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Alternanthera tenella Colla. Var. tenella Veldk. Extracts affects the Seed Germination and Seedling Growth of Wheat (*Triticum aestivum* L.)

M.B. Ghadge[1], R.G. Chillawar[1], M.E. Navgire[2] and B.D. Takate[2,3*]
[1]Yashwant Mahavidyalaya, Nanded, (MS), 431602, India.
[2]Jijamata College of Science and Arts, Bhende Bk, Ahmednagar, (MS), 414605, India.
[3]Krishi Vidnyan Farm, Bhende Bk, Ahmednagar, (MS), 414605, India.
*Corresponding author email id: takatebd@gmail.com

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Abstract **– In most agricultural lands, farmers have been facing the problem of unwanted plants that compete with main crops, resulting in a reduction in crop yield. In the agricultural land of Newasa tahsil, Ahmednagar, MS, India, *Alternanthera tenella Colla*var. *tenella* Veldk weed is recorded as abundant. *Alternanthera tenella Colla*. var. *tenella* Veldk. (Amaranthaeae family) is one of the most common and invasive weeds found in agricultural lands, bunds, irrigated areas, roadsides, waste places, along canals, etc. throughout Maharashtra state except Beed district. Many plants inhibit or promote the growth of other plants. In agriculture, most unwanted plants affect the crop yield; therefore, farmers have been practicing crop rotation and weed control methods to solve these problems. The direct or indirect harmful effect of one plant on another through the production of chemical compounds that escape into the environment results in a decrease in crop yield. In the present investigation, the effects of root, stem, and leaf extracts of *Alternanthera tenella Colla*. var. *tenella* Veldk were tested against a wheat, "*Triticum aestivum* Linn.," for germination and seedling growth. In the present investigation, it was recorded that, the extracts of leaves, stems, and roots exerted a promotory effect on the 'ARg' of the wheat in the following order: Root > Leaf >Stem Leaf and stem extracts of all concentrations exerted inhibition of plumule growth (Plg) over control, while root extracts of lower concentrations exerted promotion. Higher extracts (10-1 %) inhibited 'PLg' in the following order: Root>Leaf>Stem. Except for inhibition of the test plant at 10-1 % by leaf and stem, promotion of 'TSg' was recorded in an order of: Root>Leaf>Stem. All extracts, except for insignificant inhibition by root and leaf extracts.**

Keywords **– *Alternanthera Tenella, Wheat,* Leaf, Stem, Roots, Extracts.**

I. INTRODUCTION

On agricultural land, we have been facing another problem: unwanted plants that compete with or influence main crops and reduce crop yield. *Alternanthera tenella Colla* var. *tenella* Veldk. (Amaranthaeae family) is one of the common and invasive extensively growing weeds found in agricultural lands, bunds, irrigated areas, roadsides, waste places, along canals, etc. throughout Maharashtra state except Beed district (Naik, 1998). The family Amaranthaceae is one of the 12 unique families belonging to the Order Caryphyllales of Cronquist's system and the Centrospermae of Engler and Prantl's system of classification of angiosperms. This order is embryologically, chemically, and physiologically unique. The majority of them have nitrogenous pigments called betalains, which are not found in other flowering taxa. Therefore, we selected this weed, viz. *Alternanthera tenella Colla*. var. *tenella* Veldk., to find out the effect of extracts on germination and seedling growth of wheat, *Triticum aestivum* Linn.

Alternanthera tenella Colla var. tenella; Veldk. in Taxon 27:310.1978; Naik and Pokle in J. Ind. bot. Soc. 64:292.1978 *pro parte* non var. *versicolor* (Lem.). Veldk. *Gomphrena ficoidea* L. Sp. Pl. 235.1753. *G. polygonoides* L. Sp. Pl. 225.1753 *pro parte. Alternanthera polygonoides.*(L.) R. Br. Prodr. 416.1810. *A ficoides*

(L.) R. Br. ex Roem. and Sch. Syst. 5:555.1819. *Telanthera ficoidea* (L.) Moq. et *T. polygonoides* (L.) Moq. in DC. Prodr. 13, 2:363.1849; Naik, Fl. Osmanabad 288.1979.

Prostrate, aggressive, perennial herbs; stems many, rooting at lower nodes; terete, glabrous, or with two lines of hairs Leaves oblong-obovate or spathulate, narrowed at base, entire, acute or obtuse, and mucronate, green, thinly pubescent with dentate hairs; Flowers throughout the year. In axillary and terminal, dense clusters of 2-5 spikes; rachis hairy; bracts and bracteoles ovate–acuminate, glabrous, or with long hairs. Tepals 5, ovate-lanceolate, white or pale yellow, 3-nerved from the base, densely patently pilose on the back, glabrous upwards Stamens 5; filaments united at base, alternating with as many long pseudo-staminodes, which are 3-5 toothed or lobed at apex. Fruits are ovoid-orbicular, acute, and pointed at the apex. Common weed of waste lands, agricultural fields, gardens, roadsides, along streambanks, etc.

"Allelopathy" is defined as beneficial as well as harmful (detrimental) reciprocal biochemical interactions among plants, including microorganisms (Molisch, 1937). He was a physiologist and the father of allopathy. Allelopathy is any direct or indirect harmful effect of one plant on another through the production of chemical compounds that escape into the environment. Molisch's work was published in his monograph in German, "Der Einfluβ einerPflanze auf die andere: Allelopathie" ("The Influence of One Plant on Another: Allelopathy").

Many crop plants inhibit the growth of other crop plants. Farmers have been practicing crop rotation to solve these problems (Narwal *et al*., 2003). "Smother crops," viz., barley, rye, buckwheat, sweet clover, sunflower, Sudan grass, sorghum, etc., suppress the growth of weeds. Barley is one of the best smother crops (Overland, 1966). Isoflavonoids released by red clover are decomposed into phenolic compounds that accumulate in soil and inhibit crop growth (Chang et al., 1969).

II. MATERIALS AND METHODS

Collection of Experimental plant:

Plant materials were collected from agricultural lands near the village of Telkugaon, Tal Newasa. Plants were identified by using flora (Naik, 1998; Pradhan, 1999). Fresh plant materials were further used in laboratory bioassays.

Extraction of Plant Parts

The 10% extracts of *Alternanthera tenella* Colla var. tenella Veldk were obtained by crushing leaves, stems, and roots separately. 10% stock solutions of each plant part in distilled water were filtered with muslin cloth and what man filter paper Number 1, stored in the refrigerator. Further diluted with distilled water to get extracts of lower concentrations (10^{-1} to 10^{-3} (More and Baig, 2013). Used for bioassays in laboratory conditions. The test seeds were dipped in water, and those seeds that settled at the bottom were selected for the experiment. These wheat seeds were then surface sterilized with 0.01% mercuric chloride, followed by thorough washing with distilled water before use.

Assay on Plant Growth and Seed Germination

The effects of filtered fresh extracts of 10^{-1} to 10^{-3} concentrations on seedling growth parameters viz. germination (Ger), shoot/plumule growth (Sg/Plg), root/(Rg) adventitious root growth (ARg), and total seedling growth (TSg) of wheat [*Triticum aestivum* L.] were recorded (Baig et al., 2002). Recording was done after the

fifth day. Germination of seeds (ten seeds per plate) was carried out. 10 ml of extract was added to the Petri dishes containing 10 seeds each. The slight emergence of radicals was considered a sign of germination. Germination percentage was calculated, and photographs were taken. Percentage inhibition or stimulation of Sg/Plg (shoot/plumule growth), Rg/ARg (root/adventitious root growth), TSg (total seedling growth), and 'Ger' (%germination) over control was calculated, from which graphs were drawn. Effects of the three concentrations of extracts on seedling growth parameters were statistically analyzed to find out if there was any correlation between extract concentration and growth and denoted by alphabets.

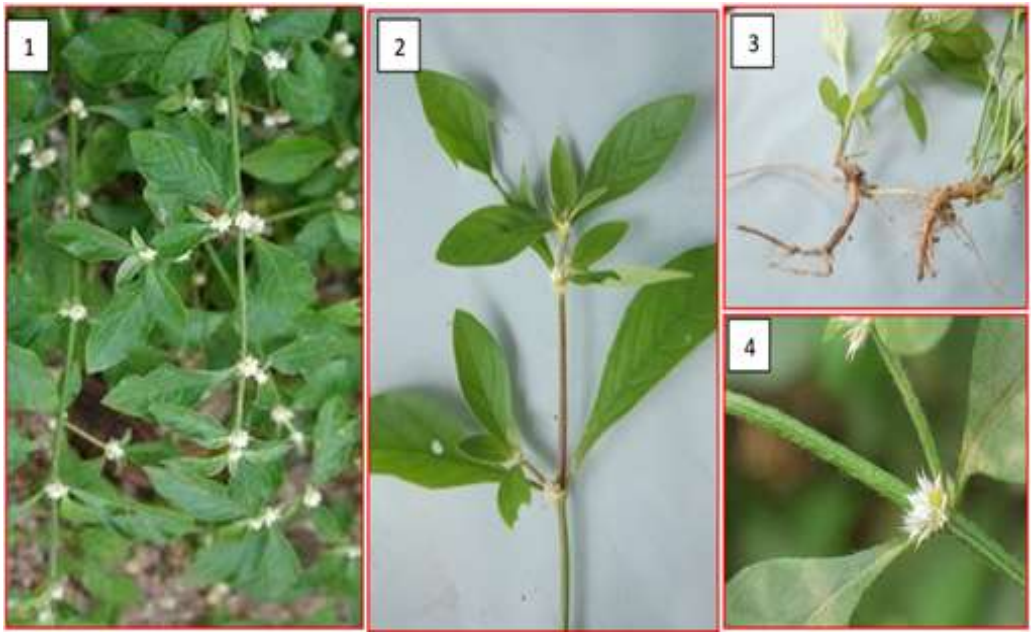


Fig. 1. Photo of *Alternanthera tenella* Colla. var. Tenella 1) Prostrate habit, 2) A twig, 3) Roots and 4) axillary flowers.

Table 1. Effect of Extracts of *Alternanthera tenella*Colla. Var. tenellaVeldk. on Germination and Seedling Growthof 'Wheat' *Triticum aestivum* Linn.

Extract	Growth Parameters	Control	Extract Concentrations			CD at 0.05%	P-Value at 0.05%
			Conc. I	Conc. II	Conc. III		
Leaf	ARg (cm)	7.35a ± 0.46	7.76a ± 0.57(5.58)	8.47a ± 0.39(15.24)	8.70ac±0.30(18.37)	0.83	0.12
	Plg (cm)	6.00a ± 0.48	5.43a ± 0.42(-9.50)	5.64a ± 0.30(-6.00)	5.68a±0.21(-5.33)	0.69	0.75
	TSg (cm)	13.35a ± 0.91	13.19a ± 0.97(-1.20)	14.11a ± 0.64(5.69)	14.38a±0.46(7.72)	1.44	0.64
	Ger %	93.33	90.00(-3.57)	100.00(7.15)	100.00(7.15)		
Stem	ARg (cm)	7.35a ± 0.46	7.91a ± 0.43(7.62)	8.56ab ± 0.54(16.46)	8.07a±0.58(9.80)	0.95	4.10E-01
	Plg (cm)	6.00a ± 0.48	5.84a ± 0.36(-2.67)	5.59a ± 0.40(-6.83)	5.36a±0.48(-10.67)	0.81	0.74
	TSg (cm)	13.35a ± 0.91	13.74a ± 0.76(2.92)	14.15a ± 0.91(5.99)	13.43a±1.01(0.60)	0.9	9.20E-01
	Ger %	93.33	96.67(3.58)	93.33(0.00)	93.33(0.00)		
Root	ARg (cm)	7.35a ± 0.46	7.63a ± 0.58(3.81)	8.84b ± 0.68(20.72)	8.88b±0.62(20.82)	0.9	1.50E-01
	Plg (cm)	6.00a ± 0.48	4.58b ± 0.38(-23.67)	6.13a ± 0.44(2.17)	6.18a±0.48(3.00)	0.9	3.00E-02
	TSg (cm)	13.35a ± 0.91	12.21ab ± 0.89(-8.54)	14.96a ± 1.09(12.06)	14.39a±1.12(7.79)	1.89	2.30E-01

Extract	Growth	Control	Extract Concentrations			CD at	P-Value
	Ger %	93.33	93.33(0.00)	90.00(-3.57)	93.33(0.00)		

Data presented are means of three replicates; values within the same row with different letters are significantly different at 0.05% P-level by Single factor ANOVA test followed by CD and Tukey's test. [Figures in parentheses indicate %stimulation (+) and % inhibition (-) over control; Sg: shoot, Rg: root and TSg: total seedling growth; Ger: seedgermination; T1: 0.1%, T2: 0.01% and T3: 0.001% extract concentration]., Conc.:Concentration.

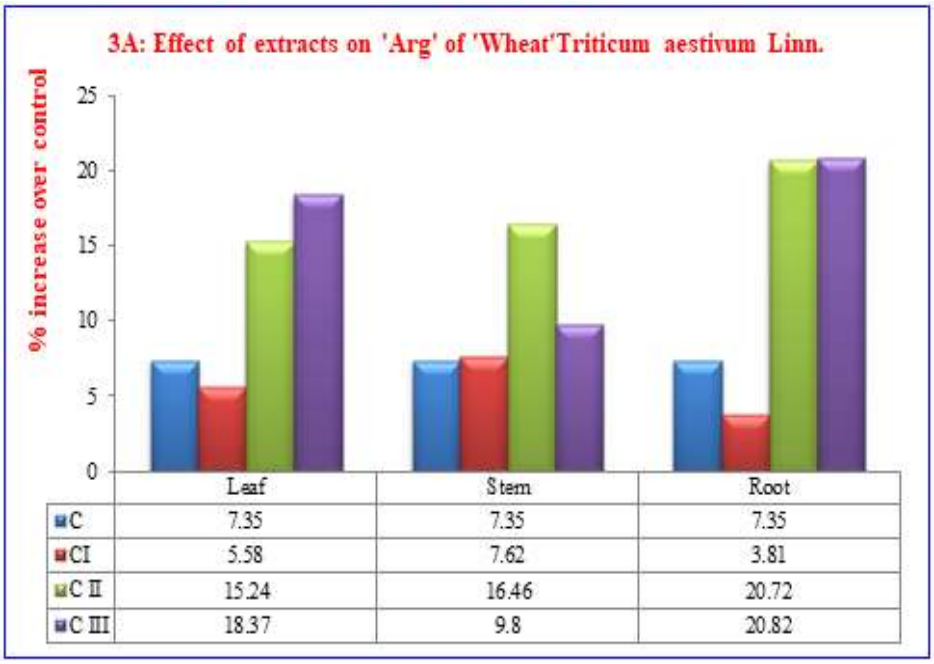


Fig. 2. Effect of extracts of *Alternanthera tenella* Colla. on average root growth of growth of 'Wheat' *Triticum aestivum* Linn.'.

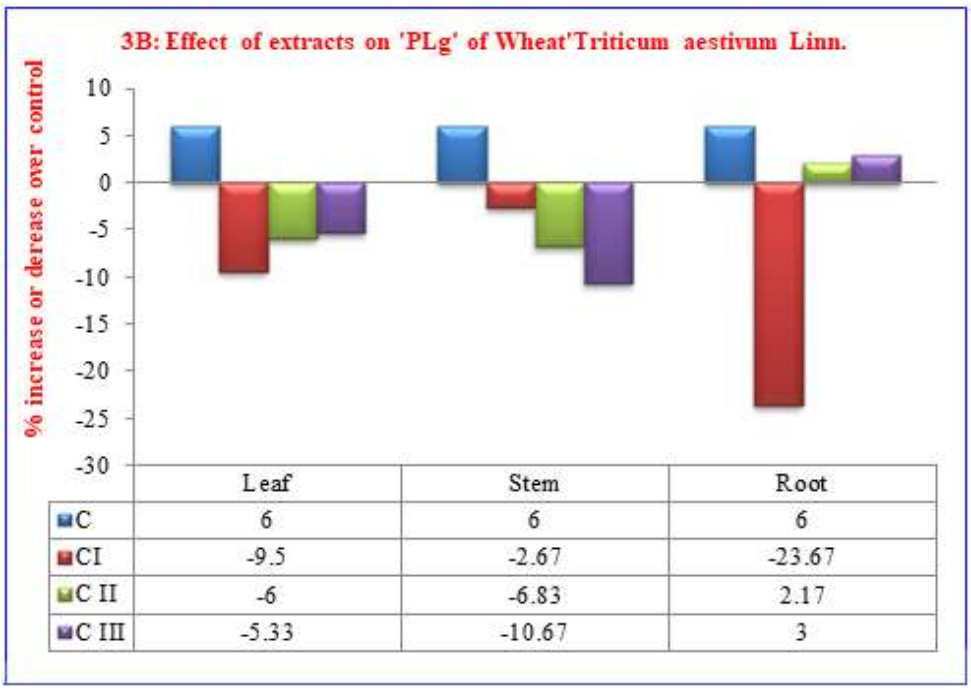


Fig. 3. Effect of extracts of *Alternanthera tenella* Colla. on Plumule growth of 'Wheat' *Triticum aestivum* Linn'.

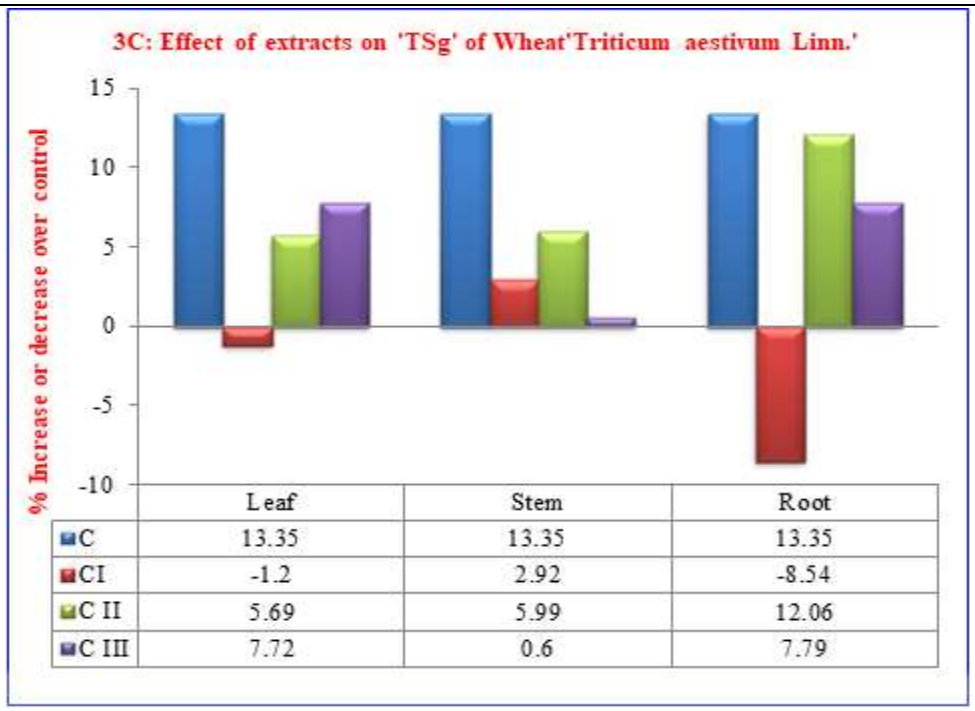
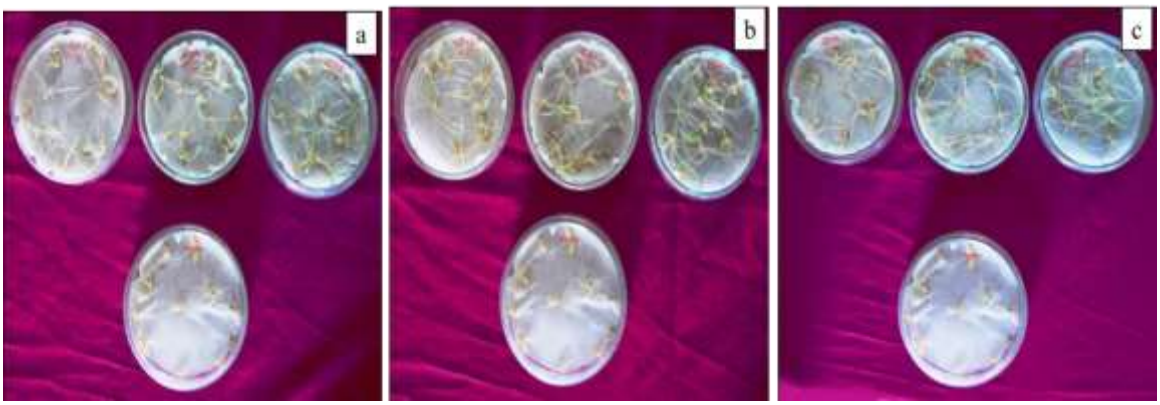


Fig. 4. Effect of extracts of *Alternanthera tenella* Colla. on total seedling growth of 'Wheat' *Triticum aestivum* Linn.'



a) Stem Extract, b) Leaf Extract and c) Root Extract

Fig. 5. Effect of extracts of *Alternanthera tenella* Colla. on germination and seedling growth of 'Wheat' *Triticum aestivum* Linn.'.

III. Result and Discussion

Effect of Aqueous Extracts of Alternanthera tenella Colla. on Germination and Seedling Growth of Wheat [Triticum aestivum Linn.]:

Effect of extracts on (ARg) adventitious root growth (Figure 1 and Table 1):

Aqueous extracts of leaves, stems, and roots of Alternanthera tenella Colla exerted a promotory effect on adventitious root growth (ARg) of the test crop plant 'Wheat' [*Triticum aestivum* Linn.]. All extracts (Conc. I = 10^{-1} %, Conc. II = 10^{-2} and Conc III = 10^{-3} %) promoted 'ARg'. Lower Conc. III promoted 'ARg' in the following order: Root > Leaf >Stem Root, leaf, and stem extracts exerted 20.82%, 18.37%, and 9.80% promotion over control, respectively.

Effects of extracts on (Plg) plumule growth (Figure 3 and Table 1):

Leaf and stem extracts of all concentrations exerted inhibition of plumule growth (Plg) by 5.33% and 10.67%, respectively, over control. Root extracts of lower conc. (Conc. II and III) exerted promotion. Higher extracts (10-1 %) inhibited "PLg" in an order: root>leaf>stem.

Effect on (TSg) total seedling growth (Refer to Table 1, Figure 4):

Except for inhibition of the test plant at higher concentrations (10-1 %) by leaf and stem, promotion of (TSg) total seedling growth was recorded in an order of root > leaf > stem. Root, leaf, and stem extract exerted promotion by 7.79%, 7.72%, and 0.60%, respectively, over control.

Effect on Germination (Refer Table No. 1): All extracts, except insignificant inhibition by root and leaf extracts, either exerted promotion or had no effect on seed grain germination of the wheat.

IV. Conclusion

All extracts of leaves, stems, and roots exerted a promotory effect on the 'ARg' of the wheat test crop plant in the following order: Root>Leaf >Stem Leaf and stem extracts of all concentrations exerted inhibition of plumule growth (Plg) over control, while root extracts of lower concentrations exerted promotion. Higher extracts (10-1 %) inhibited 'PLg' in an order: Root>Leaf>Stem. Except for inhibition of the test plant at 10-1 % by leaf and stem, promotion of 'TSg' was recorded in an order of: root>leaf>stem. All extracts, except for insignificant inhibition by root and leaf extracts.

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Author's Profile

First Author
Mr. Ghadge M.B., M.Sc. M.Ed. DSM M Phil., He has 17 years of teaching experience; he has published 13 research papers in national and international journals. He has attended several conferences, presented poster and oral research papers in many national and international conferences. He is working as in-charge principal in Trimurti Arts Commerce and Science College Dhorjalgaon Ahmednagar (MS) India.

Second Author
Dr. R.G. Chillawar, M.Sc. B.Ed. PhD., He is working as a Assistant Professor and research Supervisor in Yashwant Mahavidhyalaya Nanded. He has 22 years of experience of teaching. He is expert in plant pathology, medicinal plants, cyanogenic plants, toxic plants, and parasitic plants. He has published several research papers in well peer reviewed journals. He has attended several conferences. He has presented poster and oral research papers in many national and international conferences. 4 research students are pursuing their PhD. under his guidance affiliated to the Ramanand Tirth Marathavada University Nanded.

Third Author
Dr. M.E. Navgire, M.Sc. B.Ed. PhD., He is working as a Assistant Professor in Jijamata College of Science and Arts, Bhende Bk, Ahmednagar, since 1999. He has 25 years of teaching and research experience in the specialization of Chemistry, Material Science and Nano-Technology. He is In-charge of Soil and Water Testing Laboratory recognized by Government of Maharashtra. He recently visited to France, Belgium and Bhutan to present paper in International conferences. He has published 28 research papers listed in Scopus and Web of Science. He is research guide affiliated to the Savitribai Phule Pune University, Pune.

Fourth Author

Dr. Takate B.D., M.Sc. B.Ed. PhD. (Corresponding author). He has 18 years of experience in Soil Water analysis, Bio-fertilizers, Bio-pesticides, PGR and Multi-micronutrient production, quality control and research. He obtained Gold Medal award for best poster presentation in National conference held at Jagannath Puri,Odisa, and two award for best oral paper presentation in international conference held at New Arts Commerce and Science College Parner, Ahmednagar, Maharashtra and Faculty of Agriculture Kamla Neharu Institute of Science Sultanpur, Faridpur, Utter Pradesh. He has published 22 research papers in well peer reviewed journals and patent. He has attended several conferences. He has pres--ented poster and oral research papers in many national and international conferences.