Biological Forum – An International Journal 14(1): 131-135(2022)

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Effect of different Fungicides against Collar Rot of Groundnut (*Arachis hypogaea* L.) caused by *Aspergillus niger* Van Tiegham

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(Received 01 October 2021, Accepted 07 December, 2021)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: Groundnut is an economic important edible oilseed crop. Seed and soil borne pathogens are the major constraints in production of groundnut, causing poor germination and early mortality of seedling. Collar rot is one of the most destructive diseases of groundnut. To develop effective management strategies for this menacing disease using the different studies such as *in vitro* evaluation of fungicides and field management through seed dressing fungicides were taken. The result revealed that *in vitro* Saaf [Carbendazim (12%) + Mancozeb (63%)], Nativo [Tebuconazole 50% + Trifloxystrobin 25%] and Tilth [Propiconazole] showed 100 per cent mycelial growth inhibition at all the concentration (250, 500, 750 & 1000 ppm) and *in vivo* condition Saaf [Carbendazim (12%) + Mancozeb (63%)] at 2.0 gm/kg (17.00%) followed by Tilth [Propiconazole] at 2.0 ml/lit (19.28%) inhibit maximum fungal growth under field condition as a seed treatment.

Keywords: Groundnut, fungicides, *in vivo, in vitro, A. niger.*

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is an important and a member of leguminosae family widely grown food legume and oil seed crops of tropics and sub-tropic regions of the world. It is an important source of oil for majority of human population of world and is a rich source of protein for human and animal consumption. Groundnut kernels contains 48-50% of edible oil and 26-28% protein, along with rich dietary fibre, minerals and vitamins (Ntare *et al*., 2008). Hence, groundnut is popularly known as “poor man’s badam”. Groundnut cake is also good source of organic manure which contains high nitrogen (7.0-8.0%) and other nutrients. It is also used for the feeding of cattle and poultry. Groundnut crop is mostly cultivated to the geographical region between 40°N and 40°S latitude (Pattee and Young, 1982), and presently grown in about 82 countries of the world. Groundnut is one of the most important oilseed *kharif* crop in India and regarded as “king of oil seed crops” (Reddy, 1976). China is the largest producer as well as consumer of groundnut in the world with production of 16.62 million tonnes followed by India (6.70 million tonnes), Nigeria (3.02 million tonnes) and United States (2.57 million tonnes) annually. India rank first in term of area and second in production of groundnut. In India it is grown in the states *viz*; Gujarat, Andhra Pradesh, Rajasthan, Tamil Nadu and Punjab and is cultivated over an area of 4.8 m. ha with the production of 6.70 million tonnes and 1395 kg/ha productivity. (Anon., 2018-19). In Rajasthan the area, production and productivity of groundnut was 0.73 m. ha, 1.56 million tonnes and 2131 kg/ha, respectively (Anon., 2019). Groundnut roots contain countless nodules which harbour *Rhizobium* microscopic bacteria and in relationship of these microbes it fixes about 80-160 kg N/ha per season (Alam *et al*., 1980). The crop suffers from more than 50 pathogens including fungi, bacteria, viruses and nematodes (Grover, 1981) Among them collar rot caused by *A. niger* Van Teighem is one of the most important disease of groundnut which is more broad in the *kharif* than the *rabi* and summer seasons and causes more harm in sandy loam and medium dark soil. Yearly world yield misfortune due to collar rot is more than 10 per cent (Pande and Rao, 2000). Collar rot disease on groundnut seedlings was first revealed by (Jochem, 1926) and in India it was accounted for by (Jain and Nema, 1952) as Aspergillus blight. The disease is expressing their symptoms in pre and post emergence phase. Many seed dressing fungicides are reported to be effective against collar rot of groundnut (Bhatia and Gangopadhyay, 1996; Karthikeyan, 1996). The loss due to this disease was reported 28 to 50% (Bakhetia, 1983). Looking to the losses due to this disease, field testing of combine molecules of fungicides was necessary as a seed treatment. The objective of the present study was to find out evaluate the various fungicides against collar rot disease *in vitro* and *in vivo*.

MATERIALS AND METHODS

A. In vivo and in vitro testing of fungicides

The experiment was conducted in Instructional Farm, College of Agriculture, Jodhpur. HNG-123 seeds were treated with seed dressing fungicides (Table 2) with a control and the seeds were sown in plot with a size of 2 × 2.5 m and replicated thrice with RBD design. All recommended agronomic practices were followed. Observations of germination per cent and seedling mortality were recorded.

Percent Disease Incidence (PDI) =

$$\frac{\text{No. of infected plants}}{\text{Total no. of plants}} \times 100$$

Efficacy of seven fungicides was studied against mycelia growth of *A. niger* by Poisoned Food Technique (Nene and Thapliyal, 1979) with four different concentrations (250, 500, 750 & 1000 ppm). The fungicides screened are given in the Table 1 along with their common name, trade name and concentrations.

Table 1: List of fungicides evaluated against *Aspergillus niger* by Poison Food Technique (*in vitro*).

Sr. No.	Common Name	Trade Name	in vitro Conc. (ppm			
1.	Carbendazim 12% + Mancozeb 63%	Saaf 75% WP	250	500	750	1000
2.	Carboxin 37.5% + Thiram 37.5%	Vitavax power 75%WP	250	500	750	1000
3.	Carbendazim	Bavistin 50% WP	250	500	750	1000
4.	Propiconazole	Tilt 25 EC	250	500	750	1000
5.	Azoxystrobin 18.2% + Difenoconazole 11.4%	Amistar Top 29.6 SC	250	500	750	1000
6.	Hexaconazole 5% + Captan 70%	Taqat 75% WP	250	500	750	1000
7.	Tebuconazole 50% + Trifloxystrobin 25%	Nativo75 WG	250	500	750	1000
8.	Control	-	-	-	-	-

B. Poison Food Technique

Required quantity of each fungicide under study was mixed thoroughly in sterilized 100 ml PDA media filled in 250 ml flask separately under aseptic condition. The medium was supplemented with streptomycin sulphate @ 50 ppm to prevent bacterial contamination. The poisoned medium was then poured in sterilized petri plates (20 ml) and allowed it to solidify. Mycelium discs of 5 mm size from seven days old culture was cut by a sterile cork borer and one such disc was placed at the center of each agar plate. The plate without any fungicide served as control. Three replications were maintained for each concentration. Such plates were incubated at room temperature and the radial growth was measured when fungus attained maximum growth in control plates. Percent inhibition of mycelial growth over untreated control was calculated by applying the formula given by Vincent (1947).

Table 2: List of fungicides evaluated against *A. niger (in vivo)*.

Sr. No.	Common Name	Trade Name	*in vivo* g/kg or ml/lit.
1.	Carbendazim 12% + Mancozeb 63%	Saaf 75% WP	2.00
2.	Carboxin 37.5% + Thiram 37.5%	Vitavax power 75% WP	2.00
3.	Carbendazim	Bavistin 50% WP	2.00
4.	Propiconazole	Tilt 25 EC	2.00
5.	Tebuconazole 50% + Trifloxystrobin 25%	Nativo75 WG	2.00
6.	Control	—	—

RESULTS AND DISCUSSION

Results revealed that all the fungicides were capable of inhibiting the growth of the test fungus *in vitro* at different concentrations as compared to control. The data presented in (Table 3, plate 1a to 1d) all the fungicides screened were found significantly superior in inhibiting the mycelial growth of *A. niger* over control. Carbendazim (12 %) + Mancozeb (63 %), Propiconazole and Tebuconazole 50% + Trifloxystrobin 25% at all the concentrations completely inhibited the mycelial growth (100 %) over control and found significantly superior over rest of the treatments. The next best treatment in order of merit were Carboxin (37.5%) + Thiram (37.5%) (91.73, 95.01, 100 & 100 %) at 250, 500, 750 and 1000 ppm concentrations, respectively followed by Carbendazim (85.87, 89.48, 100 & 100 %) and Azoxystrobin (18.2%) + Difenoconazole (11.4%) (90.84, 92.59, 80.20 & 100%) at 250, 500, 750 and 1000 ppm concentrations. While Hexaconazole (5%) + Captan (70%) gave mediocre effect in inhibiting the mycelia growth (65.83, 74.13, 88.11 & 90.13 %) at 250, 500, 750 and 1000 ppm concentrations, respectively.

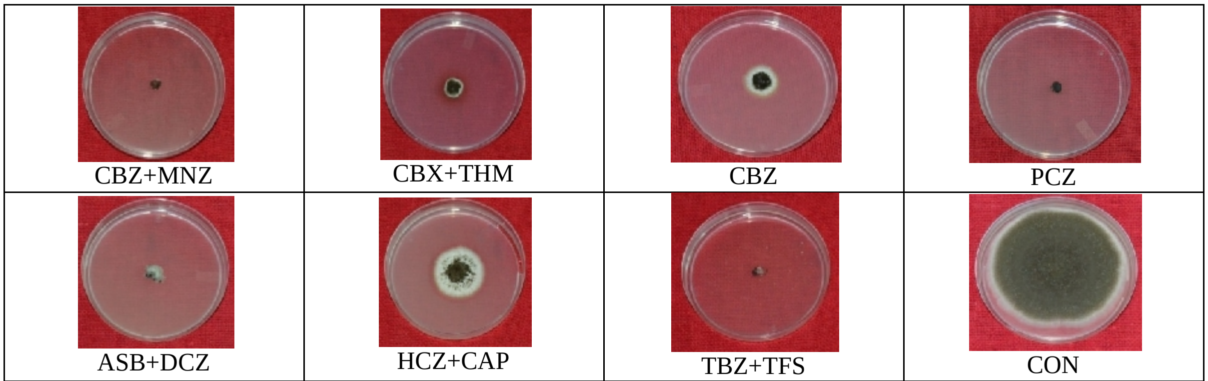

Plate 1a. Efficacy of fungicides against *A. niger in vitro* (250 ppm).

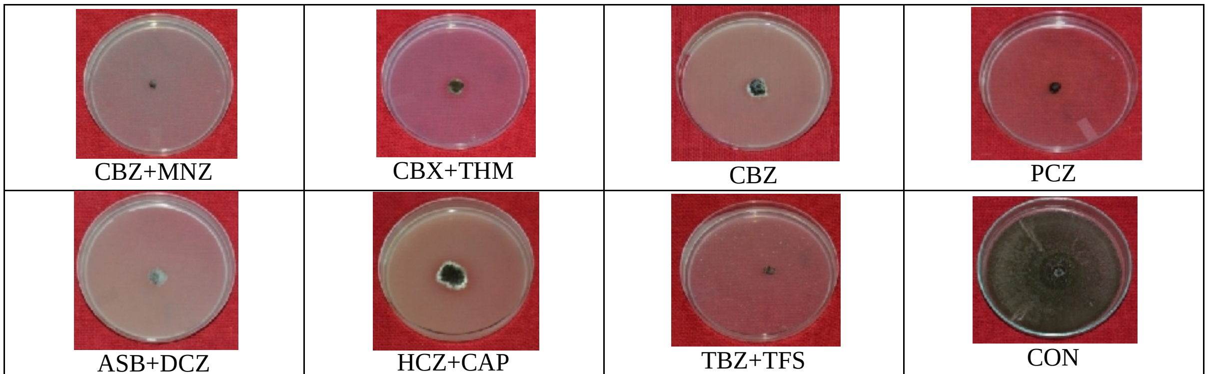

Plate 1b. Efficacy of fungicides against *A. niger in vitro* (500 ppm).

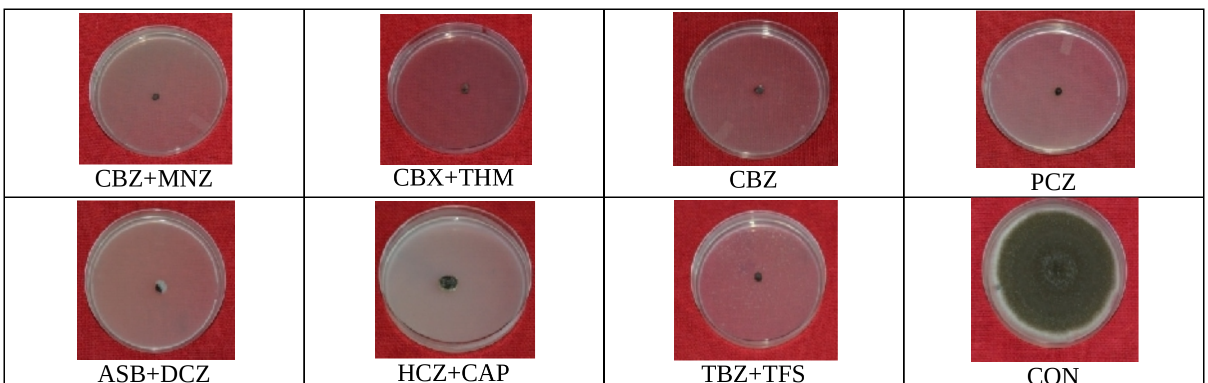

Plate 1c. Efficacy of fungicides against *A. niger in vitro* (750 ppm).

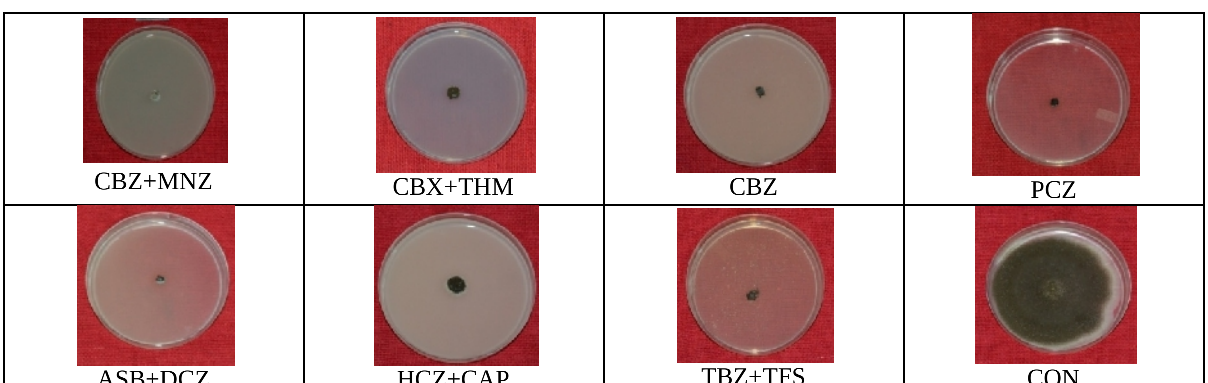

Plate 1d. Efficacy of fungicides against *A. niger in vitro* (1000 ppm).

Table 3: Effect of different fungicides against *Aspergillus niger in vitro.*

Sr. No.	Treatment	Per cent inhibition of mycelial growth*				
		Concentration (ppm)				
		250	500	750	1000	Mean
1.	Carbendazim 12% + Mancozeb 63%	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100 (90.00)
2.	Carboxin 37.5% + Thiram 37.5%	91.73 (73.29)	95.01 (77.11)	100.00 (90.00)	100.00 (90.00)	96.62 (82.52)
3.	Carbendazim	85.87 (68.03)	89.48 (71.07)	100.00 (90.00)	100.00 (90.00)	93.16 (79.30)
4.	Propiconazole	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100 (90.00)
5.	Azoxystrobin 18.2% + Difenoconazole 11.4%	90.84 (72.39)	92.59 (74.21)	97.04 (80.12)	100.00 (90.00)	95.07 (79.14)
6.	Hexaconazole 5% + Captan 70%	65.83 (54.23)	74.13 (59.43)	88.11 (69.84)	90.13 (71.69)	79.61 (63.82)
7.	Tebuconazole 50% + Trifloxystrobin 25%	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100 (90.00)
8.	Control	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Fungicide (F)			**0.24**		**0.68**	
Concentration (C)			**0.17**		**0.48**	
F × C			**0.48**		**1.35**	

*Average of four replications; Figures in parentheses are angular transformed values

Our observations are in conformity to Kumari *et al.*, (2016) studied combination of companion (carbendazim 12 % + mancozeb 63 %) and Vitavax power @ (50 to 250 ppm) and Bavistin (150 and 250 ppm) against *A. niger*. control recorded in Companion (carbendazim 12 % + mancozeb 63 %) 71.83% followed by Bavistin 69.16% and Vitavax power 65.80% inhibit fungal growth. Saharan and Rathi (2016) recorded per cent mycelial growth inhibition of *A. niger* by revealed fungicides *viz*; Propiconazole, carbendazim and carboxin completely inhibited the mycelial growth up to 100 per cent at 200, 500 and 1000 ppm concentration, respectively as comparable with 86.94, 88.05 and 59.96 per cent at their respective 100, 200 and 500 ppm. Captan and thiram were found very less effective as they inhibited 81.11 and 72.77 per cent of fungal growth, respectively at higher concentration of 1000 ppm.

The data presented in (Table 4) revealed that all treatments were significantly superior in *in vivo* over control. Among the treatments employed in management of collar rot of groundnut with different seed dressing fungicide. Carbendazim (12%) + Mancozeb (63%) recorded least per cent disease incidence of 17.00 % followed by 19.28% in the seeds treated with propiconazole whereas, 53.33 % disease incidence was recorded in control plot.

Table 4: Effect of different fungicides against *Aspergillus niger in vivo.*

Sr. No.	Treatment	Dosage (g/kg or ml/lit. of seed)	Germination*(%)	PDI**	Disease Control (%)
1.	Carbendazim (12%) + Mancozeb (63%)	2	88.33 (70.11)	17.00 (24.35)	68.12
2.	Carboxin (37.5%) + Thiram (37.5%)	2	80.00 (63.43)	29.17 (32.66)	45.30
3.	Carbendazim	2	81.67 (64.69)	24.51 (29.67)	54.04
4.	Propiconazole	2	86.67 (68.66)	19.28 (25.99)	63.84
5.	Tebuconazole (50%) + Trifloxystrobin (25%)	2	83.33 (65.95)	21.93 (27.89)	58.88
6.	Control	—	73.33 (58.93)	53.33 (46.92)	0.00
S. Em ±		—	**1.29**	**1.14**	
CD (p = 0.05)		—	**4.06**	**3.59**	

*****Average of three replications ; Figures in parentheses are angular transformed values ; ******PDI = Percent disease incidence

This finding collaborate with the finding of earlier workers Kumari *et al.* (2016) Companion was found most effective with (71.83%) disease control followed by Bavistin and Vitavax power with (69.16% and 65.80) disease control, respectively. Rakholiya *et al.*, (2012) studied fungicides namely vitavax, carboxin, ipconazole, thiram and mancozeb in field condition and reported that collar rot disease incidence was minimum (5.16 %) and maximum pod yield (1232 kg ha^{-1}) were recorded in the treatment of vitavax 200 WP 4.0 g kg^{-1} seed followed by Propiconazole at Junagarh.

CONCLUSION

Seven fungicides were evaluated against *A. niger* at different concentrations *in vitro.* Among the all, Carbendazim (12%) + Mancozeb (63%), Tebuconazole 50% + Trifloxystrobin 25% and Propiconazole showed 100 per cent mycelial growth inhibition at all the concentration (250, 500, 750 & 1000 ppm), whereas Carboxin (37.5%) + Thiram (37.5%), Carbendazim at 750 & 1000 ppm and Azoxystrobin (18.2%) + Difenoconazole (11.4%) at 1000 ppm recorded 100 per cent mycelia growth inhibition. while Hexaconazole (5%) + Captan (70%) showed least mycelial growth inhibition (65.83, 74.13, 88.11 & 90.13 %) at 250, 500, 750 and 1000 ppm concentrations, respectively.

In field condition lowest collar rot severity was observed in seed treated with Carbendazim (12%) + Mancozeb (63%) at 2.0 gm/kg (17.00 %) followed by Propiconazole at 2.0 ml/lit (19.28 %) under field condition whereas, 53.33 per cent disease incidence was recorded.

Acknowledgement. The authors are sincerely thankful to the Dean College of Agriculture Jodhpur, Rajasthan for providing necessary facilities and guidance to conduct the different experiments.

Conflicts of Interest. None.

REFERENCES

Alam, K. B., Bakr, B. A. and Talukdar, M. J. (1980). Effect of fungicides on the control of 'Tikka' disease of groundnut. *Bangladesh Journal of Agricultural Research*, *5*(2): 17-20.

Anonymous (2018-19). Directorate of Economics and Statistics, Department of Agricultural, Cooperation and Welfare.

Anonymous (2019). Commissionarate of Agriculture, Rajasthan, Jaipur.

Asalmol, M. N., Sen, B. and Awasthi, J. (1990). Role of temperature and pH in antagonism of *Aspergillus niger* and *Trichoderma viride* against *Fusarium solani*. *Proc. Indian Phyto-Pathol. Soc*., 11-13.

Bakhetia, D. R. C. (1983). Control of white-grub (*Holotrichia consenguinea* Blanchard) and collar-rot (*Aspergillus niger* van Tiegh) of groundnut sown on different dates in Punjab. *Indian Journal of Agricultural Sciences*, *53*(9): 846-850.

Bhatia, J. N. and Gangopadhyay, S. (1996). Sources of resistance to collar rot and leaf spots of groundnut in Rajasthan. *Indian Journal of Mycology and Plant Pathology*, *26*(1): 108-109.

Grover, R. K. (1981). Present state of research and future trends in controlling diseases of oilseeds and pulses. In PAI *National Seminar on Increasing of Pulses and Oilseeds Production Through Plant Protection.* Vigyan Bhavan, New Delhi, 13-14 November, (Vol. 1314).

Jain, A. C. and Nema, K. G. (1952). *Aspergillus* blight of groundnut seedlings. *Science and Culture*, *17*: 348-349.

Jochem, S. C. J. (1926). *Aspergillus niger* on groundnut. *Indisch Culturen* (Teysmannia). *11*: 325-326.

Karthikeyan, A. (1996). Effect of organic amendments antagonist *Trichoderma viride* and fungicides on seed and collar rot of groundnut. *Plant Disease Research*, *11*(1): 72-74.

Kumari, M., Singh, M., Godika, S., Choudhary, S. and Sharma, J. (2016). Effect of different fungicides, plant extracts on incidence and varietal screening against collar rot of groundnut (*Arachis hypogaea* L.) caused by *Aspergillus niger* van Tiegham. *Int. J. Life Sci. Res, 11*(4): 2835-2839.

Nene, Y. L. and Thapliyal B. W. (1979). Fungicides in plant disease control. Oxford & IBH Publisher house New Delhi. 425.

Ntare, B. R., Diallo, A. T., Ndjeunga, J. and Waliyar, F. (2008). *Groundnut Seed Production Manual*. Patancheru, 502324. Andhra Pradesh, India. *International Crops Research International for the Semi-Arid Tropics* (*ICRISAT*). 20.

Pande, S. and Rao, J. N. (2000). Changing scenario of groundnut diseases in Andhra Pradesh, Karnataka and Tamil Nadu states of India. *International Arachis Newsletter*, *20*: 42-44.

Pattee, H. E. and Young, C. Y. (1982). Peanut science and technology. *American Peanut Research and Education Society*, Inc., Yoakum. pp. 655-687.

Rakholiya, K. B., Jadeja, K. B. and Parakhia, A. M. (2012). Management of collar rot of groundnut through seed treatment. *International Journal of Life science and Pharma Research*, *2*(1): 62-66.

Reddy, M. V. (1976). Crop management of groundnut, irrigated and dry crop. Paper read at 9th annual workshop-cum-seminar on an India Coordinated Research Project on Oilseed Crops held at Nagpur on 5-9th April, 1976.

Saharan, H. S. and Rathi, A. S. (2016). Management of Collar rot of Groundnut with Bio-agent, Botanicals and Chemicals. *Biosciences Biotechnology Research Asia*, *13*(3): 1657-1663.

Vincent, J.M. (1947). Distortion of fungal hyphae in the presence of certain inhibitors. *Nature*, *159*(4): 850-850.

How to cite this article: Saran, M. K.; Ram, D.; Verma, J. R. and Choudhary, A. (2022). Effect of Different Fungicides Against Collar Rot of Groundnut (*Arachis hypogaea* L.) caused by *Aspergillus niger* Van Tiegham. *Biological Forum – An International Journal*, *14*(1): 131-135.