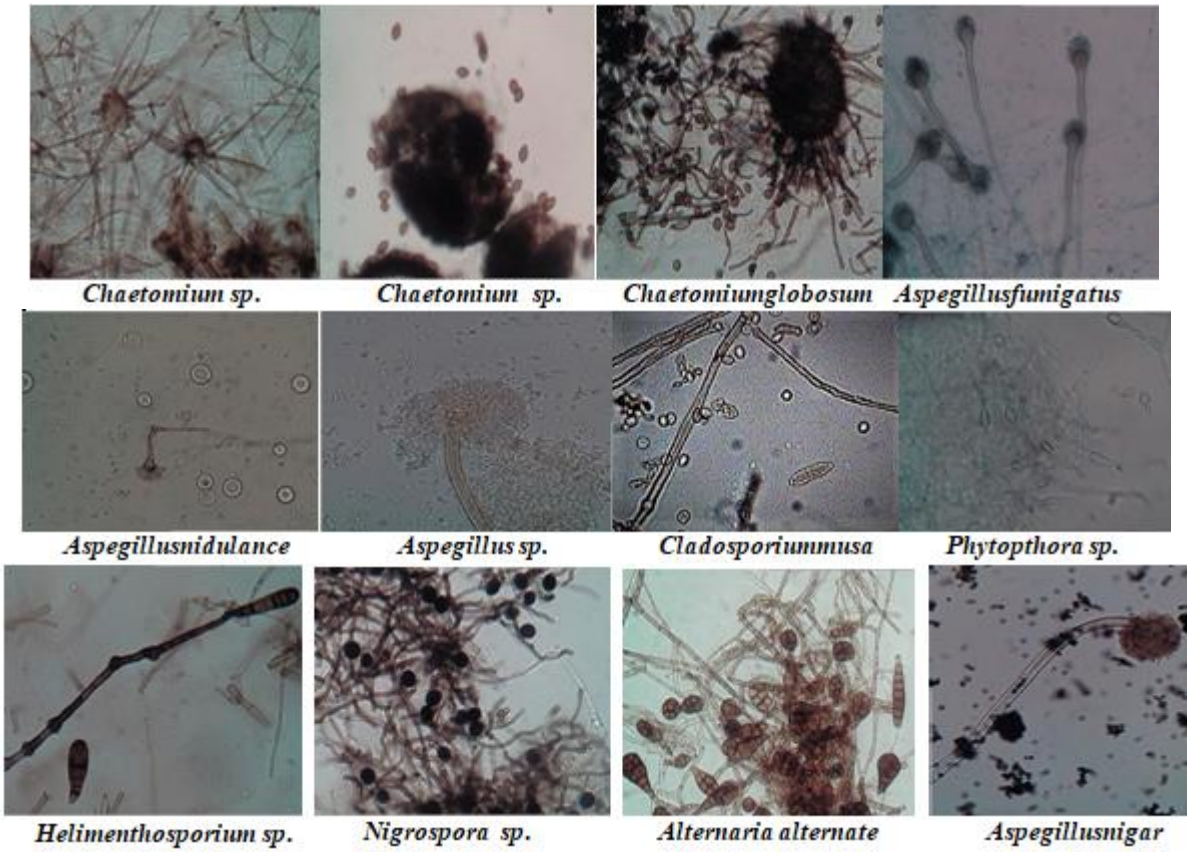
Species Evenness: Highest evenness was occurred in field no.1 and then it decreased as following sequences i.e. field no.7, field no.13, field no.15, field no.5, field no.2 It was equal range in field no.17 and field no.4 as well as in field no.8, field no.10, field no.16, field no.18.Lowest evenness recorded in field no. 12. (Table No. II).Highest evenness indicates low species diversity observed in fields

4. Conclusion

Present study revealed that, the percent contribution *Cladosporiummusa* (7.75%), *Fusariumoxysporum* (7.38%), *Fusariummoniliformia* (6.50%), *Verticillium sp*. (6.13%), *Aspergillusnigar* (5.46%), *Fusariumverticilliods* (4.65%) were maximum in all banana fields. As well as the statistical analysis of soilmycoflora clearly indicates that, species richness was high in field their fungal species diversity also high. On the other hand where species evenness was maximum there species diversity was less.



Photoplate 1: Fungal colonies of rhizosphere soil on PDA



Photoplate 2: Microscopic Structure of Isolated fungi

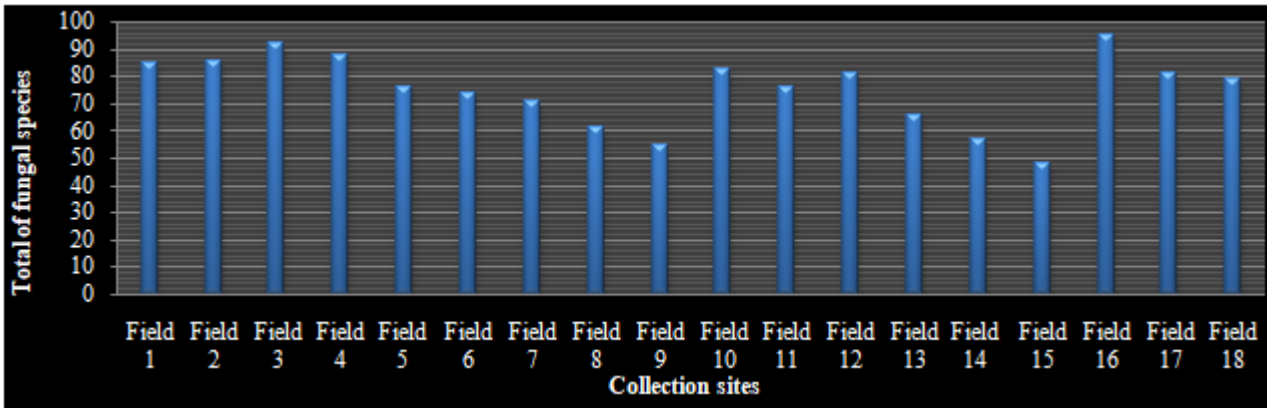


Figure 1: Total contribution of fungal species in each field

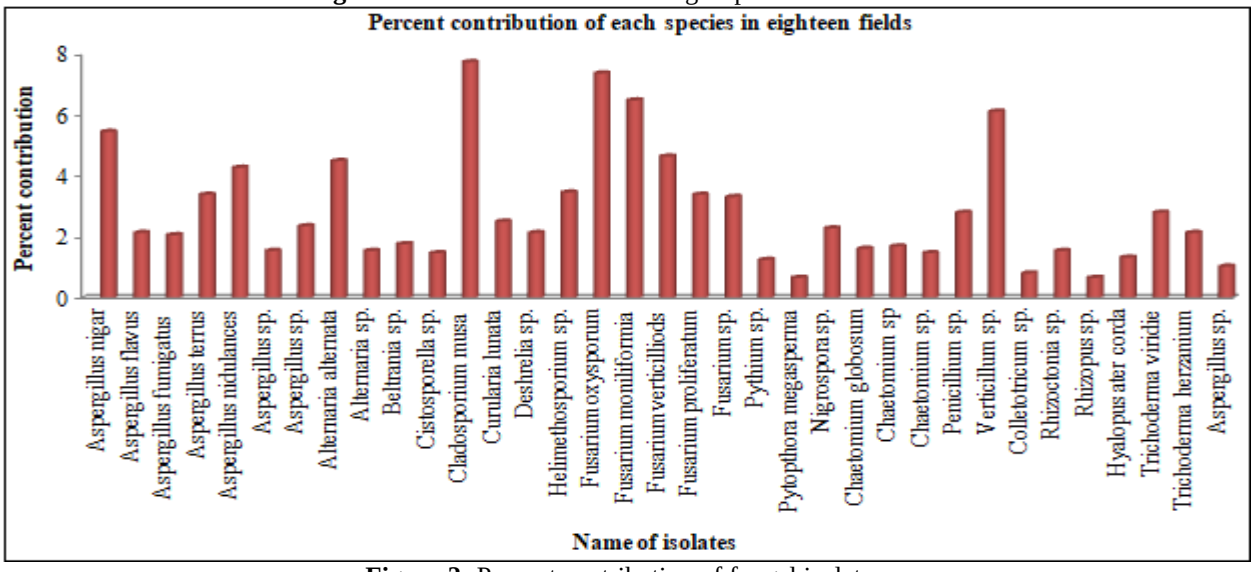


Figure 2: Percent contribution of fungal isolates

Table I: Season and Site of sample collection

Field No.	*Season*	*Collection site*	*Taluka*
Field 1	Rainy	Hatgaon	Chalisgaon
Field 2	Rainy	Hatgaon	Chalisgaon
Field 3	Rainy	Hatgaon	Chalisgaon
Field 4	Winter	Balad	Pachora
Field 5	Winter	Balad	Pachora
Field 6	Winter	Balad	Pachora
Field 7	Winter	Nagardeola	Pachora
Field 8	Winter	Nagardeola	Pachora
Field 9	Winter	Nagardeola	Pachora
Field 10	Winter	Savada	Pachora
Field 11	Winter	Savada	Pachora
Field 12	Winter	Savada	Pachora
Field 13	Rainy	Raver	Raver
Field 14	Rainy	Raver	Raver
Field 15	Rainy	Raver	Raver
Field 16	Summer	Vakod	Jamaner
Field 17	Summer	Vakod	Jamaner
Field 18	Summer	Vakod	Jamaner

Table 2: Statistical analysis of isolated soil fungi

Sr. No.	Sampling location	Species Richness	Shannon Diversity indices	Simpson Diversity indices	Eveness
1	Field 1	6.27	1.33	0.039	0.9907
2	Field 2	6.35	1.34	0.038	0.9709
3	Field 3	6.79	1.36	0.036	0.9611
4	Field 4	6.49	1.33	0.040	0.9636
5	Field 5	5.61	1.33	0.037	0.9767
6	Field 6	5.46	1.31	0.044	0.9491
7	Field 7	2.24	1.30	0.041	0.9832
8	Field 8	4.50	1.27	0.043	0.9605
9	Field 9	4.06	1.15	0.062	0.9551
10	Field 10	6.13	1.27	0.049	0.9605
11	Field 11	5.61	1.30	0.044	0.9547
12	Field 12	5.98	1.21	0.057	0.9462
13	Field 13	4.87	1.32	0.036	0.9833
14	Field 14	4.20	1.23	0.046	0.9619
15	Field 15	3.54	1.15	0.056	0.9778
16	Field 16	7.01	1.39	0.035	0.9605
17	Field 17	5.98	1.33	0.041	0.9636
18	Field 18	5.83	1.27	0.047	0.9605

References

[1] Ratna Kumar P.K., Hemanth .G, P. Shiny Niharikaand Samuel k kolli (2015), Isolation and identification of soil mycoflora in agricultural fields at Tekkali Mandal in Srikakulam District, *International Journal Of Advances In Pharmacy, Biology And Chemistry*, Vol. 4, No.2, PP.484-490.

[2] Sharma and Shrivastava (2017), Isolation and Characterization of PGPR from Rhizospheric Soil, *International Journal of Scientific & Engineering Research*, Volume 8, Issue 4, PP.54-58.

[3] Gnanasekaran, Mohamed Salique and Panneerselvam (2015), Isolation and Identification of Soil Mycoflora in Banana Field at Manachanallur, Tiruchirappalli Dt., Tamil nadu, India, *Int.J.Curr.Microbiol.App.Sci*, Volume 4, Number 7, pp. 729-740.

[4] Gaddeyya, G., Shiny, P., Niharika, Bharathi, P. and Ratna Kumar, P. K., (2012), Isolation and identification of soil mycoflora in different crop fields at SalurMandal. *Advances in Applied Science Research*, Vol.3 No.4, PP.2020-2026.

[5] Selman A, Waksman A. (1921), Method for counting the number of fungi in the soil. Vol.2, PP.339-340.

[6] Saravanakumar K, Kaviyaeasan V. (2010), Seasonal distribution of soil fungi and chemical proportion of montatne wet temperate forest type of Tamilnadu, *Journal of plant Science*, 2 4 (6).

[7] Nagmani (2006), Hand book of soil fungi-.

[8] Gillman, J.C., (1957), A Manual of Soil Fungi, Revised 2nd edition Oxford and IBH publishing company (Indian reprint) Calcutta, Bombay, New Delhi.

[9] Subramanian, C.V., (1971), Hypomycetes- An account of Indian species, Indian Counc. Agri. Res., New Delhi.

[10] Barnet C.J., (1972), The illustration of imperfect fungi,

[11] Saravanakumar K, et al. (2010), *African journal of plant science*Vol.4 (6), PP.191-196.

[12] NoynulAbedin, NuzhatAra M, Sohrab Ali M. Khalequzzaman (2011), Nematode diversity in banana Rhizosphere from northern districts of *Bangladesh, Journal of Bio- Science*, 19.

[13] Warcup J.H., (1950), The soil plate method for isolation of fungi from soil. Nature, Vol.166, PP. 117-117