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Effect of Plant Growth Regulators (Indoles) on Germination Percentage and Seedling Growth of *Rauvolfia serpentina (L.) Benth. ex Kurz.*

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Abstract: ***Rauvolfia serpentina (L.) Benth. ex Kurz (family: Apocynaceae) is most important medicinal plant and its importance increasing day by day due to its higher medicinal value. PGR's (Plant Growth Regulators) are known to improve the growth and yield of plants. The effect of varying concentration of IAA (Indole Acetic acid) and IBA (Indole Butyric Acid) was ascertained for seed germination and seedling growth of Rauvolfia serpentina (L.) Benth. ex Kurz. Plant were grown in the field and ten different plots viz (T_1) Control, (T_2) IAA (25ppm), (T_3) IAA (50ppm) , (T_4) IAA (100ppm), (T_5) IBA (25ppm), (T_6) IBA (50ppm) , (T_7) IBA (100ppm), (T_8) IAA + IBA (25ppm), (T_9) IAA + IBA (50ppm) and (T_{10}) IAA + IBA (100ppm) has been taken. The result revealed that germination percentage and seedling growth increased in all low concentration (25ppm) treatments while declined in all high concentration (100ppm) treatments.***

Keywords: *Rauvolfia serpentina*, Growth regulators, IAA and IBA.

1. Introduction

Rauvolfia serpentina (L.) Benth. ex Kurz plant belongs to the family Apocynaceae. It is commonly known as "**Sarpagandha**" and is an important medicinal plant used for various medicinal purposes (Salma et.al., 2008). In India, according to Ayurveda the root of Sarpagandha and whole plant has 400 year of use in treatment of snakebite, rheumatism, hypertension, insanity, epilepsy, eczema and nervous disorder. Ojha and Mishra (1985), Weisburger,J.H (2002). The leaves are used in removal of opacities of the cornea (Joshi and Kumar 2000 and ManuChair 2002). It's required in allopathic, ayurvedic and unani systems of medicines. Its consumption is more than its production because of this it is included in the endangered species of Red data book. Use of PGRs help to overcome the ever increasing demand of medicinal plants through increase production as expected. Several work has been done on PGRs showing low concentration increased seed germination percentage and seedling growth Paul et.al..(2008), Richa and sharma (2004), Vamil et. al.,(2010) in *Rauvolfia*, *cephalostachyum* and *bambusa* arundinaceae respectively. Choe (1972) in *Pisum sativum* that IAA and IBA treatments enhanced seedling growth.Persual of literature reveals that no much work on *Rauvolfia serpentina* affected by PGRs has been done. The present study aimed to assess the effect of growth regulators on seed growth of *Rauvolfia serpentina (L.) Benth. ex Kurz* crop.

2. Material and Methods

Seeds of *Rauvolfia serpentina Benth Ex. Kurz.* were collected from NBPGR, New Delhi and experiment was conducted at Botanical garden, Department of Botany, M.M.H College Ghaziabad and Govt P.G. College Noida during the year 2010-2011. For seed germination and seedling growth studies, seeds were pre imbibed in distilled water for 24 hours, then the seeds were germinated in the field and sprayed with plant growth regulators (IAA and IBA) singly and in combination. The seeds were germinated within 15-20 days. Ten different plots viz T_1(control), T_2(IAA 25ppm), T_3(IAA 50ppm), T_4(IAA 100ppm), T_5(IBA 25ppm), T_6(IBA 50ppm), T_7(IBA 100ppm), T_8(IAA+IBA 25ppm), T_9(IAA+IBA 50ppm) and T_{10}(IAA+IBA 100ppm) has been taken. Germination percentage was observed on the basis of radicle emergence as 2mm in length and considered as germinated.

Seedlings were dissected in radical and plumule for growth measurements. Different growth parameters viz. length, fresh and dry weights were measured and compared with control. Method of Kumar, (1981) was adopted for growth pattern studies. The mean values with ±SD of three seedlings from each plot were calculated, represented in the results with the help of SPSS 15.0 software.

Seed germination (%): The germination percentage was calculated by following formulae:

$$\text{Germination \%} = \frac{\text{Number of seed germinated}}{\text{Total number of seeds plotted}} \times 100$$

3. Result and Discussion

In the present study Table 1 and Fig. (1.a-1.c) and Plate 1 indicated that there was significant effect of plant growth regulators on seed germination of *Rauvolfia serpentina (L.) Benth. ex Kurz* however, the growth of seedlings affected by PGRs (indoles) when compared with control.

Seed germination percentage was decreased maximum 20% by IAA 100ppm T_4 treatment while increase maximum 36 % by IAA + IBA (25ppm) T8 treatment as compared to control. Germination percentage increased in all low concentration treatments viz. IAA + IBA (25 ppm) while declined in all high concentration treatments viz. IAA + IBA (50 ppm) and IAA + IBA (100 ppm). Similar results were observed with PGRs treatments by Richa and sharma,

(2003) in *Cephalostachyum*; Paul et al., (2008) in *Rauvolfia serpentina*; Vamil et al., (2010 and 2011) in *Bambusa arundinaceae*.

Length of radicle was promoted 3%, 9%, 34%, 1%, 31%, 20% and 1% at T_2, T_3, T_5, T_7, T_8, T_9 and T_{10} treatments respectively however, it was inhibited 22% and 5% at T_4 and T_6 treatments respectively when compared with control. Fresh weight of radicle was promoted 1% at T_8 and 8% at T_9 treatments however, it was inhibited 8% at T_2, 15% at T_3, 27% at T_4, 4% at T_5 and 12% at T_{10} treatments and no effect was observed in fresh weight of radicle at T_5 treatment when compared with control. Dry weight of radicle was promoted 25% at T_5, T_6 and T_9 treatments however, no change was observed in dry weight of radicle at T_2, T_3, T_4, T_7, T_8 and T_{10} treatments respectively when compared with control (Table 1, Fig. 1.a-1.c and Plate 1).

Promotion in plumule length was observed 4% at T_2 treatment however, inhibition was observed 35% at T_4, 22% at T_7, 10% at T_9, 19% at T_{10}, 2% at both T_3 and T_6 and 6% at both T_5 and T_8 treatments when compared with control. Fresh weight of plumule was promoted 65% at T_2, 40% at T_3, 15% at T_6, 35% at T_9, 30% at T_{10} and 20% at T_5, T_7 and T_8 treatments however, no change was observed in fresh weight of plumule at T_4 treatment when compared with control. Dry weight of plumule was inhibited 25% at both T_4 and T_7 treatments however, no effect was observed in dry weight of plumule at T_2, T_3, T_4, T_6, T_8, T_9 and T_{10} treatments respectively when compared with control (Table 1, Fig. 1.a-1.c and Plate 1)

Number of leaves was promoted 13%, 16%, 24% and 4% at T_2, T_3, T_8 and T_9 treatments respectively however, it was inhibited 40%, 4%, 4%, 6% and 17% at T_4, T_5, T_6, T_7 and T_{10} treatments respectively when compared with control. Inhibition in fresh weight of leaves was observed 7% at T_2, 5% at T_3, 32% at T_4, 18% at T_6, 28% at T_7 and 28% at T_5, T_8, T_9 and T_{10} treatment when compared with control. Dry weight of leaves was increased 9% at T_8, 27% at T_9 treatments however, it was decreased 45% at T_4, 18% at T6, 28% at both T_5 and T_7 and 9% at both T_3 and T_{10} treatments. No change in dry weight of leaves was observed at T_2 treatments when compared with control (Table 1, Fig.1a-1c and Plate 1).

Maximum promotion in the length of radicle was observed 34% at T_5 (IBA 25 ppm) treatment however, inhibition in the length of radicle was observed 22% at T_4 (IAA 100 ppm) treatment. Fresh weight of radicle was maximum promoted 8% at T_9 (IAA+IBA 50 ppm) treatment however, maximum inhibited 27% at T_4 (IAA 100 ppm) treatment. Maximum promotion in dry weight of radicle was observed 25% at T_5 (IBA 25 ppm), T_6 (IBA 50 ppm) and T_9 (IAA+IBA 50 ppm) treatments however, no inhibition was observed in dry weight of radicle at T_2 (IAA 25 ppm), T_3 (IAA 50 ppm), T_4 (IAA 100 ppm), T_7 (IBA 100 ppm), T_8 (IAA+IBA 25 ppm) and T_{10} (IAA+IBA 100 ppm) treatments respectively when compared with control.

The length of plumule was promoted 4% at T_2 (IAA 25 ppm) treatment however, it was inhibited 35% at T_4 (IAA 100 ppm) treatment. Maximum promotion in the fresh weight of plumule was observed at all PGRs treatment with the exception at T_4 (IAA 100 ppm) treatment and it was observed maximum 65% at T_2 (IAA 25 ppm) treatment. No inhibition was observed at T_4 (IAA 100 ppm) treatment. Maximum inhibition in dry weight of plumule was observed 25% at T_4 (IAA 100 ppm) and T7 (IBA 50 ppm) treatments however, no promotion was observed at T_2 (IAA 25 ppm), T_3 (IAA 50 ppm), T_4 (IAA 100 ppm), T_6 (IBA 50 ppm), T_8 (IAA+IBA 25 ppm) T_9 (IAA+IBA 50 ppm) and T_{10} (IAA+IBA 100 ppm) treatments when compared with control.

Number of leaves was maximum influenced by 24% at T_8 (IAA+IBA 25 ppm) treatment however, it was adversely affected by 40% at T_4 (IAA 100 ppm) treatment. Inhibition in fresh weight of leaf was observed at all PGRs treatments and it was observed maximum 32% at T_4 (IAA 100 ppm) treatment and there was no promotion in fresh weight of leaf at seedling stage. Dry weight of leaf was maximum promoted by 27% in T_9 (IAA+IBA 50 ppm) treatment however, it was maximum inhibited by 45% in T_4 (IAA 100 ppm) treatment as compared with control.

Result indicated that dual nature of plant growth regulators affected the growth in terms of length, fresh and dry weight of the seedlings in *Rauvolfia serpentina (L.) Benth ex. Kurz.* on one hand low concentration of indoles promoted the growth and on the other hand high concentration inhibited the growth too.

It has been shown that at seedling stage IAA and IBA treatments singly and in combination, promoted radicle length with IBA (25 ppm) i.e. T_5 treatment and plumule length with IAA (25 ppm) i.e. T_2 treatment however, radicle and plumule length declined with IAA (100 ppm) i.e. T_4 (IAA 100 ppm) treatment. Fresh and dry weight of radicle and plumule increased maximum in low concentration of PGRs treatments however, these parameters were declined in high concentrations of PGRs treatments. Similar findings were observed by Vamil et al., (2010 and 2011) in *Bambusa arundinaceae* and Choe, (1972) in *Pisum sativum* that IAA and IBA treatments enhanced seedling growth whereas Prakash, (1998) reported that at seedling stage in *Artocarpus heterophyllus* IAA (100 ppm) and IBA (100 ppm) increased shoot length and root length respectively; Patel and Saxena, (1994) observed that at seedling stage in *Vigna mungo and Vigna radiata* the IBA at all concentrations was less effective as compared to control but Buzarbarua, (1998) reported that IBA in combination with NAA resulted in well developed root and shoot buds of *Cymbidium aloifolium*.

4. Conclusion

From present findings it can be conclude that low concentration of PGRs showed promotory effect on seed germination percentage, radicle and plumule while high concentration of PGRs had inhibitory effect on seedling growth parameters of *Rauvolfia serpentina (L.) Benth. ex Kurz* So this technique will be helpful for farmers to increase the production of medicinally important plant.

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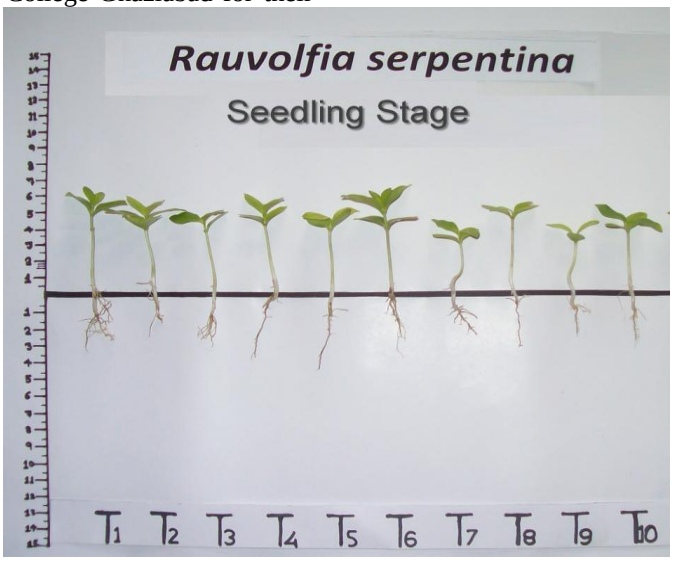

Plate 1: Effects of plant growth regulators (Indoles) at seedling stage of *Rauvolfia serpentina* (L.) Benth. ex Kurz.

Table 1: Effects of plant growth regulators (Indoles) on seed germination and seedling growth of *Rauvolfia serpentina* (L.)

			Parameter/Seedling Part		
Treatment	*Parameter*	*Germination %*	*Radicle*	*Plumule*	*Leaf*
Control	Length, cm	28%	2.83±0.59	3.20±0.60	1.277±0.333
T1	fw, gm		0.026±0.009	0.020±0.004	0.060±0.016
	dw, gm		0.004±0.001	0.004±0.001	0.011±0.004
IAA(25ppm)	Length, cm	32%	2.93±0.93	3.33±0.32	1.443±0.127
T2	fw, gm		0.024±0.005	0.033±0.007	0.056±0.003
	dw, gm		0.004±0.001	0.004±0.001	0.011±0.004
IAA(50ppm)	Length, cm	25%	3.07±0.75	3.13±0.31	1.360±0.052
T3	fw, gm		0.022±0.005	0.028±0.003	0.057±0.006
	dw, gm		0.004±0.001	0.004±0.001	0.010±0.003
IAA(100ppm)	Length, cm	20%	2.20±0.10	2.07±1.15	0.753±0.144
T4	fw, gm		0.019±0.002	0.020±0.009	0.041±0.010
	dw, gm		0.004±0.001	0.003±0.002	*0.006±0.004
IBA(25ppm)	Length, cm	28%	3.80±0.36	3.00±0.70	1.223±0.333
T5	fw, gm		0.026±0.006	0.024±0.007	0.043±0.016
	dw, gm		0.005±0.001	0.004±0.001	0.008±0.002
IBA(50ppm)	Length, cm	27%	2.70±0.95	3.13±0.85	1.223±0.267
T6	fw, gm		0.025±0.006	0.023±0.007	0.049±0.011
	dw, gm		0.005±0.001	0.004±0.002	0.009±0.002
IBA(100ppm)	Length, cm	22%	2.87±0.80	2.50±1.49	1.197±0.707
T7	fw, gm		0.019±0.006	0.024±0.013	0.037±0.005
	dw, gm		0.004±0.002	0.003±0.002	0.008±0.001
IAA+IBA	Length, cm	36%	3.70±0.56	3.00±0.26	1.583±0.364
(25ppm)	fw, gm		0.029±0.012	0.024±0.003	0.043±0.006
T8	dw, gm		0.004±0.001	0.004±0.001	0.012±0.003
IAA+IBA	Length, cm	30%	3.40±1.14	2.87±0.31	1.333±0.583
(50ppm)	fw, gm		0.028±0.009	0.027±0.005	0.043±0.002
T9	dw, gm		0.005±0.001	0.004±0.001	0.014±0.003
IAA+IBA	Length, cm	24%	2.87±0.80	*2.60±0.56	1.057±0.344
(100ppm)	fw, gm		0.023±0.003	0.026±0.007	0.043±0.007
T10	dw, gm		0.004±0.001	0.004±0.000	0.010±0.002

fw =fresh weight**, dw** = dry weight, **cm**= centimeter, **gm**= gram, ± = **s**tandard deviation, *= significant at 5% level.

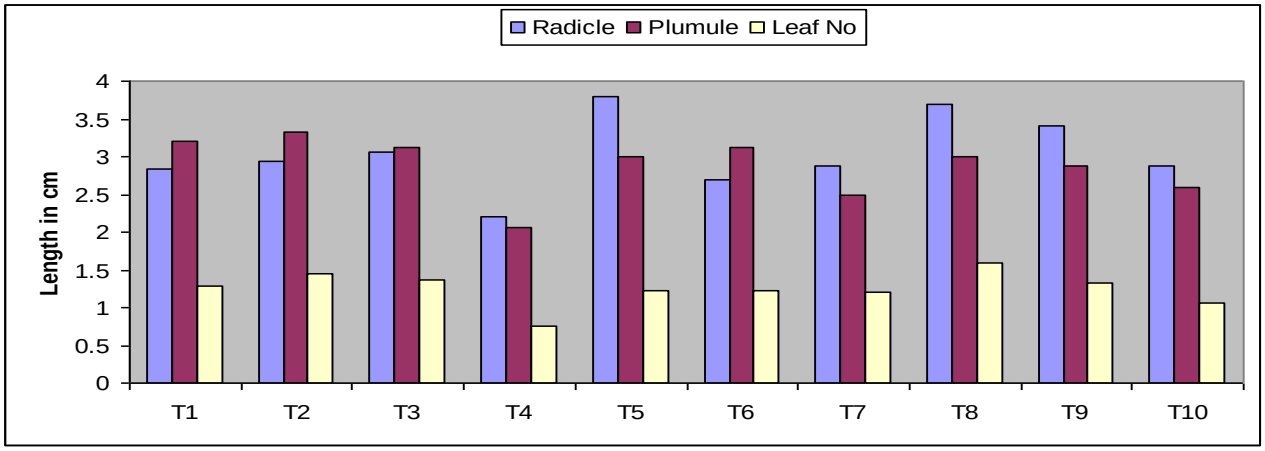

Figure 1(a): Effects of plant growth regulators (Indoles) on seedling growth in *Rauvolfia serpentina* (L.) Benth. ex Kurz

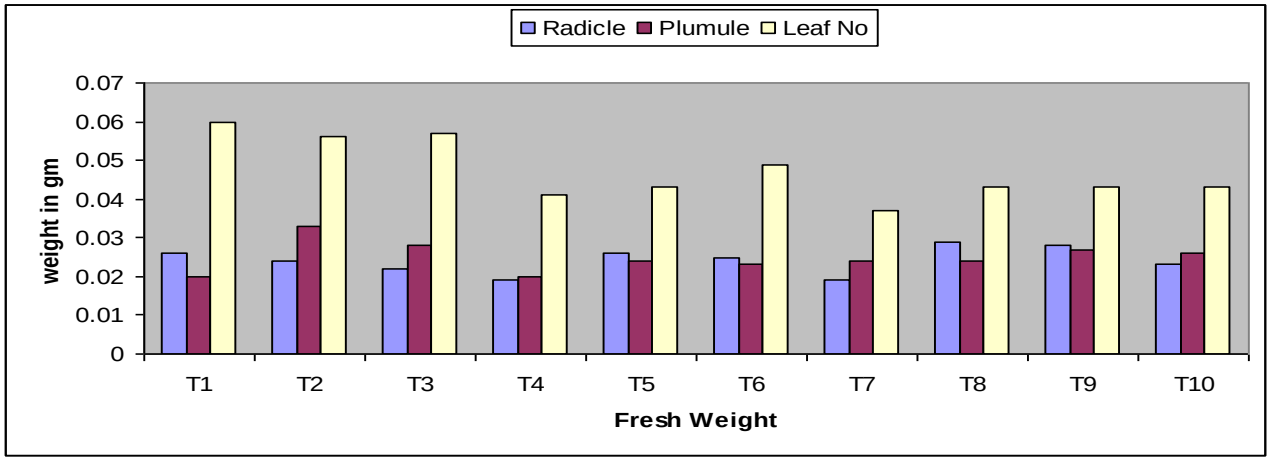

Figure 1(b): Effects of plant growth regulators (Indoles) on fresh weight of radicle, plumule and leaf in *Rauvolfia serpentina* (L.) Benth. ex Kurz.

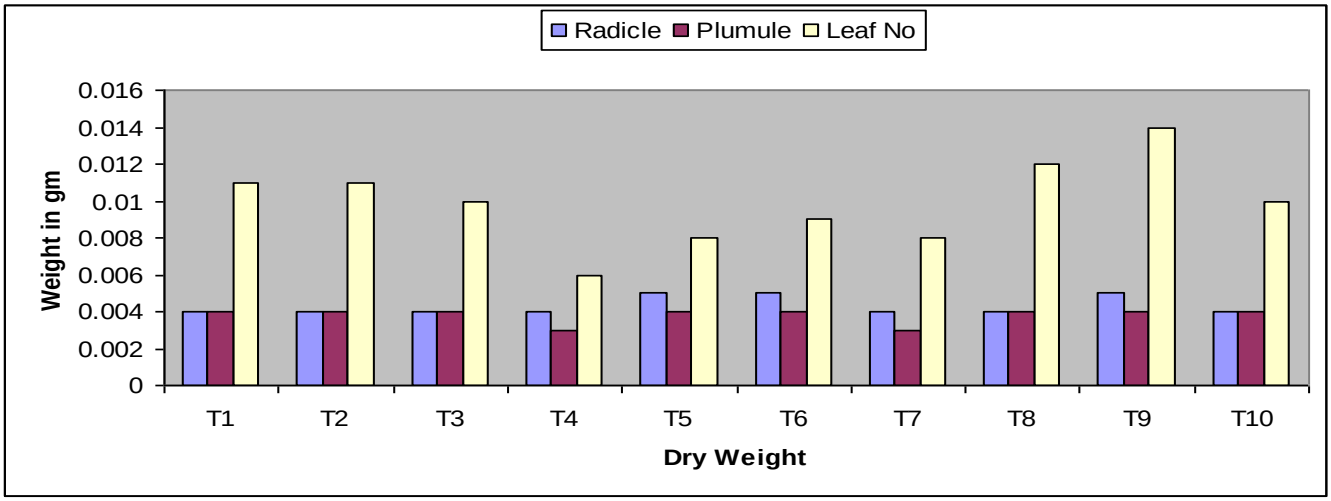

Figure 1(c): Effects of plant growth regulators (Indoles) on dry weight of radicle, plumule and leaf in *Rauvolfia serpentina* (L.) Benth. ex Kurz.

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