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Effect of pre-sowing seed treatment with kinetin on physiological parameters of *Nigella sativa* Linn.

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Abstract

Cultivation of medicinal plants is one of the major mechanisms by which conservation, sustainable harvesting as well as utilization can be drawn simultaneously. With the increasing demand of natural resources in the world, cultivation of medicinal plants will be more profitable than cultivating conventional cash crops. Thus, it becomes essential to generate the knowledge of agronomics and make the same available to the farmers with agricultural technologies. Phytohormones play a major role in physiological effects of the plant. The present paper deals with the effect on pre-sowing treatment with kinetin in physiological parameters of *Nigella sativa* Linn. The results show that the 10^{-4} M concentration of applied phytohormones is very beneficial for the physiological effects of the *Nigella sativa*.

Key-Words: *Nigella sativa*, Kinetic, Pre-sowing seed, Physiological effects.

Introduction

Man has been always attempting to possess such of the materials as are useful to him. Food and spices are necessities of life and in his desire to possess more and more of these he has succeeded in cultivating plants to his needs. It is as a result of such necessity that intensive cultivation of crops has indeed, been made. In other words the necessity to possess more and more of food and spices has been the incentive for intensive and extensive cultivation of plants. Scientists feel the need to find out natural sources of spice crops containing various drugs of medicinal importance. Their sole aim has been to develop more amount of spice on the same area of land. Further with their present increased appreciation on the dining table, the species have assumed and important place in man's economy. For this, besides improved methods of cultivation, better and high yielding varieties and strains must be developed. Fortunately, great success has been achieved in this direction in recent years[1].

Plant growth regulators are the organic compounds other than nutrients which effect the morphological structure and physiological processes of plants in low concentrations. Plants hormones are naturally occurring growth hormones which in low concentrations control physiological processes in plants.

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More commonly the term plant growth regulators are used because it includes both the native and synthetic substances which modify the plant growth. The five major kinds of substances are auxins, gibberellins, cytokinins, abscisic acid and ethylene. In general the plant growth regulators serve in regulating cell enlargement, cell division, cell differenciation, organogenesis, senescence and dormancy. They are employed in seed treatment to achieve earlier growth and root development, quality improvement like protein level and amino acid balance etc.[4]

Physiological parameters include the important events in the life of the species. It also highlights the growth of the plant along with the flowering and fruiting events. Moreover, it can cope up with environmental conditions. *Nigella sativa* Linn. is an oil yielding plant commonly grown in July-August and harvested in November-December, having short life cycle of about 5-7 months. The physiological parameters of the plant are influenced by number of factors and plant hormones[5-10]. Till date any work was not yet reported with pre-sowing seed treatment with kinetin. Therefore, the present work was undertaken.

Material and Methods

Selection of plant

Nigella sativa L. commonly known as Karayal (Hindi), Black cumin (English) belongs to family Ranunculaceae and is medicinally important oil

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yielding plant commonly grown in some parts of our country in July and harvested in October-November. The plant have short life cycle and so, far no any systematic work was carried out to study the physiological effect of the plant as affected by the pre-sowing seed treatment with kinetin therefore, the plant was selected for present investigation.

Collection and authentication of seeds

The seeds of the selected plant were collected from the Deori village of Jabalpur District of Madhya Pradesh and were identified and authenticated by Late Dr. J. L. Shrivastava, Scientist & Head, Biodiversity and Medicinal Plant, State Forest Research Institute, Jabalpur, (M.P.).

Experimental area

The present study was carried out at State Forest Research Institute, Jabalpur, (M.P.). The experiment was conducted during July- 2009 to December-2009. The material used and the methodology adopted to carry out this research, and the periodical observations recorded in the field and in laboratory including chemical analysis work are being presented.

Physico-chemical analysis of experimental soil

The soils samples were collected from the study sites located in State Forest Research Institute, Jabalpur, (M.P.) and their physical and chemical characters were analyzed[11-12]

Experimental details

Seed viability test: The seed before sowing in to the field was tested for its quality for which viability test was performed. The methods to test seed viability are mentioned below[12] (Mishra, 1968). **Method I**: Cut the seed at one side and dissect out the embryo. Allow the embryo to remain between 2 pieces of filter paper in a petridish for a few days, if embryo develops within 2-3 days implies that seed is viable. **Method II**: The viable seed respire, which causes colorless tetrazolium dyes to change into highly colored compounds by chemical reduction. The reaction does not occur if the seed is dead. Prepare 0.1 % TTC (2,3,5- triphenyl tetrazolium chloride) in distilled water. Cut each seeds in half, longitudinally through the centre of the embryo. Immerse the halves in the above solution in a petridish and put in the dark for a few hours at pH between 6-7.

Sowing of seeds

The seeds of *Nigella sativa* Linn. were surface sterilized by soaking in 0.01 % mercuric chloride solution for 3 minutes, washed thoroughly with double distilled water and divided in fifteen sets which were soaked in different concentration of kinetin (KIN) along with control treatment with distilled water (KIN conc. 10^{-6}M, 10^{-5}M, 10^{-4}M and10^{-3} M) for 12 hours[7-9]. The seeds were then sown (100 per plot) in a field (3 X 2 feet) in three replicates of five sets. The field was then irrigated with water as required and after germination physiological parameters were recorded by selecting three plants from each section randomly.

CR_1	CR_2	CR_3
T_1R_1	T_1R_2	T_1R_3
T_2R_1	T_2R_2	T_2R_3
T_3R_1	T_3R_2	T_3R_3
T_4R_1	T_4R_2	T_4R_3

Abbr. C = Control, T1 = KIN Conc. (10^{-6} M), T2 = KIN Conc. (10^{-5}M), T3 = KIN Conc. (10^{-4}M), T4 = KIN Conc. (10^{-3}M), R1 = Replicate 1; R2 = Replicate 2; R3 = Replicate 3

Layout of Plot

Fig. 1: Field showing layout of Plot

Growth hormones (KIN) treatment

Kinetin (KIN) of varying conc. (10^{-6}M, 10^{-5}M, and 10-4 M and10^{-3} M) was used at pre-sowing stage with seeds of selected plant for 12 hours[9].

Parameter studied

After the treatment of seeds with Kinetin (KIN) of varying conc. 10^{-6}M, 10^{-5}M, 10^{-4} M and10^{-3} M for 12 hours with different concentration the seeds were sown and the following physiological events were observed and recorded periodically[12].

Results and Conclusion

The plant *Nigella sativa* Linn. is an indigenous herb which was chosen for this study. The plant belongs to the family Ranunculaceae. The scanty availability of information on this plant facilitates the study on it. The attempt was made to study the changes in physiological effects of the plant as affected by varying concentration of kinetin during pre-sowing seed treatment. The soil was analyzed for the physical and chemical

characteristics before starting up the field experiment. The various parameters were determined. The soil of experimental area is black having sand and loam, pH was 7.8 i.e, slightly alkaline. All the obtained results are presented in Table No. 1.

Table 1: Physico-chemical analysis of soil

Parameter	Results
Physical characters	Soil is black having sand and loam.
Soil pH	7.8
Electrical conductivity	0.92 mmhos/cm
Organic carbon	0.75%
Available nitrogen	260.8 kg/ha
Available phosphorus	32 kg/ha
Available potassium	130 kg/ha

Physiological parameters include the important events in the life of the species. It also highlights the growth of the plant along with the flowering and fruiting events. Moreover, it can cope of with environmental conditions. A physiological event has been greatly influenced by plant hormones. In the present investigation pre-sowing seed treatment of *Nigella sativa* Linn. with different concentration of Kinetin was studied and was found to produce significant results in all the considered parameters and appreciably enhance all parameters studied, especially at the rate of 10^{-4} M concentration (Table 2, Fig. 2). However, a higher concentration failed to bring about any significant effects. The seeds before sowing were tested for its viability in order to check the quality of the seeds. The seeds pass the viability test.

Thus, these experimental studies provide a scientific support to the selected medicinal plant by which the various physiological effects was studied to improve the agrotechniques of the species and it was concluded that the kinetin concentration of 10^{-4} M concentration is very beneficial for the physiological effects of the *Nigella sativa*. Also, in the kinetin concentration 10^{-4} M the studied parameters recorded was found to be maximum as compared to other applied ranges of concentration and control treatments as well as the oil content was also found to be maximum in this range.

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References

1. Singh V. K., Singh Sanjay and Singh D. K. (2008). Pharmacological effects of spices, In Recent progress in medicinal plants, Ed. V. K. Singh, 2, 321-322.
2. Verma Vandana, Kasera P. K. and Mohammed S. (2007). Conservation of desert medicinal plants and cultivating practices of *Asparagus racemous*: A potential bio resource, In Indian folk medicine Ed. P. C. Trivedi, Pointer publication, Jaipur, 299-302.
3. Purohit S. S. and Vyas S. P. (2004). Medicinal plant cultivation: A scientific approach, 1st edition, Agrobios India, Jodhpur, 1-9.
4. Datta S. C. (1980). A Text-book of Plant Physiology, 1st edition, Central book depot, Allahabad, 583-694.
5. Shah S. H. (2007). Physiological effects of pre-sowing seed treatment with gibberellic acid on *Nigella sativa* Linn., Acta Bot. Croat., 66(1), 67-73.
6. Shah S. H. (2007). Influence and phytohormones spray on seed, inorganic protein and oil yields and oil properties of *Nigella sativa* Linn., Asian Journal of Plant Science, 6(2): 364-368.
7. Shah S. H. (2008). Carbonic anhydrase, net photosynthetic rate and yield of black cumin (*Nigella sativaI* Linn.) plants sprayed with kinetin, Acta Bot. Croat., 67(1), 63-68.
8. Shah S. H. and Shamiullah (2008). Responses of black cumin (*Nigella sativa* Linn.) to applied nitrogen with or without gibberellic acid spay, World Journal of Agricultural Sciences, 3(2): 153-158.
9. Shah S. H. (2007). Photosynthetic and yield responses of *Nigella sativa* Linn. to pre-sowing seed treatment with GA3, Turk J. Biol., 31, 103-107.
10. Shah S. H. (2008) studied effects of nitrogen fertilization on nitrase reductase activity, protein and oil yield of *Nigella sativa* Linn. as affected by foliar GA3 application, Turk J. Biol., 32, 165-170.
11. Black C. A. (1965). Methods of soil analysis, American society of Agronomy, Inc. Wisconsin, U.S.A.
12. Misra R. (1968). Ecology work book. Oxford IBH publishing company, New Delhi.

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Table 2: Effect of pre-sowing seed treatment with kinetin on radicle length of *Nigella sativa* Linn.

Treatments	Radicle Length (cm)					
	R1	R2	R3	X	SD	X+SEM
C	1.9	1.9	1.7	1.83	0.09	1.83±0.05
T1(10^{-6}M)	2.2	2.3	1.9	2.13	0.17	2.13±0.09[b]
T2(10^{-5}M)	2.5	2.2	2.6	2.43	0.17	2.43±0.09[a]
T3(10^{-4}M)	2.5	2.7	2.6	2.60	0.08	2.60±0.04[b]
T4(10^{-3}M)	1.8	1.9	2.1	1.93	0.14	1.93±0.08[a]
Plumule Length (cm)						
C	1.9	1.5	1.8	1.73	0.17	1.73±0.09
T1(10^{-6}M)	1.7	2.1	2.0	1.93	0.17	1.93±0.09[a]
T2(10^{-5}M)	2.3	1.9	2.2	2.13	0.17	2.13±0.09[d]
T3(10^{-4}M)	2.7	2.3	2.6	2.53	0.17	2.53±0.09[c]
T4(10^{-4}M)	1.6	1.1	1.4	1.36	0.20	1.36±0.11[c]
Length of root (cm)						
C	10.3	9.8	10.6	10.23	0.33	10.23±0.19
T1(10^{-6}M)	11.7	12.6	12.1	12.13	0.36	12.13±0.20[a]
T2(10^{-5}M)	14.4	13.8	14.2	14.13	0.24	14.13±0.13[a]
T3(10^{-4}M)	15.1	14.7	15.4	15.06	0.28	15.06±0.16[b]
T4(10^{-4}M)	7.7	8.9	8.3	8.30	0.48	8.30±0.27[c]
Length of shoot (cm)						
C	40.7	39.8	40.3	40.26	0.36	40.26±0.20
T1(10^{-6}M)	43.1	42.6	43.9	43.20	0.53	43.20±0.30[c]
T2(10^{-5}M)	47.2	47.1	47.7	47.33	0.26	47.33±0.15[a]
T3(10^{-4}M)	48.5	48.3	48.3	48.36	0.22	48.36±0.12[c]
T4(10^{-4}M)	37.9	38.6	38.0	38.16	0.30	38.16±0.17[d]
Branches/plant (No)						
C	6	5	5	5.33	0.47	5.33±0.27
T1(10^{-6}M)	5	7	6	6.00	0.81	6.00±0.46[a]
T2(10^{-5}M)	6	6	7	6.33	0.47	6.33±0.27[a]
T3(10^{-4}M)	7	8	8	7.66	0.47	7.66±0.27[b]
T4(10^{-3}M)	5	4	5	4.60	0.47	4.60±0.27[c]
Flowers/plant (No)						
C	22	24	20	22.00	1.63	22.00±0.94
T1(10^{-6}M)	25	26	25	25.33	0.47	25.33±0.27[c]
T2(10^{-5}M)	31	29	32	30.66	1.24	30.66±0.71[a]
T3(10^{-3}M)	32	36	35	34.33	1.69	34.33±0.97[c]
T4(10^{-2}M)	19	21	20	20.00	0.81	20.00±0.46[d]
Capsule/plant (No)						
C	16	16	17	16.33	0.47	16.33±0.27
T1(10^{-6}M)	18	16	19	17.66	1.24	17.66±0.71[a]
T2(10^{-5}M)	25	25	24	24.66	0.47	24.66±0.27[a]
T3(10^{-4}M)	28	27	27	27.33	0.47	27.33±0.27[d]
T4(10^{-3}M)	12	16	15	14.33	01.69	14.33±0.97[b]
Seeds/plant (gm)						
C	1.25	1.29	1.24	1.26	0.02	1.26+0.01
T1(10^{-6}M)	1.39	1.43	1.42	1.41	0.01	1.41+0.005[b]
T2(10^{-5}M)	1.84	1.82	1.80	1.82	0.01	1.82+0.005[c]
T3(10^{-4}M)	2.16	2.15	2.13	2.14	0.01	2.14+0.005[c]
T4(10^{-3}M)	1.13	1.18	1.17	1.16	0.02	1.16+0.01[a]

Values are expressed as X (Mean) ±SEM, n=3. (One way ANOVA followed by Student t-test). Statistically significance of [a]P < 0.05, [b]P<0.01, [c]P<0.001 and [d]NS in comparison to respective control. Abbr. C = Control, T1 = KIN Conc. (10^{-6} M), T2 = KIN Conc. (10^{-5}M), T3 = KIN Conc. (10^{-4}M), T4 = KIN Conc. (10^{-3}M).