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STUDIES ON ECOLOGY AND REPRODUCTIVE BIOLOGY OF CRESS (*LEPIDIUM SATIVUM* L.) FOR ITS VARIOUS PHARMACEUTICALS AND AGRICULTURAL IMPORTANCE IN INDIA

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Abstract

Since, nature has provided a complete store house of remedies to cure all ailments of mankind. The knowledge of drugs has accumulated over thousands of years as a result of man's inquisitive nature so that today we possess many effective means of ensuring health care. The dependence of tribal and rural people on medicinal plants is increasing day by day. Ecology includes the important events of life of a species. Among these, growth and yield of cress plant play the vital role in maintenance of the economy of common people and marginal farmers. Cress (Chansur) is native to South West Asia and it is now cultivated in numerous parts of our country during winter season as a cash crop. The high nutritional value, it's processing in a large number of products, including health supplements, makes this crop quite attractive for the country where other crops cannot be grown. With this crop during 2008 and 2009 in season an experiment was laid out at the research farm of Janta Post Graduate College, A.P.S. University, Rewa (M.P.). There were twelve treatment combinations replicated three times in randomized block design. During the course of investigation growth and yield attributes were computed. The experimental results showed that seed of cress can retain their ability to germinate for a considerable period with maximum germination at the depth of 2 cm depth in monochromatic red light which have promoted the seed germination. In general growth behavior of cress was influenced significantly by fertilizer application and enhanced very fast in early stage and there after very slow to reproductive phase. Significant yield (7.43 q/ha) and maximum net returns (Rs 35384 per ha) were obtained with treatment $\mathbf{T_2}$- 45 kg N, 30 kg P_2O_5 and 15 kg K_2O per hectare. It also has been concluded that cress is a medicinal and oil yielding crop of winter season having medicinal values and more useful for many pharmaceutical industries. Cress seeds remain viable for a period of 19 months. This plant also may important role in improving soil health by enhancing organic matter and soil microbes.

Key words : Ecology, reproductive biology, nature, pharmaceuticals, agricultural, Cress plant, nutritional and medicinal value, India.

Introduction

Cress (*Lepidium sativum* L.) commonly known as Chansur (H), garden cress (E) belongs to family Brassicaceae is an annual, erect herbaceous plant, growing upto 50-75 cm (Hewson, 1982). Cress is well suited to all soils and climates, although it does not tolerate rains frosts. In our country it is cultivated as a winter crop for its valuable seeds. *Lepidium sativum* is distributed throughout almost all temperate and subtropical regions of studies in the U. Kraine, UzKo listnyti was the best, being highly productive and of good quality. Cress is an easily grown plant with few requirements. It can be cultivated during October – November. The seed are light and small and recommending sowing in shallow furrows, which enables surplus plants to be thinned out. The seeds sprout four to six days after sowing, depending on the soil moisture. Its growth is very rapid and harvesting can begin in the month of February – March after four months. The yield is approximate 4-6 per hectare.

Chemical composition of seeds reveals the presence of protein (27.5 – 33.1%), fat (6%), dietary fiber (75%)

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amino acid (19.3%). The product contained 12% protean, 4% fat and 74.3% DF and exhibited desirable functional properties such as dispensability, gelling ability, stability, formed homogenous mild alkaline suspension and was comparable to propriety DF (Sumangala *et al*., 2004).

Humanities rely on a diverse range of cultivated species. It is after stated that only a few staple crops produce the majority of the food supply. Several countries in the worlds have a rich heritage of herbal drugs, very few can put claim for their procurement only from cultivated species. Obviously, some of these herbs have been subjected to systematic cultivation based on modern scientific information (Getinet and Sharma, 1996). However, at present medicinal plants are looked upon not only as a source of health care but also as a source of income (Dwivedi *et al.*, 2009, 2010). Cress is cultivated in some parts of Madhya Pradesh in India also. A very little effort has been made so for to study the ecological and reproductive biological parameters of this species. Recently, medicinal value of the many species has also attracted the attention of this species worker (Jain, 1999; Bakhru, 1998; Kumar *et al*., 2009). Singh *et al*. (2002) have studied the various aspects of growth and yield of this herb.

The growth and yield attributing characters viz., plant height, leaves per plant, tillers and fingers per plant and weight of rhizome increased significantly with farm yard manure (FYM) application in *Curcuma longa*. Vermicompost has been advocated as good organic manure for integrated nutrient management (Ranwa and Singh, 1999). A review of literature reveals that cress (*Lepidium sativum*) has not been studied ecologically and reproductive biologically. Therefore, the present studies have been carried out to know its germination and growth behavior, ethno botany, yield and ecology.

Materials and Methods

The cress plant is cultivated throughout our country for its valuable seeds during the month of October – November. To study the various parameters in field and laboratory various methods were adopted as suggested by eminent workers. Climatic data regarding monthly temperature range, monthly average rainfall, humidity of the study period were obtained. Morphology of seeds was studied by illustrating its microscope parameters (Misra, 1968). Germination of seed speed was calculated as per method suggested by Pandey (1992). It is refer is days within which 50% seeds undergo germination. Germination % can be calculated by the formula given below by Sharma (1955):

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

Seed germination in varying soil depths

To find out a proper depth of seed sowing for better germination 50 seeds were sown in polythene bags with varying depths of soil as shown in table 1 and data were recorded.

Table 1 : Seed germination of cress in varying soil depth.

No. of bag	Depth of soil (cm.)	G.I. (days)	G.S. (days)	G.P. (%)
1	0	4	-	10
2	1	5	8	52
3	2	7	10	82
4	3	9	13	64
5	4	10	-	16.20
6	5	-	-	-

G1= Germination initiation, GS = Germination speed, GP = Germination percentage.

Seed germination in different types of soil

Seed of cress were sown in petri-dishes fielded with different type of soil and emergence of seed lings were observed. Obtained are mentioned in table 2.

Table 2 : Seed germination and seedling growth of cress in different type of soil.

Soil type	G.I. (days)	G.S. (days)	G.P. (days)	Seedling growth (cm)		
				Radical	Plumule	Total
Black soil (BS)	7	10	52.00	1.5	0.8	2.3
Garden Soil (GS)	5	09	69.00	1.6	0.8	2.4
FYM	4	08	76.00	1.7	1.0	2.7
GS+FYM	8	11	65.00	1.6	1.0	2.6
GS+FYM+ BS	6	08	86.00	2.0	1.1	3.1

Effect of photosensitivity, monochromatic light and temperature on seed germination were also observed and presented in table 3, 4 and 5.

For the influence of fertilizers a field experiments were conducted during rabi season of 2008-2009 and 2009 – 2010, respectively at private Agricultural Farm, near Petrol Pump, Allahabad Rood, pertaining to growth and yield of cress were tabulated and statistically computed and presented in table 6.

The experiments were laid out in randomized block design with three replications. Size of each plot was 4×3

m. the treatmental details were as under :

T_0 - control

T_1 - N:P:K = 30:20:10 kg/ha

T_2 - N:P:K = 45:30:15 kg/ha

T_3 - N:P:K = 60:40:20 kg/ha

The textural classification of the soil was sandy – clay- loam before stating the experiment. The soil samples were collected and were subjected to determine the physico- chemical properties of the soil by standard chemical procedures and presented in table 7. The topography of the field was fairly uniform having mild slope.

Results and Discussion

The experimental results high lighting the ecology and reproductive biology of *Lepidium sativum* Linn during winter season are being discussed here for the clarity and convenience. It is an annual, erect herbaceous plant belonging to family Brassicaceae, growing upto 50-75 cm height. The inflorescences are in dense racemes. The flowers have white or slightly pink petals, measuring 2mm. the siliquae measure 5 to 6×4 mm, are elliptical, elate from the upper half and glabrous. Seed are small and yields lighting and medicinal purpose.

The mechanical analysis of the soil of experimental field indicated the variation in sand, silt and clay loam. Almost the similar results have been obtained by the other workers (Patel, 2007; Dwivedi, 2008). The soil pH of experimental field was 7.8, which is considered as normal (Dutta Biswas, 1971).

The seeds of cress were small light having thin and brown coat. In the present study volume of seed heavier its weight and lesser the volume, lighter its weight. Similar conclusions have been drawn by Dwivedi (2008). It is obvious from the present study that the seed have a viability period of 19 months. The experiment conducted to study the effect of various soil depths on germination (table 1) indicate that maximum germination (82%) occurred at depth of 2 cm. Similar conclusion have been drawn by Ramesh Bbu and Joshi (1970).

Present investigation reveals that different type of soil (table 2) causes variations in seed germination and seedling growth. Maximum seed germination (86%) was observed in mixture of black soil, garden soil and FYM and minimum (52%) in black soil. Better germination performance is due to physical and chemical characteristics of the soil (Shrivastava, 2009).

Data mentioned in the text reveal that monochrome tie light has played an important role in seed germination

Table 3 : Effect of photo sensitivity on seed germination of *Lepidium sativum*.

Light shade	GI (days)	GS (days)	GP (%)	Seedling growth (cm)		
				Radical	Plumule	Total
Total darkness	6	-	38	1.70	0.90	2.60
Room shade	4	8	86	1.90	0.80	2.70
Tree shade	5	8	72	1.80	0.70	2.50
Bright light	6	10	12	1.50	0.50	2.00

Table 4 : Effect of monochromatic light on seed germination of *Lepidium sativum*.

Light condition	GI (days)	GS (days)	GP (%)	Seedling growth (cm)		
				Radical	Plumule	Total
White (Control)	3	7	88	1.90	1.00	2.90
Blue	4	8	58	1.60	0.60	2.20
Green	5	9	42	1.50	0.50	2.00
Yellow	6	10	62	1.50	0.70	2.20
Red	5	9	82	1.80	0.90	2.70

Table 5 : Effect of temperature range on seed germination of *Lepidium sativum*.

Temp. range	GI (days)	GS (days)	GP (%)	Seedling growth (cm)		
				Radical	Plumule	Total
5-10	10	-	38	1.40	0.50	1.90
10-20	4	8	72	1.80	0.80	2.60
20-30	5	9	86	1.90	1.00	2.90
30-40	6	10	52	1.60	0.70	2.30

of cress. It is evident from the present study that red light and room shade or tree shades are suitable and promotes the seed germination (tables 3 and 4). Photo control of seed germination has also been studied by Misra (1968) and gave similar results.

Seed due to ecological requirements have deficit temperature range in which they germinate. The present study indicates that seeds of cress had been found to germinate within a temperature range of 5°C to 40°C (table 5). The present results are similar to those of Kumar and Chaudhary (1971) and Shrivastava (2009).

In a majority of medicinal crops, nitrogen, phosphorus and potassium are considered to play the significant role on growth and yield. In present study the application of fertilizers in all the treatments gave significant results on growth and yield of cress plant (table 6). These finding are corroborate with the results of Harinkehde *et al*.

Table 6 : Height, no. of seed plant, seed yield and net returns of *Lepidium sativum* as influenced by various doses fertilizer application.

Fertilizer doses (kg/ha)	Height		No. of seed per plant		Seed yield (q/ha)		Net returns (Rs)
	I year	II year	I year	II year	I year	II year	Mean of two years
Control (To)	77.60	73.30	1617	1649	4.51	4.63	17598
N:P:K=30:20:10 (T_1)	80.30	80.60	1659	1691	6.54	6.60	28712
N:P:K=45:30:15 (T_2)	82.60	83.60	1693	1741	7.58	7.69	35384
N:P:K=60:40:20 (T_3)	78.30	76.60	1639	1654	5.61	5.80	22142
CD (5%)	2.15	3.53	16.00	24.00	0.60	0.80	-

Table 7 : Physico – chemical properties of the experimental soil.

Soil characteristics	Results	Methods of determination
A. Physical		
i. Sand (%)	65.37	International pipette method (Piper, 1950)
ii. Silt (%)	14.62	
iii. Clay (%)	20.01	
B. Chemical		
i. Soil pH	7.8	Blackman glass electrode pH meter (Black, 1965)
ii. Electrical conductivity (m mhose/cm)	0.87	Electrical conductivity meter (Black, 1965)
iii. Organic Carbon (%)	0.75	Walkley and Black's method (Black, 1965)
iv. Available N (kg/ha)	283.80	Alkaline – permagnate method (Subbiah and Asija, 1956)
v. Available P (kg/ha)	26.30	Olsen's method (Olsen *et el*., 1954)
vi. Available K (kg/ha)	250.50	Flame photometer

(2005) and Ajay *et al*. (2005).

There are two aspects of reproductive biology (Fryxell, 1957) :

1. The natural mode of pollination of the species and
2. The usual or possible mode of pollination

Both the above aspects have been investigated in relation to reproductive biology of *Lepidium sativum* and plant under study exhibits both open and insect pollination. However, maximum fruit setting was observed as a consequence of insect pollination.

Summary and Conclusion

Garden cress is a medicinal and oil yielding crop of winter season and can be cultivated in our country for its valuable seeds and seeds remain viable for a period of 19 months. Alternate day watering and room shade have been found to be favors the seed germination. Optimum temperature for the germination of seed is 20-30°C and in red light. Growth and yield can be obtained significantly better with 45:30:15 kg/ha of N:P:K fertilizer application respectively through FYM.

Due to adoption of improved production technology, can get hand some financial gain by cultivating this crop and may help to provide low cost without any side effects with improving soil health and climate.

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