IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 3, March 2022
Impact Factor: 6.252

Effect of Inoculation of Arbuscular Mycorrhizal Fungi on 'P' Uptake and N Content Activity in *Tephrosia purpurea* (L.) Pers.

N. B. Mane[1] and C. J. Khilare[2]
P.G. and Research Department of Botany, Yashavantrao Chavan Institute of Science, Satara[1]
S. M. Joshi Mahavidyalaya, Hadapsar Pune[2]
Corresponding Author: E. Mail: nbmane123@gmail.com

Abstract: *Tephrosia purpurea (L). Pers belongs to family fabaceae studied for their association of Arbuscular Mycorrhizal fungi. Test plant was grown in permanently drought prone area of Man Tahasil (Dahiwadi) from Satara District of Maharashtra India. The present study deals with the effect of inoculation of Arbuscular Mycorrhizal fungi on Nitrogen content and uptake of Phosphorus in Tephrosia purpurea. Inoculation of Arbuscular Mycorrhizal fungi attributed a significant increase in Nitrogen content and Uptake of Phosphorus at 90 and 135 days Plant. The increase in Nitrogen content and uptake of Phosphorus were recorded with inoculation of Acaulospora deligata compare to Glomus geosporum, Glomus fasciculatum, Glomus dimorphicum over uninoculated control.*

Keywords: *Tephrosia purpurea* (L). Arbuscular Mycorhizal fungi, *Acaulospora deligata*, Nitrogen, Phosphorus

I. INTRODUCTION

Dahiwadi is growing site of cultivated plant in Man Tahsil of Satara District in Maharashtra State, India. It is located 67 KM towards East from District headquarters Satara. Study site included under permanently drought prone area of Satara District in Paschim Maharashtra in India.

Vescicular Arbuscular Mycorrhizae are associated with almost all plants in nature Haymon, (1982). The host plants were being able to absorb phosphate and other minerals more efficiently due to Arbuscular Mycorrhizal association. Has been attributed from time to time in different host plants growing in phosphorus deficient soil, Bagyaraj, (1986). Arbuscular mycorrhizal (AM) fungi are ubiquitous obligate mycobionts forming symbiosis with terrestrial plants, Burea and Jefferies, (1995). AMF improve plant nutrition by increasing the availability as well as translocation of various nutrients Rouphael et al., (2015).

Numerous reports describe improved resistance to a variety of stresses including drought, salinity, herbivory, temperature, metals, and diseases due to fungal symbiosis, Rodrigues et al., (2008); Ahanger et al., (2014); Salam et al., (2017). The importance of other soil microorganism for plant growth is well documented by different researchers in recent days, Harley and Smith, (1997), Bagyaraj, (2006), Lakshman 2009, 2012. Mane et al., (2013), (2016). Arbuscular Mycorrhizal (AM) fungi play a major role in soil fertility, nutrient acquisition specifically uptake of Phosphorus nitrogen from soil and thereby enhancing plant vigour.

Many researcher recorded AM fungi are known to improve the nutritional status of the host, particularly that of Phosphorus and Nitrogen enhance their growth. Bagyaraj and Verma, (1995), Bagyaraj, (2007). However, in order to known the possible synergid effect of the AM fungi on plant growth Nitrogen uptake, Nitrogen content in shoot of *Tephrosia purpurea* L. Pers was undertaken.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 3, March 2022
Impact Factor: 6.252

II. MATERIAL METHODS

Soil Sample collection:

Soil samples were collected from rhizosphere of *Tephrosia purpurea* growing places. Process was done with soil digging with small amount of soil close to the plant roots up to 20 cm depth, collected soil samples were preserved in sterilized Ziplock polythene bag and kept in refrigerator 4o C for further process.

Arbuscular Mycorrhizal Fungi isolation and its identification:

The soil samples were collected in sterile zip lock polythene bags. AMF were isolated from rhizosphere soil by wet sieving and decanting method of Gerdemann and Niccolson, (1963). Intact AM spore were examined under binocular stereo microscope and identified spores with size shape and wall layers and hyphal attachments using the species descriptions given by INVAM and manual of Schenck and Peerez, (1990).

Nitrogen content of shoot and fruit:

Nitrogen content of shoot was determined at 90 and 135 days after transplanting by Micro-kjeldal's digestion and distribution method (Jackson, 1973).

Phosphorus uptake of shoot and fruit:

Phosphorus uptake of shoot was determined at 90 and 135 days after transplanting by Vanadomolybdate yellow colour method using Spectronic -20 (Jackson, 1973).

IV. RESULT AND DISCUSSION

Nitrogen content (%):

The results on shoot nitrogen content of *T. purpuria* at 90 and 135 days are given in Table.1 and Fig. 1. Maximum nitrogen content of shoot was recorded by inoculation treatment of *Acaulospora deligata* 6.82±0.15 % and minimum N count by *Glomus dimorphicum* 4.82±0.15 %. It was followed by *Glomus geosporum* 6.64±0.16 %, *Glomus fasciculatum* 5.37±0.04 % and over control 1.84±0.15 %.

Inoculated plants exhibited higher concentration of nitrogen content at 135 days. The nitrogen concentration in shoot of the plant inoculated with *Glomus geosporum* was found to be maximum 8.34±0.38 %. It was supported by the inoculation treatment of *Acaulospora deligata* 7.89±4.66 % *Glomus dimorphicum* 6.54±0.31 % and *Glomus fasciculatum* 6.07± 0.44% over uninoculated samples 2.55±0.27 %.

Nitrogen Uptake:

At 90 days stage, uptake of nitrogen was recorded maximum with the inoculation of *Acaulospora deligata* 74.53 ± 2.11 mg and minimum due to *Glomus geosporum* (55.69 ± 1.75mg) followed by *Glomus fasciculatum* 67.36 ± 1.99 mg. The shoot nitrogen content supported with *Glomus dimorphicum* showed 66.66±1.70 mg of Nitrogen uptake. Showed more Nitrogen uptake than control 52.31 ± 4.40 mg.

The maximum nitrogen uptake of shoot by the inoculation of *Acaulospora deligata* showed 161.80±1.54mg of N uptake at 135 days. The treatments of the AMF viz. *Glomus dimorphicum* with 149.49 ± 2.07 mg, *Glomus fasciculatum*137.96 ± 2.19 mg nitrogen uptake quantities in decreased order but more than control 103.84±59.96 mg.

Table 1. Effect of VAM inoculum treatments on Nitrogen content and N uptake in *T. purpuria*

T	AM treatement	N-content at 90 days (%) (Shoot)	Total N Uptake Mg/plant at 90 days	N-content at 135 days (%) (Shoot)	Total N Uptake Mg/plant at 135 days
	Control	1.84 (0.15)	52.31 (4.40)	2.55 (0.27)	103.84 (59.96)
T1	*Acaulospora deligata*	6.82 (0.15)	74.53 (2.11)	7.89 (4.66)	161.80 (1.54)

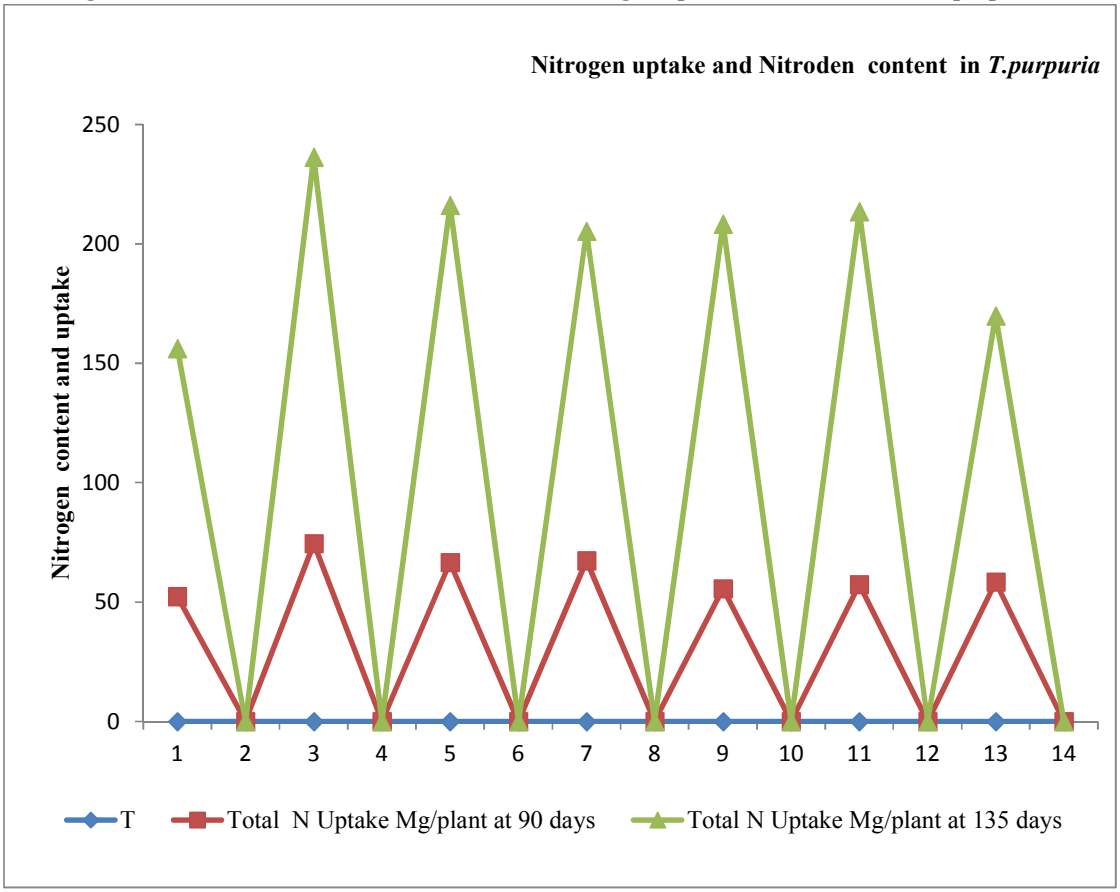
IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 3, March 2022
Impact Factor: 6.252

T2	*Glomus dimorphicum*	4.82 (0.15)	66.66 (1.70)	6.54 (0.31)	149.49 (2.07)
T3	*Glomus fasciculatum*	5.37 (0.04)	67.36 (1.99)	6.07 (0.44)	137.96 (2.19)
T4	*Glomus geosporum*	6.64 (0.16)	55.69 (1.75)	8.34 (0.38)	152.61 (0.95)

* Values are means of three replications Mean values (Mean ± S.D.)

C-Control, T1- *Acaulospora deligata,* T2- *Glomus dimorphicum*
T3- *Glomus fasciculatum,* T4- *Glomus geosporum,*

Fig. 1: Effect of VAM inoculum treatments on Nitrogen uptake and N content of *T. purpuria:*



Phosphorus content (%):

The results mentioned in Table 1 and Fig. 1 reflect maximum phosphorus content at 90 days of shoot with the inoculation treatment of *Glomus geosporum* 0.431±0.06 % followed by *Glomus fasciculatum* 0.365±0.079 % and *Acaulospora deligata* 0.348±0.03 % and minimum in control (0.184±0.11 %).

Phosphorus Uptake:

The data depicted in Table 1. and Fig. 1 on the effect of AM fungi on phosphorus uptake at the end of 90 days showed the highest shoot nitrogen uptake in plants inoculated with *Acaulospora deligata* 4.42±0.25 mg. It was followed by

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 3, March 2022
Impact Factor: 6.252

Glomus fasciculatum 4.18 ±0.20 mg), *Glomus dimorphicum* 3.46± 0.01 mg over control 2.40±0.27 mg. At 90 days phosphorus content noticed between 2.81 and 4.42 mg. Minimum P uptake recorded due to treatment of Glomus *geosporum*2.81±0.62mg.

Effect of AM fungi on Phosphorus uptake after 135 days showed higher concentration in shoot by *Glomus fasciculatum* 8.75±0.61 mg and lowest concentration in non-treated 3.44 ± 0.33n mg. However, *Glomus dimorphicum* exhibited maximum phosphorus uptake 7.10 ± 0.60 mg followed by *Glomus geosporum* 6.15 ± 0.58 mg, and *Aculospora deligata* 5.29 ± 0.54 mg in descending order.

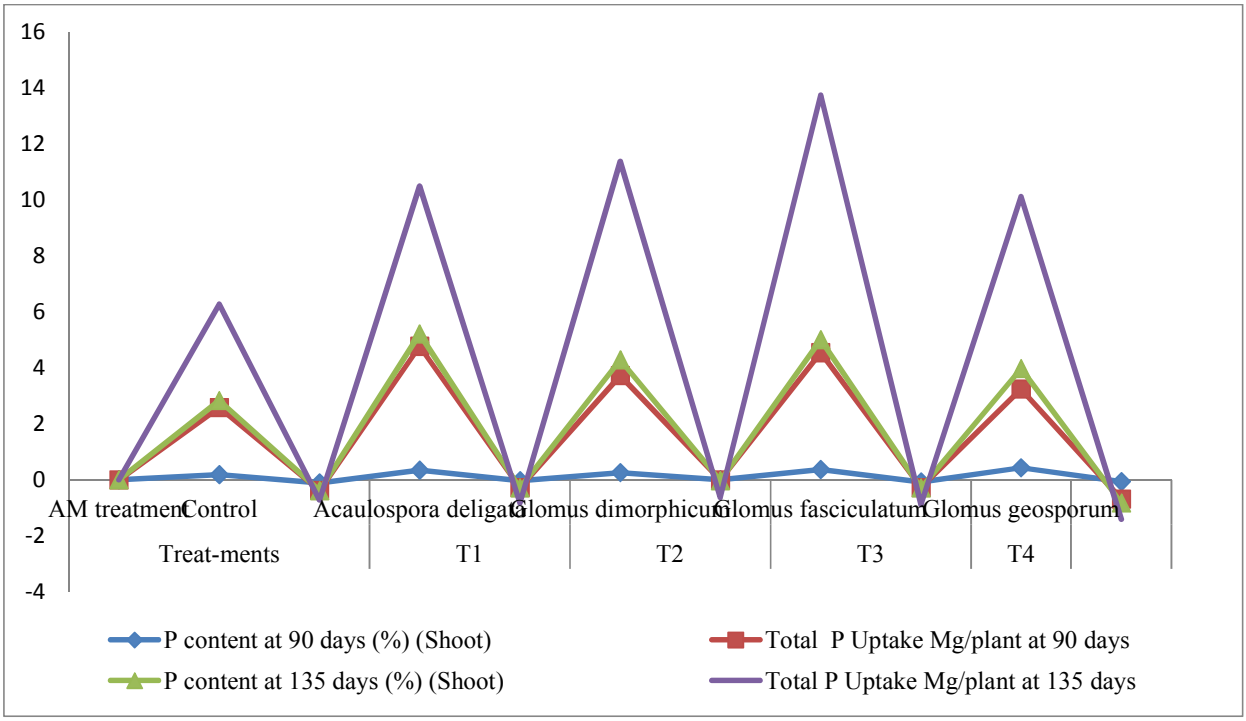
Table 2. : Effect of VAM inoculum treatments on Phosphorus content and P uptake of *T. purpuria*

Treat-ments	AM treatment	P content at 90 days (%) (Shoot)	Total P Uptake Mg/plant at 90 days	P content at 135 days (%) (Shoot)	Total P Uptake Mg/plant at 135 days
	Control	0.184 (0.11)	2.40 (0.27)	0.25 (0.01)	3.44 (0.33)
T1	*Acaulospora deligata*	0.348 (0.03)	4.42 (0.25)	0.44 (0.01)	5.29 (0.54)
T2	*Glomus dimorphicum*	0.259 (0.007)	3.46 (0.010	0.56 (0.03)	7.10 (0.60)
T3	*Glomus fasciculatum*	0.365 (0.079)	4.18 (0.20)	0.46 (0.01)	8.75 (0.61)
T4	*Glomus geosporum*	0.431 (0.068)	2.81 (0.62)	0.73 (0.14)	6.15 (0.58)

* Values are means of three replications Mean values (Mean ± S.D.)

C-Control, T1- *Acaulospora deligata,* T2- *Glomus dimorphicum* T3- *Glomus fasciculatum,* T4- *Glomus*

Fig 2: Effect of VAM inoculum treatments on Phosphorus content and P uptake of *T. purpuria*



IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 3, March 2022
Impact Factor: 6.252

V. DISCUSSION

Studies on Nitrogen content and N uptake and Phosphorus content and uptake in *T. purpuria* at 90 and 135 days was attributed with N, P uptake and content in *Capsicum annum* showed growth of plant increases with Phosphorus content on soil Paula et al., (1992). The positive effect of AM fungi inoculation is mainly attributed with improved root development and increase in rate of water and mineral uptake. Our results are corroborate with the results of Koomen et al., (1987), Gurumurthy and Srinivasa, (1996); Siverding, 1998; Laksman, (2012). No of researcher attributed that the synergid affects of AM fungi with respect to their combined beneficial impact on plants, Trappe, (1987). Our findings are also supports the result of Zhu et al., (2000). The some AM fungi may be preferentially associated with particular plant species and helps the host plant to get better nutrient status. In the present investigation *Acaulospora deligata, Glomus dimorphicum, Glomus fasciculatum* and *Glomus geosporum* species tested were found to be the most beneficial foe excellent growth. Nutritional responses and economic yield in *T. Purpuria* production under protected condition.

VI. CONCLUSION

Supply of FYM and Phosphorus every time to Plant improved NPK and protein content of crop and maintain soil fertility. Cultivation of medicinal weed plant withought phosphorus fertilization drastically decreases available P status of Soil. AM fungi are the best option for chemical fertilizer.

ACKNOWLEDGEMENT

The authors are thankful to honorable Director Dr. B. T. Jadhav of Rayat Shikshan Sanstha's Yashvantrao Chavan Institute of Science, Satara (Autonomous) and Head, Department of Botany, for their constant support and facilities provided.

REFERENCES

[1]. B. Mosse, (1973) Advances in the study of vesicular-arbuscular mycorrhiza. Ann. Rev. Phytopathology, 11, 171-196.

[2]. D. J. Bagyaraj (2007). Arbuscular mycorrhizal fungi and their role in Horticulture. In: Recent trends in horticultural biotechnology. Keshavchandran et al. (Eds.), p. p: 53-58

[3]. D. J. Bagyaraj, (1986). Mycorrhizal association in crop plants and their utilization in agriculture. In: Beneficial fungi and their utilization. Nair, M.C. and Balakrishnan, S. (eds), Scientific Publ. Jodhpur, India, Pp. 59 72.

[4]. D. J. Bagyaraj, (2006). Arbuscular mycorrhizal fungi in sustainable agriculture. In: Techniques in Mycorrhizae Eds. Bukhari, M.J., and B.F. Rodrigues, Department of Botany. Govt. College. Quepem, Goa- India. pp. 1-8.

[5]. D. S. Hayman, 1982. Practical aspects of VAM. In: Advances in agricultural microbiology. Subba Rao, N.S. (Ed). New Delhi Oxford, IBA, Pp. - 325 373. Powell, C.L.,

[6]. E. A. Salam, A. Alatar, M. A. El-Sheikh, (2017). Inoculation with arbuscular mycorrhizal fungi alleviates harmful effects of drought stress on damask rose. Saudi J. Biol. Sci. 25 (8), 1772–1780. doi: 10.1016/j.sjbs.2017.10.015

[7]. E. Sieverding, (1998). Should VAM inocula for cassava contain single or several fungal species? Proceedings of 2nd European symposium on mycorrhizae. Czechoslovakia: pp 98.

[8]. Endomycorrhizas. Academic Press, London, pp 495-509

[9]. H. C. Lakshman, (2012). Techniques in mycorrhizal studies. In: Glimpses of Arbuscular Mycorrhiza Fungal Research. LAMBERT Academic Publishing, Germany. pp 5-14.

[10]. Koomen, C. Grace, D. S. Hayman, (1987). Effectiveness of single and multiple mycorrhizal inoculations: growth of clover and strawberry plants at two soil pH. Soil Biology and Biochemistry 19 (5), pp 539- 544.

[11]. INVAM (2018) International culture collection of (vesicular) arbuscular mycorrhizal fungi. West Virginia University, Morgantown

[12]. J. M. Barea and P. Jefffferies (1995). Arbuscular mycorrhizhas in sustainable soil plant systems. In: B Hock and A. Verma (eds) Mycorrhiza, structure, Functions, Molecular Biology and biotechnology. Springer-Verlag, Heidelberg 521-559.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 3, March 2022
Impact Factor: 6.252

[13]. J. M. Trappe, (1987). Phylogenetic and ecologic aspects of mycotrophy in the Angiosperms from an evolutionary standpoint. In: Ecophysiology of VA Mycorrhizal Plants (Ed. By G. R. Safir). pp 5-25. CRC Press, Boca Raton, Florida

[14]. J. M. Trappe. (1987). Phylogenetic and ecologic aspects of mycotrophy in the Angiosperms from an evolutionary standpoint. In: *Ecophysiology of VA Mycorrhizal Plants* (Ed. By G. R. Safir). pp 5-25. CRC Press, Boca Raton, Florida.

[15]. J. W. Gerdemann 1968. Vesicular arbuscular mycorrhiza and plant growth. Annu. Rev. Phytopathol. 6: 397-418

[16]. J.W. Gerdemann, T.H. Nicolson, 1963. Spores of mycorrhizal Endogone species extracted from soil by wet sieving and decanting. Trans. Br. Mycol. Soc., 46: 235 246.

[17]. Lakshman, H. C. (2009). AM Fungi with rhizosphere soil influence on Jatropha curcas L. Int. J. Plant Sci.1(1), pp 120-123.

[18]. Lakshman, H. C. (2012). Techniques in mycorrhizal studies. In: Glimpses of Arbuscular Mycorrhiza Fungal Research. LAMBERT Academic Publishing, Germany. pp 5-14.

[19]. M. A. Ahanger, S. R. Tyagi M. R. Wani, P. Ahmad (2014). "Drought tolerance: role of organic osmolytes, growth regulators, and mineral nutrients," in *Physiological mechanisms and adaptation strategies in plants under changing environment*, vol. 1 . Eds. Ahmad P., Wani MR. (New York, NY: Springer;), 25–55. 10.1007/978-1-4614-8591-9_2 [CrossRef] [Google Scholar

[20]. M. L. Jackson, (1973). Soil Chemical Analysis, Prentice Hall of India Pvt, Ltd. New Delhi.

[21]. N. B. Mane, C. J. Khilare and Y. T. Shinde. (2016). Influence of arbuscular mycorrhizae on growth of *Tephrosia purpurea* (L.) pers. international journal of researches in biosciences, agriculture and technology © vishwashanti multipurpose society (Global Peace Multipurpose Society) R. No. MH-659/13(N). Vol. 4 (1), Jan 2016: 198-200

[22]. N. B. Mane, D. D. Namdas and C. J. Khilare (2013). Studies on AM fungi in Withania somnifera (L.) Dunal. Proceding of National conference on "Plant biotechnology for Agriculture Development and Human Welfare. P.P.66.

[23]. R. J. Rodriguez, J. Van Volkenburgh Henson, E., Hoy, M., Wright, L., Beckwith, F., et al. (2008). Stress tolerance in plants via habitat-adapted symbiosis. Int. Soc. Microb. Ecol. 2, 404–416. doi: 10.1038/ismej.2007.106

[24]. S. B. Gurumurthy, and M. N. Sreenivasa, (1996). Response of Chilli to different inoculum levels of Glomus macrocarpum in two soil types of Karnataka. Karnataka Journal of Agricultural Sciences, 9, pp 154-159

[25]. Y. Rouphael P. Franken C., D., Schneider Schwarz, M. Giovannetti, M. Agnolucci. (2015). Arbuscular mycorrhizal fungi act as bio-stimulants in horticultural crops. Sci. Hort. 196, 91–108. 10.1016/j.scienta.2015.09.002

PROFILE

Dr. N. B. Mane
Associate Professor
Department of Botany,
Rayat Shikshan Sanstha's
Yashvantrao Chavan Institute of Science, Satara (Autonomous) (M. S.)