Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.2408

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **4 (6):** 168-175 (2016)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Rhizosphere and Non-Rhizosphere Mycoflora of Som (*Persea bombycina* Kost.) with Physico-Chemical Properties of Soil from Goalpara District of Assam, India

Manjit Kumar Ray[1], Piyush Kumar Mishra[2] and Pradip Kumar Baruah[3]

[1]SRF, DBT-Biotech Hub, BN College, Dhubri, Assam & PhD scholar,
University of Science & Technology, Meghalaya-793101

[2]Assistant Professor, Dept. of Botany, BN College, Dhubri, Assam-783324

[3]HOD & Assoc. Prof., Dept. Of Botany, University of Science & Technology, Meghalaya-793101

*Corresponding Author E-mail: manjit_ray2002@yahoo.com

Received: 23.11.2016 | Revised: 3.12.2016 | Accepted: 5.12.2016

ABSTRACT

Muga Silkworm (Antheraea assamensis Helfer) that produces the golden silk primarily feed on two host plant namely Som (Persea bombycina Kost. Family-Lauraceae) and Soalu (Listea polyantha Juzz.). Goalpara district of Assam, India has given Geographical identification mark as its climate is suitable for silkworm rearing. As food plants play an important role for the growth and development of silkworm, hence a mycological study was conducted in rhizosphere and nonrhizosphere soil of Som in Goalpara district of Assam, India by using serial dilution and agar plating method. A total of 13 fungal species have been isolated from non rhizosphere soil while a total of 21 fungal species were identified from the rhizosphere soil. Rhizopus stolonifer, Aspergillus flavus and Penicillium chrysogenum were the dominant mycoflora during the study period. Rhizopus stolonifer were dominant in spring (25.5%), autumn (16.0%) and winter season (32.0%) while Aspergillus flavus were dominant myflora in summer season (20.5%). During Spring Rhizopus stolonifer (22.5%), Aspergillus flavus in summer (16.5%) and autumn (13.0%) and during winter Penicillium chrysogenum (13.0%) were the dominant fungal species of the rhizosphere soil. The physico-chemical properties such as P^H, Organic Carbon, available Nitogen, available Phosphorus, available Potassium, water holding capacity and moisture of the soil samples from 4 different places depending upon direction of the district were evaluated with its textures by standard sampling procedures. Seasonal variations of the fungal occurrence is observed for both the nonrhizoshphere and rhizosphere soil samples as well.

Key words: *Rhizosphere, non rhizosphere, mycoflora, physico-chemical properties, Goalpara*

INTRODUCTION

Fungi plays major important role in the soil ecosystem, which functions as the main decomposers of forest as well as involve in nutrient cycling , while few other species form mycorrhizal associations and can also act as harmful agents as plant pathogens. Plants root system is associated with various organic and inorganic substances with microbial communities.

Cite this article: Ray, M.K., Mishra, P.K. and Baruah, P.K., Rhizosphere and Non-Rhizosphere Mycoflora of Som (*Persea bombycina* Kost.) with Physico-Chemical Properties of Soil from Goalpara District of Assam, India, *Int. J. Pure App. Biosci.* **4(6):** 168-175 (2016). doi: http://dx.doi.org/10.18782/2320-7051.2408

The plant types, age of the plant and the soil influences the nature and number of mycoflora. Foster and Marks[16] observed the soil root interface through TEM and reported relationship that occurred among microorganisms, soil and roots. Bowen and Theodoros[9] reported that the surface of the 90 days old plant root contains more microorganisms (37%) than three weeks old plant root (10%). Soil pH, moisture content, Organic carbon, total nitrogen concentration, available K and topography also influences the fungal diversity[7,32].

Persea bombycina Kost. Commonly known as "Som" is the primary food plant of golden silk producing Muga silkworm (*Antheraea assamensis* Helfer.),which is endemic to Northeast India. Sericulture in Goalpara district of Assam, India existed almost as a practice among the people since a long time. The district is situated at a distance of 146 km from Guwahati, the capital city of Assam. The district covers an area of 1,824 sq. km and is located between latitudes 25.53 degree and 26.30 degree North and longitudes 90.07 degree and 91.05 degree east. The district has been given the geographical identification mark because its climate is suitable for silkworm rearing. The present study deals with the rhizosphere and non-rhizosphere mycoflora of som from Goalpara district of Assam during February, 2014 to January, 2015 with various physicochemical properties of different soil samples.

MATERIALS AND METHOD

The pH of the soil sample was determined in distilled water and 1N Kcl solution taking soil solution ratio of 1:1 using Systronics digital PH meter. The organic carbon percentage was determined by titration method as described by Walkley and Black[34]. Available Nitrogen was determined by Kjeldahl distillation method by Jackson[19]. Available phosphorus was determined by Bray's No.1 method[10]. Available potassium was determined by Toth and Prince[33] method. Water holding capacity was determined by using Lal[22] method. The moisture content was determined by gravimetric method[35]. The texture of the soil is determined by International pipette method by Black[8].

For microbiological studies, soil samples from various som plantation area were collected following standard sampling method. A total of 4 sites were selected depending upon the direction namely Budlung pahar on north, Lengopara on the south, Dorapara Agia on the east and Bhalukdubi on the west respectively for collecting the samples during the summer, Autumn and Winter seasons. For collection of rhizosphere soil sample each Som plantlet was carefully uprooted and the soil adhering to the roots was gently shaken into a strerile polythene bag; the bag was tied and labelled. The non rhizosphere soil samples were collected by digging a few centimeters deep into the field with a sterile hand trowel; the soil collected was then tied and labelled. Isolation and evaluation of microfungi from soil and rhizosphere will be done by serial dilution agar plating method[4]. The petridishes were inoculated at 26˚ C for 5 days and then the plates are examined for the development of fungal colonies. The isolated fungi were identified. The mycelia and spore characters of fungi were studied under microscope (Labomed, Germany) using Lactophenol cotton blue staining and with the help of " A manual of soil fungi by Gilman[18] and Illustrated genera of imperfect fungi by Baranatt[5].

Physicochemical properties of soil samples with its texture is tabulated in Table1. Observation of fungal isolates from Non-rhizosphere and rhizosphere of Som are presented in Table .2 & Table.3 respectively. Fig.1 represents the map of the study site, i.e the Goalpara district, Assam, India.

Fig.2 and Fig.2 represents statistical analysis of occurrence of both the non-rhizosphere and rhizosphere mycoflora in soil in four different seasons from Goalpara district of Assam, India.

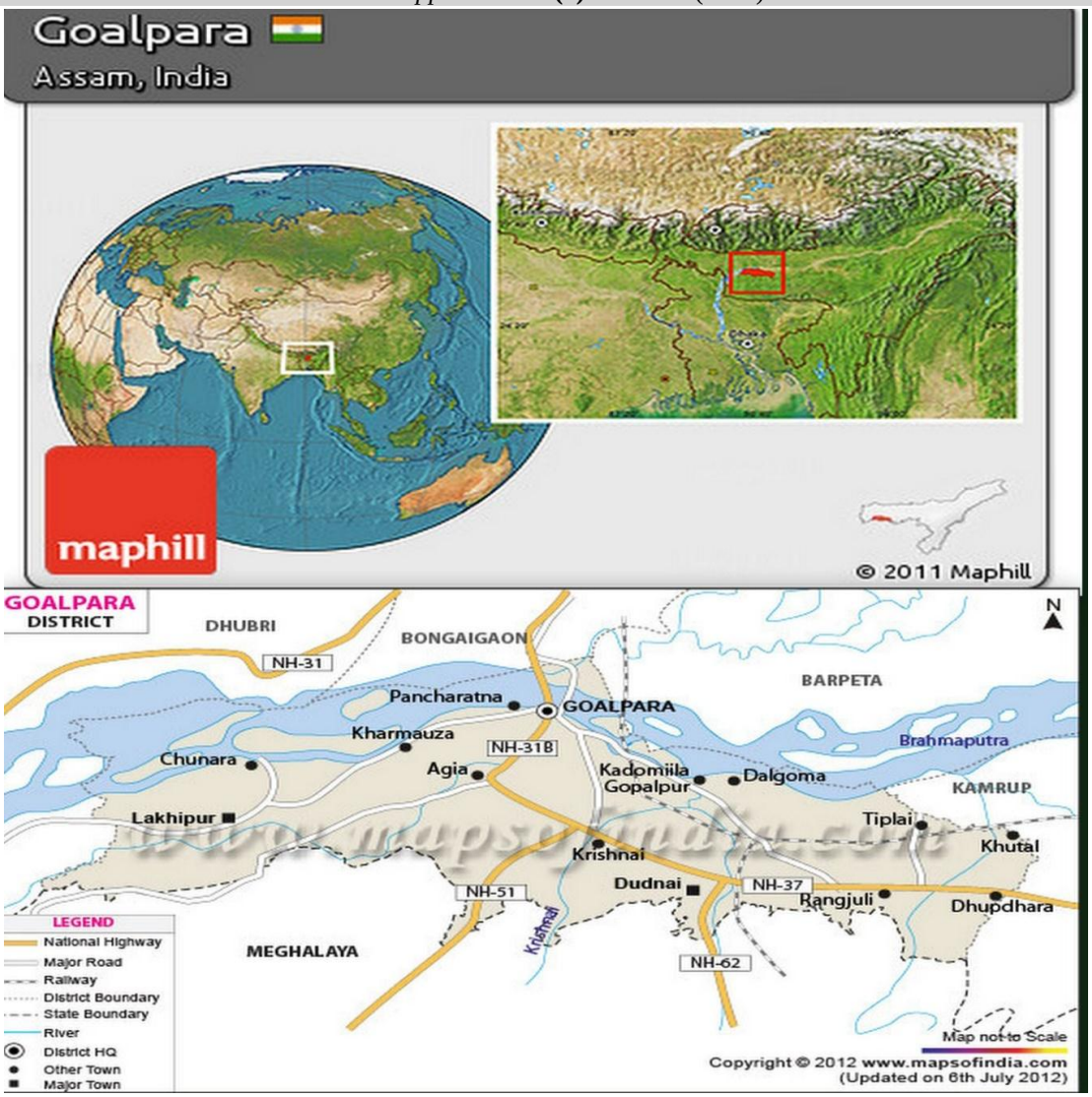

Fig. 1: Map of Goalpara district, Assam, India

Table1. Physico chemical properties of Soil of Goalpara district, Assam during Summer and winter season

Season	pH	O.C (%)	Av. N_2 (Kg/ha)	Av. P_2O_5 (kg/ha)	Av. K_2O (kg/ha)	Water Holding Capacity (%)	Moisture (%)
Summer	6.13±5	2.194	730.18	39.23	325.92	38.34	35.46
Winter	4.74±5	2.438	811.20	21.798	483.16	46.42	12.28

Texture:

Season	Sand %	Silt %	Clay %	Texture
Summer	9.51	54.21	36.27	Silty clay loam
Winter	10.63	55.25	34.10	Silty clay loam

Table 2. Frequency of Occurence (%) of fungal isolates in the Non-rhizosphere soil of Som

S.No.	Fungal isolates	% of occurrence of fungal isolates			
		Moonsoon (Feb-Mar-Apr)	Summer (May-June-Jul)	Autumn (Aug-Sep-Oct)	Winter (Nov-Dec-Jan)
1	*Aspergillus fumigatus*	0.0	20.0	12.50	12.0
2	*Trichoderma viridae*	8.50	10.0	6.5	0.0
3	*Rhizopus stolonifer*	25.50	15.0	16.0	32.0
4	*Penicillium chrysogenum*	10.50	8.0	10.0	15.0
5	*Saccharomyces cereviseae*	5.50	0.0	4.0	0.0
6	*Aspergillus clavatus*	0.0	5.50	0.0	0.0
7	*Aspergillus niger*	24.0	15.0	15.0	10.5
8	*Mucor hiemalis*	10.50	0.0	0.0	3.5
9	*Mycelia sterile (white)*	15.50	0.0	5.5	0.0
10	*Rhodotorula glutinis*	0.0	5.50	3.5	0.0
11	*Aspergillus flavus*	0.0	20.50	15.5	12.5
12	*Pestalotiopsis disseminata*	0.0	0.0	3.0	0.0
13	*Cladosporium cladosporioides*	0.0	0.0	8.5	15.0

Table 3. Frequency of Occurence (%) of fungal isolates in the Rhizosphere soil of Som

S.No.	Fungal isolates	% of occurrence of fungal isolates			
		Moonsoon (Feb-Mar-Apr)	Summer (May-June-Jul)	Autumn (Aug-Sep-Oct)	Winter (Nov-Dec-Jan)
1	*Rhizopus stolonifer*	22.5	8.0	5.5	8.5
2	*Mycelia sterile (white)*	7.0	5.0	0.0	2.0
3	*Aspergillus flavus*	0.0	16.5	13.0	7.5
4	*Aspergillus niger*	13.5	15.0	10.0	12.0
5	*Curvularia lunata*	3.5	5.0	9.5	2.0
6	*Fusarium oxysporum*	9.5	3.0	0.0	0.0
7	*Mucor hiemalis*	18.0	0.0	0.0	3.5
8	*Trichoderma viridae*	5.0	10.5	7.0	4.5
9	*Verticillium sp.*	2.0	0.0	0.0	0.0
10	*Penicillium chrysogenum*	5.0	8.0	12.0	13.0
11	*Aspergillus fumigatus*	0.0	8.0	11.5	6.0
12	*Aspergillus clavatus*	0.0	4.0	0.0	5.0
13	*Saccharomyces cereviseae*	4.0	3.0	3.5	0.0
14	*Geotrichum candidum*	2.0	0.0	0.0	0.0
15	*Rhodotorula glutinis*	3.5	7.0	0.0	2.5
16	*Alternaria 171lternate*	4.5	10.0	12.5	0.0
17	*Cladosporium cladosporioides*	0.0	0.0	8.0	12.5
18	*Rhizoctonia solani*	0.0	0.0	4.5	10.5
19	*Pestalotiopsis disseminata*	0.0	0.0	0.0	5.0
20	*Trichothecium sp.*	0.0	0.0	0.0	5.5
21	*Mycelia sterila (grey)*	0.0	0.0	3.0	0.0

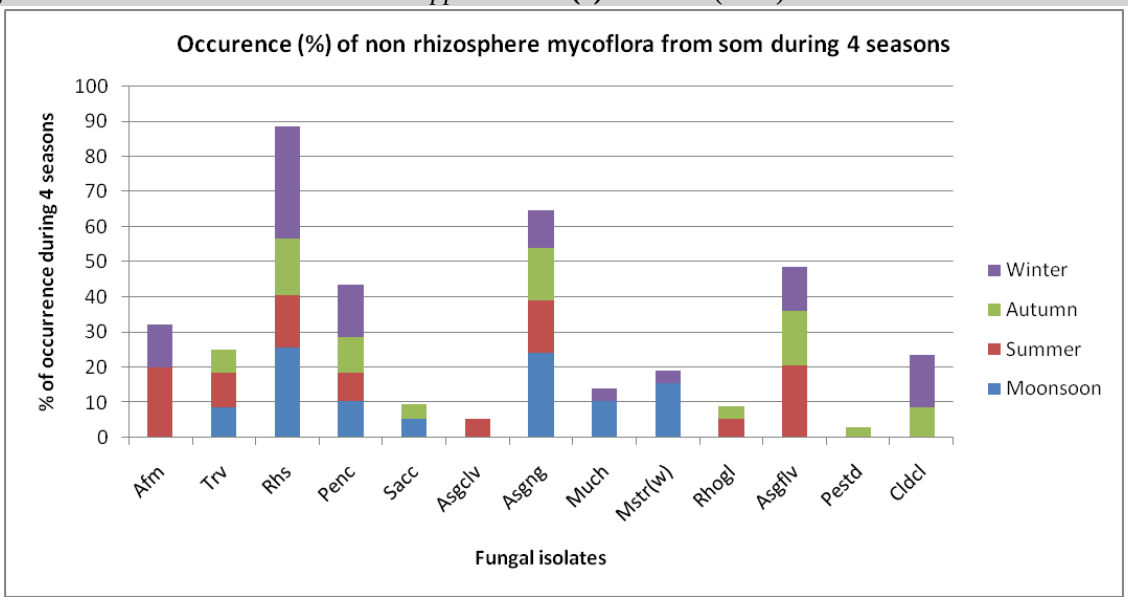

Fig.2: Occurence of fungal species from non-rhizosphere soil

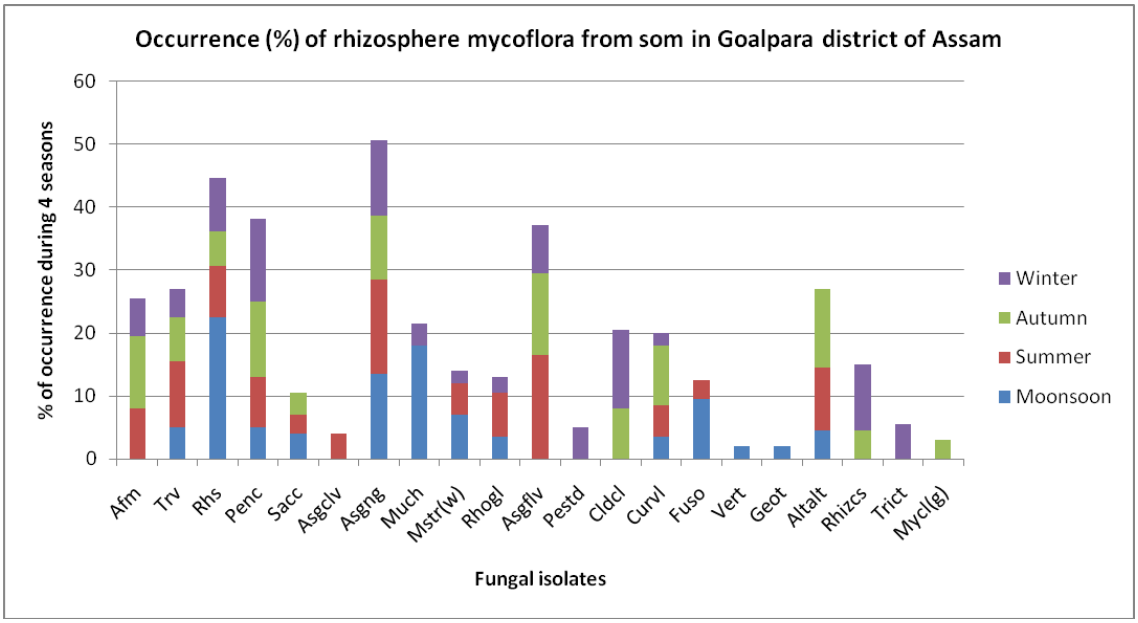

Fig.3: Occurence of fungal species from rhizosphere soil

Note: Afm- *A.fumigatus*, Trv- *T. viridae*, Rhs- *R. stolonifer*, Penc- *P. chrysogenum*, Sacc- *S. cereviseae*, Asgclv- *A.clavatus*, Much- *M. hiemalis*, Mstr(w)- *M. sterila* (white), Rhogl- *R. glutinis*, Asgflv- *A.flavus*, Pestd- *P.disseminata*, Cldcl – *C. cladosporioides*, Curvl- *C.lunata*, Fuso- *F.oxysporum*, Vert- *Verticillium sp*., Geot- *G. candidum*, Altalt- *A.alternata*, Rhizcs- *R. solani*, Trict- *Trichothecium sp*., Mycl(g)- *M. sterila* (grey)

RESULT AND DISCUSSIONS

During the study period, from the non rhizosphere soil of som plantation areas of Goalpara district of Assam, India, a total of 13 fungal species were isolated & identified based on colony morphology, spore structure & mycelia structure. *Rhizopus stolonifer* were the dominant mycoflora during monsoon (25.5%), autumn (16.0%) and winter season (32.0%). While during summer season occurrence of *Aspergillus flavus* were the highest (20.5%). Again from the Rhizosphere soil a total of 21

fungal species were isolated & identified based on colony morphology, mycelia structure. During monsoon season the dominant rhizosphere mycoflora were *Rhizopus stolonifer* (22.5%), while percentage of occurrence of *Aspergillus flavus* were dominant among other fungal group during summer (16.5 %) and autumn (13.0%). Again in winter season *Penicillium chrysogenum* (13.0 %) were the dominant rhizosphere mycoflora in the study area. Various factors of the soil such as PH, organic content ,water and moisture, topography greatly influences the fungal population and diversity[13,21,29,32,36,37]. It has been reported that the density of fungal population occurred during monsoon season when the soil moisture was significantly high. Few works have been carried forward by various workers on soil fungi in crop/agricultural fields and enlighted the importance of soil mycoflora[6,17,25,28,31]. Johri *et al.*[20] reported that several fungal species such as *Aspergillus sp*. can efficiently solubilise Phosphorus. Soil microorganisms are known to be effective in releasing phosphorous from inorganic complexes through solubilisation[26]. Dutta[15] reported that *Trichoderma viridae* and *Penicillium chrysogenum* controled the growth of *Verticillium* wilt in tomato plant. Hence *T.viridae* can be used as antagonist. Similar studies in soil mycoflora by Dalal[11] showed that *Aspergillus sp.*, *Rhizopus sp.* and *Penicilium sp.* were more prevalent in soil than other genera.

Microorganisms growing on the plant roots can influence plant growth positively or negatively[24]. The influence of exudates upon rhizosphere microorganisms varies with plant age[2,27] reported *Rhizopus stolonifer* , *A.niger* and *A.clavatus* were predominant in rhizosphere soil while *Penicillium oxalicum* and *Alternaria herbarum* were predominant in non rhizosphere soil only. On the other hand in our present study it were observed that *R.stolonifer*, *A.niger* & *Penicillium chrysogenum* were the dominant fungi in nonrhizosphere soil and *R.stolonifer*, *A.niger*, *Curvularia lunata*, *Trichoderma viridae* & *Penicillim chrysogenum* were the dominant fungal species in the rhizosphere soil. The seasonal variation of fungi is clearly observed during the study period.

Acknowledgement

Financial assistance from Department of Biotechnology, Govt. Of India is gratefully acknowledged.

REFERENCES

1. Abdul-Hafez, S.I.I., Rhizosphere & rhizoplane fungi of T.vulgare cultivated in Saudi Arabia. *Mycopathologia*, **78:** 70-79 (1982).
2. Abdul Rahim, A.M., A.M. Baghadami and M.H.Abdalla, Studies on the fungus flora in the rhizosphere of sugar cane plants.*Mycopathologia*, **81:** 183-186 (1983).
3. Adhikari R.S. and Tiwari A., Some experimental studies of phylloplane and litter fungi of *Quercus semicarrufolia. J. Ind. Bot. Soc.* **70:** 129-134(1991).
4. Atlas, R.M. and Parks, L.C., Handbook of microbial media. 2nd ed. C press; Boca Raton (1997).
5. Baranatt, H.L., Illustrated Genera of Imperfect Fungi . 2nd Ed, Published by Burgess Publishing Co. (1960).
6. Behera, B.C., Mishra, R.R., Thatoi, H.N., Diversity of soil fungi from mangroves of Mahanadi delta, Orissa, *India. J. Microbiol. Biotech. Res*., **2(3):** 375-378 (2012).
7. Bhattacharyya, P.N. and Jha, D.K. Seasonal and depthwise variation in microfungal population numbers in Nameri forest soil, Assam, Northeast India. *Mycosphere*, **2(4):** 297-305 (2011).
8. Black, C.A., Method of Soil analysis. Vol. 1., Am.Soc. Agron., Madison Wisconsin, USA(1965).
9. Bowen, G.D. and Theodorou, C., Growth of ectomycorrhizal fungi around seeds and roots. In: G.C. Marks and T.T. Kozlowski (Editors), Ectomycorrhizae: Their Ecology and Physiology. Academic Press, New York, NY, pp. 107-150 (1973).

10. Bray, R.H. and Kurtz, L.T., Determination of total organic and available forms of Phosphorus in soils. *Soil Science*, **59:** 39-45 (1945).
11. Dalal, L.P., Incidence and diversity of soil mycoflora of Wardha (M.S) area. *Int. J of Life Sc. & Pharma Res*., **4(4):** 15-20 (2012).
12. Dickinson, C.H. and Preece, T.F., "Microbiology of Aerial plant surface" A.P. London (1976).
13. Dong, A.R., Lv, G.Z., Wu, Q.Y., Song, R.Q., Song, F.Q., Diversity of soil fungi in Liangsshui natural reserve, Xiaoxing'anling forest region, *J. Northeast Forestry University*, **32(1):** 8-10 (2004).
14. Dubey, R.C. and Dwivedi, R.S., Fungitoxic properties of some plant extracts against vegetative growth and sclerotial viability of *Macrophomina phaseolina*. *Indian Phytopath*., **44(3):** 411-413 (1991).
15. Dutta, B.K., Studies on some fungi isolated from the rhizosphere of tomato plants and the consequent prospect for the control of *Verticillium* wilt. *Plant and Soil*. **63(2):** 209-216 (1981).
16. Foster, R.C. and Marks, G.C., Observations on the mycorrhizas of forest trees. II. The rhizosphere of *Pinus radiata* D. Don. *Aust. J. Biol. Sci*., **20:** 915-926 (1967).
17. Gaddeyya, G.S., Niharika, P., Bharathi, P.R., Kumar, P.K., Isolation & identification of soil mycoflora in different crop fields at salur mandal, *Adv. Appl. Sci. Res*., **3(4):** 2020-2026 (2012).
18. Gilman Joseph Charles A manual of soil fungi. Published by Printwell. Goswami Chandrama and Manisha Bhattacharya. (2013). Contribution of Sericulture to Women's Income in Assam -A Case Study in Goalpara District of Assam, India. *International Journal of Scientific and Research Publications*, **3(3):** (1995).
19. Jackson, M.L., Soil chemical analysis. Prentice Hall of India Private Limited, New Delhi, 1978 (1958).
20. Johri B.N., Sharma A., Virdi J.S., Rhizobacterial diversity in India and its influence on soil and plant health. *Adv. Biochem Eng. Biotechnol*. **84:** 49-89 (2003).
21. Jha, D.K., Sharma, G.D., Mishra, R.R., Ecology of soil microflora and mycorrhizal symbionts in degraded forests at two altitudes, *Biol. Fert. Soils*, **12:** 272-278 (1992).
22. Lal R., Physical properties and moisture retention characteristics of some Nigerian soils, *Int. Inst. trophi. Agri*., Ibadan, Nigeria, **8(1):** 1350 (1977).
23. Leben, C., Epiphytic microorganisms in relationship to plant diseases. *Annl. Rev. Phytopathology*, **3:** 209-230 (1965).
24. Liljeroth, E. and Baath, E., Bacteria and fungi on the roots of different barley varieties (*Hordeum vulgare* L.). *Biol. Fert. Soils*., **7:** 53-57 (1988).
25. Mahalingam, R., Bharatidashan, R., Ambikapathy, V.V., Panneerselvam, A., An investigation of the soil mycoflora in sugarcane field of Dharmapuri district, Tamilnadu, *Adv. Appl. Sci. Res.* **3(3):** 1255-1261 (2012).
26. Mwajita, M.R., Murage, H., Tani, A. and Kahangi, E.M., Evaluation of rhizosphere, rhizoplane & phyllosphere bacteria & fungi isolated from rice in Kenya for plant growth promoters. *Sprigerplus*, **2:** 606 (2013).
27. Oyeyiola, G.P. Rhizosphere mycoflora of Okro (*Hibiscus esculentus*). *Res. Journal Of Soil Biol.*, **1(1):** 31-36 (2009).
28. Prince, L., Prabhakaran, P., Studies on the soil mycoflora from the sugarcane field in Thanjavur district, Tamilnadu, *J. Microbiol.Biotech. Res.*, **2(1):** 63-69 (2012).
29. Rangaswami, G., and Bagyaraj, D.J., Agricultural microbiology, 2nd edition, published by prentice hall of India Pvt. Limited. (1988).
30. Sinha, S., Microbiological complex of the phyllosphere and disease control. *Indian Phytopathology* **18:** 1-20 (1965).

31. Sharma, M.S. and Raju, N.S., Frequency & percentage of occurrence of soil mycoflora in different crop fields at HD Kote of Mysore district. *Int. J. Env. Scs.* **3(5):** 1569-1576 (2013).
32. Tsai, S.H., Selvam, A., Yang, S.S., Microbial diversity of topographical gradient profiles in Fushan Forest soils of Taiwan. *Ecological research*, **22:** 814-824 (2007).
33. Toth, S.J. and Prince, A.L., Estimation of cation exchange capacity and exchangeable Ca, K and Na content of Soil by flame photometer technique, *Soil Sci.* **67:** 439-445 (1949).
34. Walkley, A. and Black, I.A., An examination of Degtjareff method for determining soil organic matter and a proposed modification of the chromic acid titration method. *Soil Sci.* **37:** 29-37 (1934).
35. Wilde, S.A., Corey, R.B., Iyer, J.G. and Viogt., G.K., Soil and plant analysis for tree culture, Oxford and IBH pub. Co. New Delhi (1985).
36. Yu, C., Lv, D.G., Qin, S.J., Du, G.D., Liu, G.C., Microbial flora in *Cerasus sachaliensis* rhizosphere, *Chinese J. Appl. Ecol.*, **18(10):** 2277-2281 (2007).
37. Zhang, C.B., Jin, Z.X., Li, J.M., Diversity of bacterial physiological groups and microbial flora in the soil of eight forest types of Tiantai Mountain, Zhejiang, *Biodiversity Sci.*, **9 (4):** 382-388 (2001).