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Research Note :

RESPONSE OF GIBBERELLIC ACID ON GROWTH BEHAVIOUR AND MENTHOL OIL YIELD OF MENTHA (*Mentha piperita* L.)

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Mint (*Mentha piperita* L.) is a perennial herb of family Lamiaceae which is extensively grown as domestic medicinal herb as well as for commercial menthol oil production. Essential oils are the most important raw materials for fragrance and aroma industry. They are also used widely in the food and pharmaceutical industries due to their therapeutic, antimicrobial and anti-oxidant activities. As secondary metabolites groups, essential oil compounds play an important role in the plant's fitness under environmental fluctuations (Kapoor, 4). Plant growth hormones also play an important role in the regulation of growth and development of plants by affecting sink-source relationship (Marscher, 5). Exogenous application of growth promoters (gibberellic acid) exhibits positive metabolic activities under seasonal variations (Kapoor, 4). Keeping the views in mind, the present study was aimed to investigate response of GA_3 on growth behaviour and menthol oil contents in *Mentha piperita* L. under the influences of variable seasons.

The present pot culture experiments were carried out in the Department of Botany, Dr. A.H. R.S. Degree College, Jaunpur during 2011 for two consecutive seasons i.e. winter (January-March) and summer (April-June) season (Table 1). Uniform suckers of mentha (American mint) were grown in nursery beds with whole care with appropriate supply of organic manures. Four weeks old nursery grown saplings were transplanted in suitable pots of 12 inch size. During each season (winter and summer), the pots containing soil and organic compost in 1:1 ratio were duly made for experimental purpose under suitable photoperiodic conditions. For each set of seasonal experiments, number of pot cultures of mint were maintained. All pots, replicated thrice, were treated by exogenous application (spray) of seven different successive concentrations (0, 10, 15, 25, 50 and 100 ppm) of gibberellic acid. After 75 days of GA_3 spray, in each season (winter and summer), observations on plant height, number of stolons and number of leaves per plant, leaf area, plant biomass and menthol oil contents were taken and average of three replications was analysed statistically. Leaf area was measured by Leaf Area Meter and oil content in fresh herb was estimated by steam distillation using Clevanger apparatus (Clevenger, 2).

The investigation was projectd to examine the effect of growth stimulator (GA_3) on growth behaviour and essential oil (menthol) yielding capacity of *Mentha piperita* L. under the influences of different seasons (i.e. winter and summer). A perusal of data (Table 2) revealed that plant height of mentha was linearly increased with every increase in GA_3 concentration in both the seasons and it was observed maximum (81.25 cm and 78.51 cm in winter and summer season, respectively) with 100 ppm GA_3 spray followed by 75 ppm and 50 ppm concentrations. In contrary to plant height, number of stolon branches per plant was decreased linearly with every increase in gibberellic acid concentration from 0 to 100 ppm, where the highest numbers of stolon branches in winter (111/plant) and summer (39/plant) were recorded in control (untreated) plants. This also reveals that low temperature and short photoperiod favours the laterals growth of the plant confirming the findings of Clark and Menary (1). Number of leaves per plant was also influenced significantly by exogenous application of gibberellic acid, and maximum numbers of leaves per plant (294 in winter and 475 in summer) were observed by the spray of higher concentration (75-100 ppm) of GA_3. Total leaf area per plant as well as dry biomass of plant were observed maximum with the application of lower concentration (25-50 ppm) of gibberellic acid. The higher biomass yield of mint plant of 8.87g in winter season and 10.84g in summer season was observed by the application of 25 ppm and 75 ppm GA_3, respectively. The findings are in consonance with Kapoor (4) and Garg *et al.* (3). Exogenous application of growth stimulator showed significant influences on menthol oil contents in different seasons. Spray of 75 ppm GA_3 resulted in the highest menthol oil contents of 0.85% and 1.94% in winter and summer season, respectively. As regard the seasonal variation is concerned, high temperature and long photoperiod

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Table 1: Meteorological data during the period of experimentation in two seasons i.e. winter and summer (2011).

Months	Week numbers	Date	Temperature (°C)		Relative Humidity (%)		Sunshine (hours)
			Max.	Min.	Max.	Min.	
Jan-Feb	2	08-14	21.8	8.5	91.8	35.5	6.8
	3	15-23	22.3	8.8	92.2	35.9	7.2
	4	22-28	23.6	12.6	91.4	63.2	6.5
	5	29-04	21.8	11.5	93.5	67.5	6.4
Feb-March	6	05-11	22.5	9.4	91.2	43.5	9.7
	7	12-18	25.7	12.4	91.5	54.3	9.5
	8	19-25	26.7	11.4	7.2	33.6	9.8
	9	26-05	27.8	12.3	81.9	43.1	7.6
March-April	10	05-11	24.6	12.6	85.2	51.2	7.2
	11	12-18	31.5	14.0	60.6	32.8	9.5
	12	19-25	32.7	14.5	65.0	31.9	9.7
	13	26-01	32.7	19.5	41.5	24.2	10.8
April-May	14	02-08	39.3	20.0	37.8	14.5	10.5
	15	09-15	38.9	18.2	41.5	16.9	10.8
	16	16-22	36.5	21.2	63.8	32.5	10.4
	17	23-29	40.7	22.9	45.5	23.3	10.9

Table 2: Responses of *Mentha piperita* L. for growth and menthol oil yields at 75 days after treatment as affected by GA3 and seasonal variation i.e. winter (W) and summer (S) season 2011.

GA3, Treatments	Height of plant (cm)		No. of stolon branches/plant		No. of leaves per plant		Total leaf area per plant (cm2)		Dry Biomass of plant (g)		Menthol oil yield (%)	
	W	S	W	S	W	S	W	S	W	S	W	S
0 ppm	35.50	41.16	111	39	266	345	2855.50	5574.35	7.95	10.25	0.64	1.24
10 ppm	47.55	54.40	102	36	275	348	3385.76	5384.15	8.30	10.54	0.73	1.67
15 ppm.	50.75	55.25	109	34	279	353	3491.25	5445.18	8.45	10.25	0.75	1.75
25 ppm	52.47	75.21	115	35	281	382	3592.55	6292.37	8.87	10.75	0.81	1.85
50 ppm	65.33	76.25	105	34	289	385	3485.65	6885.40	8.35	10.35	0.74	1.75
75 ppm	71.22	78.53	95	33	294	395	3383.21	5595.35	7.97	10.84	0.85	1.94
100 ppm	78.51	81.25	88	27	287	475	2798.81	4875.78	7.66	10.75	0.79	1.76
C.D. (P=0.05)	0.55	0.13	1.07	0.88	1.68	3.07	0.64	1.17	0.03	0.02	0.01	0.34

treatment (summer season) is the most suitable environment for menthol oil production as compared to winter season (low temperature, short day). It concludes that long photoperiod treatment along with higher concentration of GA_3 favours more stimulation of menthol oil contents in the peltate glandular trichomes of plant body which also confirms the findings of Garg *et al.* (3).

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