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Nutritional and physiological requirements of different strains of *C. indica* for growth and biomass production

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Abstract

Milky mushroom (*Calocybe indica*) is a new addition to the domestic mushroom and next to paddy straw mushroom. Fungi are cultivated worldwide for the production of edible mushrooms. Among the cultivated mushroom, milky mushroom (*Calocybe indica* P&C) is a potentially new species to the world mushroom growers. It is a robust, fleshy, milky white, umbrella like mushroom, which resembles button mushroom. The experiments was conducted to explore the role of different temperatures, media, relative humidity, light duration and pH on growth and biomass of different strain (CI-1, CI-2, CI-3, CI-4 and CI-5) of *C. indica*. There was significant difference observed in radial growth, fresh mycelia and dry mycelia weight of *C. indica* on different media under study. The highest radial growth (87.00 mm), fresh mycelia weight (5.87g) and dry mycelia weight (0.39 g) of *C. indica* was noticed on potato dextrose agar medium and potato dextrose liquid medium. Temperature significantly influenced the radial growth of *C. indica* and significantly high (87.26 mm) radial growth of *C. indica* was recorded at 25°C but more fresh (3.83g) and dry (0.50g) mycelia weight of *C. indica* was recorded at 28 °C. Maximum mycelium growth (85.93 mm), fresh and dry biomass (5.55 g, 0.53 g) was observed at 90 and 80% relative humidity. The radial growth (72.60 mm), fresh and dry biomass (3.77g, 0.54) production was more at pH 6 than other tested pH. Higher mycelia growth (87.40 mm) fresh and dry biomass (6.40 g, 0.34g) was obtained when light was provided alternate cycle of 12 hr. dark and light.

Keywords: Milky mushroom, *Calocybe indica*, temperatures, media, relative humidity, light duration

Introduction

Among the cultivated mushroom, the milky mushroom (*Calocybe indica* P&C) is a potentially new species to the world mushroom growers. It is a robust, fleshy, milky white, umbrella like mushroom. *Calocybe indica*, a tropical edible mushroom, is popular because it has good nutritive value and it can be cultivated commercially. *Calocybe indica* was first time reported from West Bengal Indica by Purkyastha and Chandra, (1976) [9]. It can help in recycling the organic wastes into profitable products (Olfati *et al.*, 2008). It grows well at a temperature of 25-35°C and relative humidity more than 80% and widely known as white vegetable among the most commonly cultivated mushrooms.

Materials and Methods

Micro-Organism: The pure culture of different strains of *Calocybe indica* viz. CI-1, CI-2, CI-3, CI-4 and CI-5 were procured from All India Co-ordinate Mushroom Research Project Center, IGKV, Raipur, Chhattisgarh.

Effect of different media: Three different media - Potato dextrose agar, wheat extract, malt extract.

Effect of temperature: Different temperature – 22 °C, 25 °C, 28 °C, 31 °C and 34 °C for incubation.

Effect of light duration: Different time periods - 1. 6 hrs. light and 18 hrs. darkness 2. 12 hrs. light and 12 hrs. darkness alternatively 3. 18 hrs. light and 6 hrs. darkness 4. 24 hrs. light 5. 24 hrs. darkness.

Effect of relative humidity: Five levels of relative humidity (60, 70, 80, 90 and 100 percent).

Effect of pH:- Different levels of pH (4, 5, 6, 7, 8 and 9) The pH was maintained in potato dextrose agar medium and potato dextrose broth with the help of pH meter using 0.1 N, HCL and 0.1 N, NaOH solution.

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In all experiment the plates and flask containing 20 ml PDA medium and 75 ml liquid medium respectively were inoculated by pure culture of each strains of *C. indica*. The inoculated plates and flask were incubated for 15 days at 30°C. The observation were recorded for radial growth, fresh and dry biomass when the mycelium growth in any treatment reached at the periphery of the plates.

Experimental design: All the experimental data were analyzed using factorial – CRD. The critical difference (C.D.) was calculated at 5% levels. The data were analyzed according to slandered methods using the OPISTAT program.

Results and Discussion

Effect of media on radial growth and biomass of different strains of *C. Indica*

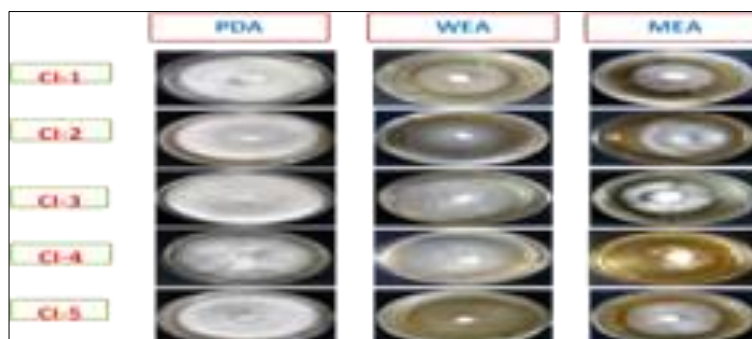


Fig 1: Effect of media on radial growth of different strains of *C. indica*.

Table 1: Effect of media on radial growth, fresh weight and dry weight of different strains of *C. indica*

Strains Medium	Radial growth of strains (mm)*				Freash weight of strains (g)*				Dry weight of strains (g)*			
	Potato dextrose agar	Wheat extract agar	Malt- yeast agar	Average	Potato dextrose agar	Wheat extract agar	Malt- yeast agar	Average	Potato dextrose agar	Wheat extract agar	Malt- yeast agar	Average
CI-1	88.75	58.25	40.75	62.58 73.41 77.25 76.33 77.08	6.65	2.97	4.64	4.75 3.01 4.07 4.63 3.70	0.47	0.14	0.30	0.30 0.21 0.23 0.25 0.27
CI-2	86.00	61.50	72.75		4.18	1.58	3.29		0.34	0.12	0.18	
CI-3	87.00	75.25	69.50		6.22	1.54	4.45		0.35	0.13	0.22	
CI-4	85.25	81.50	62.25		6.09	2.75	5.05		0.38	0.11	0.26	
CI-5	88.00	72.25	71.00		6.20	1.65	3.27		0.40	0.14	0.28	
Average	87.00	69.75	63.25		5.87	2.10	4.14		0.39	0.13	0.25	
Strains	SEm± CD (5%)				SEm± CD (5%)				SEm± CD (5%)			
Media	1.18 3.39				0.10 0.30				0.008 0.02			
Strains×	0.92 2.63				0.08 0.23				0.006 0.01			
Media	2.05 5.88				0.18 0.53				0.01 0.03			

There was significant difference in radial growth of *C. indica* on different media under study. The highest (87.00 mm) radial growth of *C. indica* was noticed in potato dextrose agar medium. The lowest (63.25 mm) radial growth was found on malt extract agar. Followed by wheat extract agar (69.75mm). On an average, the radial growth of different strains of *C. indica* differed significantly. It was maximum (77.25 mm) in CI-3 and closely followed by CI-5, CI-4 and CI-2. However, it was least recorded in CI-1 (62.58). Interaction of media x strains did also exhibit significant difference in radial growth of different strains of *C. indica*, different strains differ statistically with each other. Strain CI-1 gave significantly higher (88.75 mm) radial growth on potato dextrose agar medium than other combination and least (40.75 mm) was found in malt extract medium with CI-1. PDA as suitable medium for culturing of *C. indica* was also reported by Shukla (2003) [11], According to Prasuna (2002) [8] malt extract and PDA as suitable media for the growth of *C. indica*. Krishnamoorthy *et al.*, (2015) [2] reported that the majority of the time required for maximum mycelia growth of *C. indica* in culture media like potato dextrose agar or malt extract agar was 8 to 10 days.

Effect of media on fresh weight of different strains of *C. indica*

The mean fresh mycelial weight of *C. indica* on different media differ significantly. Maximum (5.87 g) fresh mycelial weight of *C. indica* was recorded on potato dextrose broth followed by malt extract broth (4.14 g) whereas, it was lowest (2.10 g) obtained from wheat extract medium. It is obvious from the table, that the biomass production in different strains of *C. indica* differ significantly with respect to different media. Strain CI-1 yielded significantly more fresh weight (4.75g) and next was CI-4 and CI-3 which were at par with each other. However, less (3.01g) fresh mycelial weight was obtained in CI-2. Interaction of media x strains did also exhibit significant difference in radial growth of *C. indica*. Strain CI-1 gave significantly higher (6.65g) fresh weight on potato dextrose broth medium than other combination and least (1.54g) was found in wheat extract broth medium with CI-3. In the present study, potato dextrose broth medium was found as best medium to obtain maximum fresh mycelia weight of *C. indica* and these result are matched with the finding of Shukla (2003) [11] who reported potato dextrose broth as superior medium for obtaining fresh biomass of *C. indica*.

Effect of media on dry weight of different strains of *C. indica*

The mean dry mycelial weight of *C. indica* on different media differs significantly. Maximum (0.39g) dry mycelial weight of *C. indica* was recorded on potato dextrose liquid culture followed by malt extract liquid culture (0.25 g), whereas, it was lowest (0.13g) in wheat extract liquid culture. It is obvious from the table, that the dry biomass production in different strains of *C. indica* differ significantly with respect to different media. Strain CI-1 gave significantly more dry

mycelial weight (0.30). However, less (0.21 g) dry mycelial weight was found in CI-2. Interaction of media x strains exhibit the significant difference in dry weight of *C. indica*. However, it varied from 0.11 to 0.47g in different strains. The present findings are matched with the results of Shukla (2003)^[11] who obtained maximum dry mycelia weight of *C. indica* from PDA.

Effect of temperatures on radial growth and biomass of different strains of *C. indica*.

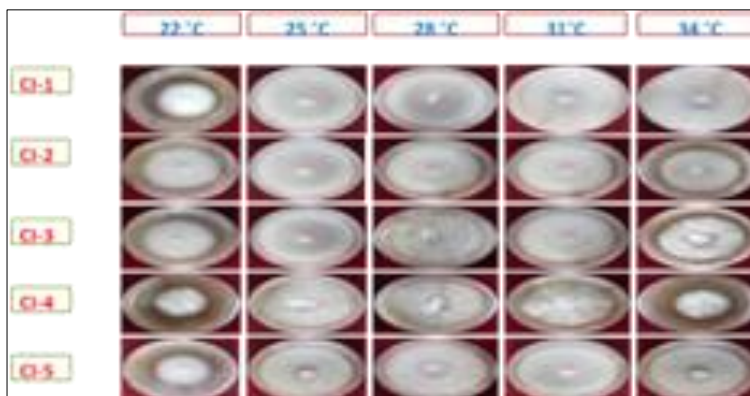


Fig 2: Effect of different levels of temperature on radial growth of different strains of *C. indica*.

Table 2: Effect of different levels of temperature on radial growth, fresh weight and dry weight of different strains of *C. indica*.

Strains/Temperature	Radial growth of strains (mm)*						Fresh weight of strains (g)*						Dry weight of strains (g)*					
	22°C	25°C	28°C	31°C	34°C	Average	22°C	25°C	28°C	31°C	34°C	Average	22°C	25°C	28°C	31°C	34°C	Average
CI-1	60.66	88.33	89.00	86.66	85.66	82.06	2.15	4.24	4.80	4.58	2.85	3.72	0.08	0.39	0.52	0.41	0.47	0.37
CI-2	61.66	86.66	84.66	83.66	72.66	77.86	0.00	0.72	2.57	1.17	0.91	1.07	0.00	0.34	0.53	0.36	0.51	0.35
CI-3	45.66	88.33	86.66	84.66	61.66	73.40	0.14	2.89	4.54	1.38	1.58	1.07	0.09	0.44	0.57	0.17	0.38	0.33
CI-4	42.33	87.33	83.00	82.00	43.33	67.60	0.00	2.97	3.62	0.78	0.42	1.55	0.00	0.42	0.44	0.36	0.15	0.27
CI-5	57.33	85.66	87.33	87.00	84.00	80.26	0.34	3.16	3.63	2.50	2.13	2.35	0.07	0.51	0.45	0.34	0.23	0.32
Average	53.53	87.26	86.13	84.80	69.46	80.26	0.52	2.79	3.83	2.08	1.58	2.35	0.04	0.42	0.50	0.33	0.35	0.32
Strains	SEm± CD (5%)						SEm± CD (5%)						SEm± CD (5%)					
Temp.	0.93 2.63						0.19 0.54						0.01 0.04					
Strains× Temp.	0.93 2.63						0.19 0.54						0.01 0.04					
	2.06 5.89						0.42 1.21						0.03 0.09					

(*)- Average of three replications

It is apparent from table that temperature significantly influenced the radial growth of *C. indica*. On an average, the highest (87.26 mm) radial growth of *C. indica* was recorded at 25 °C followed by 28 °C, 31 °C and 34 °C (86.13, 84.80 and 69.46 mm respectively). The radial growth was significantly inferior (53.53 mm) observed at 22 °C. The results presented in Table 4.4 indicated that there was considerable difference in average radial growth of different strain of *C. indica*. The growth was significantly higher (82.06 mm) in CI-1 whereas; it was lower (67.60 mm) with CI-4, followed by CI-3 (73.40 mm), CI-2 (77.86 mm) and CI-5 (80.26 mm). Interaction of temperature x strains, Strain CI-1, gave significantly higher (89 mm) radial growth at 28 °C and it was least 42.33 mm of CI-4 at 22 °C temperature. Temperature of 25 °C was found to support good mycelia growth of *C. indica*. At 22 °C, growth was least in solid media. The present findings are partially matched with the other workers. Shukla (2003)^[11] reported maximum mycelia growth of *C. indica*. Temperature 25 °C favoured the growth of *C. indica* have been reported by Prasuna (2002)^[8], Chandra and Purkayastha (1997).

Effect of different level of temperature on fresh weight of different strains of *C. indica*

Among the tested temperature, maximum (3.83g) fresh mycelial weight of *C. indica* was recorded at 28°C followed by 25 °C, 31°C and 34°C (2.79mm, 2.08mm, 1.58mm respectively) whereas, it was lowest (0.52g) was recorded at 22°C temperature. The mean fresh mycelial weight of different strains of *C. indica* varied greatly with respect to varying temperature. Significantly more (3.72 g) fresh mycelial weight was obtained in CI-1 than other strains and least (1.07 g) was noticed with CI-2 followed by CI-4(1.55 g), CI-3(2.11g) and CI-5 (2.35g). Different temperature and strains in respect to fresh mycelial weight was studied and it is clear from Table 4.5 that CI-1 produced maximum (4.80g) fresh mycelial weight at 28°C and it was significantly superior to other combinations. Biomass production was not observed in strains CI-2 and CI-4 at 22°C temperature. Temperature 28°C was found to support fresh mycelia weight of *C. indica*. The present findings are tallies with the results of Shukla (2003)^[11], who obtained maximum fresh macelial weight of *C. indica* at 30 °C and 25 °C.

Effect of different level of temperature on dry weight of different strains of *C. indica*.

Maximum (0.50g) dry mycelial weight of *C. indica* was recorded at 28°C. Whereas, it was lowest (0.04g) was recorded at 22°C temperature. The mean dry mycelial weight of different strains of *C. indica* varied greatly with respect to varying temperature. Significantly more (3.37 g) dry mycelial weight was obtained in CI-1 than other strains and least (0.27g) was noticed with CI-4 followed by CI-5 (0.32 g), CI-3(0.33g) and CI-2 (0.35g). Different temperature and strains in respect to dry mycelial weight was studied. CI-3 produced

maximum (0.57) dry mycelial weight at 28 °C and it was significantly superior than other combinations However, both strains (CI-2, CI-4) was not biomass production at 22 °C temperature. Temperature 28 °C was found to support good dry mycelial weight of *C. indica*. The present findings are in agreement with the result of Shukla (2003) [11] who obtained maximum dry mycelial weight of *C. indica* at 30 °C and 25 °C.

Effect of relative humidity on radial growth and biomass of different strains of *C. indica*

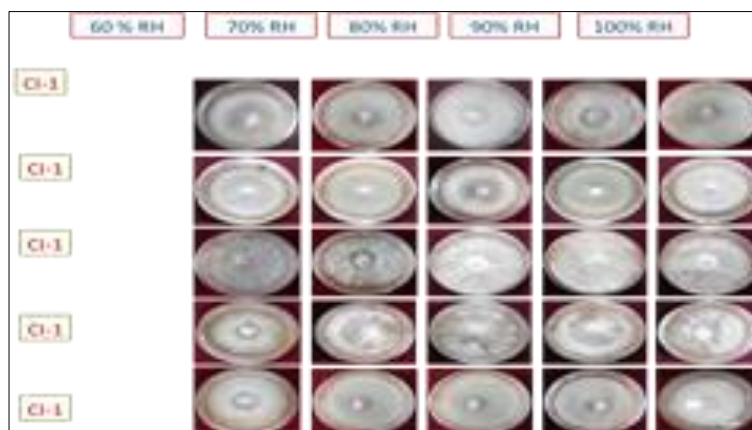


Fig 3: Effect of different level of relative humidity on radial growth of different strains of *C. indica*

Table 3: Effect of different level of relative humidity on radial growth, fresh weight and dry weight of different strains of *C. indica*.

Strains/RH	Radial growth of strains (mm)*						Fresh weight of strains (g)*						Dry weight of strains (g)*					
	60%	70%	80%	90%	100%	Average	60%	70%	80%	90%	100%	Average	60%	70%	80%	90%	100%	Average
CI-1	85.66	86.33	89.33	87.33	88.33	87.40	5.41	5.84	6.45	5.98	6.23	5.98	0.57	0.60	0.66	0.58	0.59	0.60
CI-2	80.66	80.66	85.33	81.00	76.00	80.73	4.33	5.43	5.90	5.70	3.86	5.04	0.29	0.37	0.42	0.40	0.28	0.35
CI-3	83.66	81.33	88.00	89.00	86.66	85.73	3.42	3.56	4.59	4.71	3.55	3.97	0.40	0.43	0.47	0.48	0.43	0.44
CI-4	85.00	83.33	88.00	86.66	83.33	85.26	1.27	4.25	4.48	4.43	2.98	3.48	0.25	0.41	0.49	0.45	0.28	0.37
CI-5	80.33	85.66	79.00	85.00	80.00	82.00	3.63	6.27	6.33	6.48	3.95	5.33	0.46	0.58	0.61	0.64	0.46	0.55
Average	83.06	83.46	85.93	85.80	82.86	82.00	3.61	5.07	5.55	5.46	4.11	5.33	0.39	0.48	0.53	0.51	0.41	0.55
Strains	SEM± CD (5%)						SEM± CD (5%)						SEM± CD (5%)					
RH	0.91 2.61						0.07 0.21						0.008 0.022					
Strains×	0.91 2.61						0.07 0.21						0.008 0.022					
RH	2.05 N/A						0.16 0.46						0.017 0.049					

(*)- Average of three replications

Significantly more radial growth (85.93mm and 85.80mm) of *C. indica* was noticed at 80, 90% relative humidity respectively while it was significantly less noticed at 100 percent relative humidity (82.86 mm) followed by 60 and 70 percent relative humidity (83.06 and 83.46 mm). The mean radial growth of different strains of *C. indica* varied greatly with respect to varying relative humidity. Significantly more radial growth was obtained in CI-1 (87.40mm) than other strains and least (80.73mm) was noticed with CI-2 followed by CI-5 (82.00), CI-4 (85.26mm) and CI-3 (85.73mm). Interaction of relative humidity x strains did not exhibit the significant difference in radial growth of *C. indica*. However, CI-1 produced maximum (89.33mm) radial growth at 80 percent relative humidity. However, it was least found in CI-2 (76.00 mm) at 100 percent relative humidity. Relative humidity ranging from 80-90 percent was also found to be suitable for good radial growth for *C. indica*. Shukla (2003) [11] reported maximum mycelia growth of *C. indica* observed at 75-100% relative humidity. Purkayastha (1982) reported 95-100% relative humidity as most suitable for growth of *C. indica*. Doshi *et al.* (1995) reported 70-80 percent air

humidity to be suitable for mycelia growth and sporophore production of *C. indica*.

Effect of different level of relative humidity on fresh weight of different strains of *C. indica*

Higher fresh biomass production (5.55g, 5.46g and 5.07g) was noticed at 80%, 90% and 70% RH respectively, while it was significantly less (3.61g) at 60% RH and 100% RH(4.11g). The mean fresh mycelial weight of different strains of *C. indica* varied greatly with respect to varying RH. Significantly more (5.98 g) fresh mycelial weight was obtained in CI-1 than other strains and least (3.48g) was noticed with CI-4 followed by CI-3 (3.97 g), CI-2 (5.04g) and CI-5 (5.33g). Interaction of RH x strains fresh mycelial weight of CI-5was significantly higher (6.48g) at 90%RH. However, the fresh biomass of CI-4 was significantly less 1.27g at 60% RH. The fresh mycelium weight of *C. indica* was maximum when the relative humidity varied from 70-90 percent. The present finding are confirmation with the results quoted by Shukla (2003) [11], Doshi *et al.* (1995) [1], Krishnamurthy (1995) who recorded maximum mycelial growth of *C. indica* at 75-100% relative humidity.

Effect of different level of relative humidity on dry weight of different strains of *C. indica*.

Higher biomass production (0.53g and 0.51g) in potato dextrose broth was recorded at 80% and 90% RH, while it was minimum (0.39g) at 60% RH. The mean dry mycelial weight of different strains of *C. indica* varied greatly with respect to varying RH. Significantly more (0.60 g) dry mycelial weight was obtained in CI-1 than other strains and least (0.35g) was noticed with CI-2 followed by CI-4 (0.37 g), CI-3(0.44g) and CI-5 (0.55g). Interaction of RH x strains fresh mycelial weight of CI-1 was significantly higher (0.66g) at 80%RH. However, the dry biomass of CI-4 was

significantly less 0.25g at 60% RH. The fresh mycelium weight of *C. indica* was maximum when the relative humidity varied from 80-90 percent. Thus, it can be said that *C. indica* can grow well at 80-90% as maximum biomass was obtained at these RH ranges. The dry mycelium weight results of of *C. indica* was maximum when the relative humidity varied from 70-90 percent. The present finding are tallies with the result of Shukla (2003) [11] who obtained maximum mycelial growth of *C. indica* at 75-100% relative humidity.

Effect of light duration on radial growth and biomass of difference strains of *C. indica*.

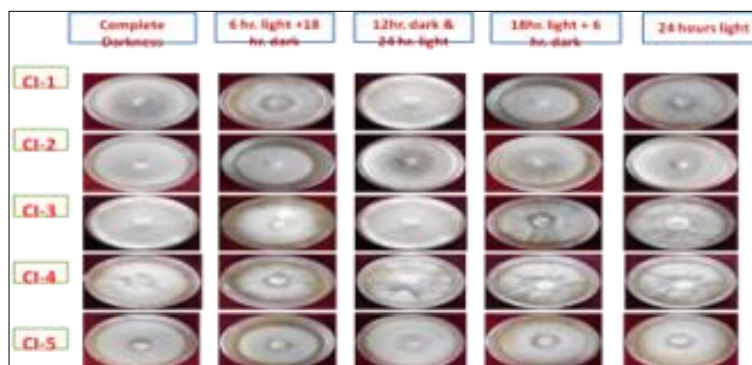


Fig 4: Effect of light duration on radial growth of difference strains of *C. indica*.

Table 4: Effect of light durations on radial growth, fresh weight and dry weight of different strains of *C. indica*

Strains / Light duration	Radial growth of strains (mm)*						Fresh weight of strains (g)*						Dry weight of strains (g)*					
	Complete darkness	6hr light +18 hr darknes	12 hr alterna te dark and light	18 hr light + 6hr darknes	24 hr. light	Average	Complete darkness	6hr light +18 hr darknes	12 hr alterna te dark and light	18 hr light + 6hr darknes	24 hr. light	Average	Complete darkness	6hr light +18 hr darknes	12 hr alterna te dark and light	18 hr light + 6hr darknes	24 hr. light	Average
CI-1					80.3						7.2							0.2
CI-2	86.66	79.00	89.00	81.00	6	83.20	7.10	6.92	7.78	7.27	4	7.27	0.36	0.18	0.38	0.29	2	0.30
CI-3	85.00	79.66	88.00	82.66	3	84.20	7.96	6.45	8.25	7.92	4.6	7.70	0.37	0.19	0.40	0.29	0.2	0.31
CI-4	88.33	78.33	88.33	79.00	3	84.06	6.02	3.70	6.22	3.52	0	4.81	0.31	0.26	0.33	0.24	8	0.28
CI-5	85.66	70.33	86.66	75.66	81.6	80.00	4.19	2.02	4.63	3.35	3.8	3.60	0.24	0.13	0.25	0.21	0.2	0.21
Average	80.00	67.33	85.00	74.66	6	76.40	4.86	2.84	5.11	3.18	2	3.89	0.26	0.17	0.33	0.21	3	0.24
	85.13	74.93	87.40	78.60	75.0		6.02	4.39	6.40	5.05	3.4		0.31	0.18	0.34	0.25	0.2	
					81.8						5.4							0.2
					0						2							0.2
Strains	SEM± CD (5%)						SEM± CD (5%)						SEM± CD (5%)					
LD	0.97 2.78						0.23 0.65						0.01 0.05					
Strains	0.97 2.78						0.23 0.65						0.01 0.05					
× LD	2.18 N/A						0.51 N/A						0.04 N/A					

(*)- Average of three replications

The duration of light showed the significant difference in radial growth of *C. indica*, and it varied from 74.93 to 87.40 mm in different duration of light. The mean radial growth of different strains of *C. indica* varied greatly with respect to varying light duration. Significantly more (84.20 and 84.06mm) radial growth was obtained in CI-2 than CI-3 other strains and least (76.40mm) was noticed with CI-5 followed by CI-4 (80.00 mm), CI-1(83.20mm). Interaction of light duration x strains did not exhibit the significant difference in radial growth of *C. indica*. However, it varied from 67.33 to 89.00 mm in different duration of light. The radial growth of *C. indica* was found to be significantly influenced by duration of light but 12 hr. alternate dark and light gave maximum radial growth. Shukla (2003) [11] obtained maximum mycelia

growth of *C. indica* in presence of alternate 122 hr. light and 12 hr. dark. Prasunna (2002) reported continuous light gave maximum growth of *C. indica*.

Effect of light duration on fresh weight of difference strains of *C. indica*

The duration of light exhibit the significant difference in fresh weight of *C. indica* and it ranged from 4.39 to 6.40g in different duration of light. The mean fresh weight of different strains of *C. indica* varied greatly with respect to varying light duration. Significantly more (7.70g) fresh weight was obtained in CI-2 than other strains and least (3.60g) was noticed with CI-4 followed by CI-5 (3.89g), CI-3(4.81g) and CI-1(7.27g). Interaction of light duration x strains did not

exhibit the significant difference in fresh weight of *C. indica*. However, it varied from 2.02g to 8.25g in different duration of light. The present findings are partially matched with the result of Shukla (2003) [11] who obtained maximum fresh weight of *C. indica* in alternate cycle of light and darkness, 6 hrs light and 18 hrs dark and alternate light and dark cycle.

Effect of light duration on dry weight of different strains of *C. indica*.

Significantly more (0.34g and 0.31g) dry mycelial weight was obtained in 12 hrs. Alternate dark and light, complete darkness. Minimum (0.18g) dry mycelium weight was recorded in 6 hrs. Light and 18 hrs. Darkness. The mean dry weight of different strains of *C. indica* varied greatly with respect to varying light duration. Significantly more (0.31g, 0.30g and 0.28g) dry mycelia weight was obtained in CI-2, CI-1 and CI-3 than other strains and least (0.21g) was noticed with CI-4 and CI-5 (0.24g) they were at par with each other.

Interaction of light duration x strains did not exhibit the significant difference in dry weight of *C. indica*. However, it varied from 0.13g to 0.40g in different duration of light. Duration of light influenced the biomass of different strain of *C. indica* but 12 hrs. Alternate dark and light produced maximum dry biomass of *C. indica* and 6hrs. Light and 18 hrs. Dark was not suitable for the dry mycelium weight. It gave minimum fresh weight of different of *C. indica*. The dry biomass of *C. indica* was found to be significantly influenced by duration of light, 12 hr. alternate dark and light and complete darkness gave maximum dry weight. The present findings are partially matched with the results of Shukla (2003) [11], who obtained maximum dry mycelia weight of *C. indica* at complete darkness, 6 hrs. Light and 18 hrs dark and alternate light and dark cycle.

Effect of different pH on radial growth and biomass of different strains of *C. indica*.

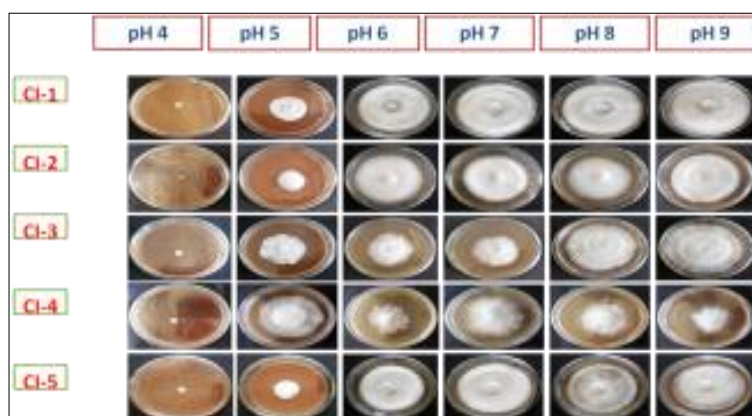


Fig 5: Effect of different pH on radial growth of different strains of *C. indica*.

Table 5: Effect of different pH on radial growth, fresh weight and dry weight of different strains of *C. indica*

Strains/pH	Radial growth of strains (mm)*							Fresh weight of strains (g)*							Dry weight of strains (g)*						
	pH-4	pH-5	pH-6	pH-7	pH-8	pH-9	Average	pH-4	pH-5	pH-6	pH-7	pH-8	pH-9	Average	pH-4	pH-5	pH-6	pH-7	pH-8	pH-9	Average
CI-1	00.00	37.00	83.00	88.00	87.66	84.66	63.38	0.84	3.66	4.18	5.05	3.90	3.70	3.56	0.11	0.32	0.40	0.54	0.38	0.31	0.34
CI-2	00.00	37.66	74.00	63.66	51.66	60.33	47.88	0.18	2.74	4.11	5.20	3.42	3.02	3.11	0.10	0.32	0.44	0.60	0.48	0.28	0.37
CI-3	00.00	51.00	83.66	50.66	60.33	65.33	51.83	0.34	1.12	5.44	3.06	1.18	1.09	2.04	0.14	0.23	0.64	0.38	0.30	0.19	0.31
CI-4	00.00	37.00	42.33	52.00	46.33	50.00	37.94	0.10	1.45	2.80	2.08	1.60	1.22	1.54	0.12	0.31	0.55	0.41	0.23	0.20	0.30
CI-5	00.00	30.00	80.00	87.33	70.00	62.66	55.00	0.36	1.18	2.31	2.39	1.94	1.32	1.58	0.08	0.31	0.67	0.60	0.39	0.21	0.30
Average	00.00	38.53	72.60	68.33	63.20	64.60	55.00	0.36	2.03	3.77	3.55	2.41	2.07	1.58	0.11	0.29	0.54	0.50	0.35	0.24	0.38
Strains	SEM± CD (5%)							SEM± CD (5%)							SEM± CD (5%)						
pH	1.22 3.48							0.16 0.46							0.011 0.032						
Strains×pH	1.34 3.81							0.17 0.50							0.012 0.035						
pH	3.00 8.52							0.40 1.13							0.028 0.079						

(*)- Average of three replications

The average highest (mm) radial growth 72.60mm was observed at pH 6 and next were pH 7 (68.33 mm), pH 9 (64.60mm), pH 8(63.20) and pH 5(38.53). At pH 4.0 no growth was observed in all strains of *C. indica*. On an average, the radial growth of *C. indica* showed significant difference in radial growth of different strains of *C. indica*. Among the strains CI-1 gave significantly higher (63.38 mm) radial growth followed by CI-5 (55.00 mm), CI-3(51.83 mm), CI-2 (47.88 mm), and CI-4 (37.94 mm). Interaction of pH x strains, Strain CI-1 gave significantly higher (88.00mm) radial growth at pH 7 than other combination and all the strains (CI-1 to CI-5) did not give radial growth at pH 4. In the present investigation, pH 6.0 gave the maximum radial growth of *C. indica* and result are matched with the finding of Shukla and Jaitly (2013) [11]. Varshney (2007), who reported all strains of *C. indica*, grew

well at pH range of 6.0-9.0 Similar type of results were also have been reported by Shukla (2003) [11].

Effect of different pH on fresh weight of different strains of *C. indica*

Among the evaluated pH, higher 3.77 g and 3.55g fresh mycelium weight of *C. indica* was recorded at pH 6, pH 7 whereas, it was significantly less (0.36g) found at 4pH. On an average, the fresh mycelial weight of *C. indica* showed significant difference with respect to different strains of *C. indica*. It was maximum fresh weight (3.56g and 3.11g) found in strain CI-1 and CI-2 and next were CI-3 (2.04g), CI-5 (1.58g), CI-4(1.54g). Interaction of pH x strain also exhibit significant difference in fresh mycelial weight of *C. indica*. Strain CI-3 gave significantly higher (5.44g) fresh mycelial

weight at 6 pH than other combination. The present finding are matched with the result of Krishnamoorthy *et al* (1995) ^[4] and Shukla (2003) ^[11] who reported pH 6.5 to 8.0 favoured the fresh biomass of *C. Indica*.

Effect of different pH on dry weight of different strains of *C. indica*.

Maximum (0.54 and 0.50g) dry mycelial weight of *C. indica* was recorded at 6 pH and 7 pH whereas, it was lowest (0.11g) recorded at 4pH. The mean dry mycelial weight of different strains of *C. indica* varied greatly with respect to varying pH. Significantly more (0.38 g and 0.37g) dry mycelial weight was obtained in CI-5 and CI-2 than other strains and least (0.30g) was noticed with CI-4 followed by CI-3(0.31g) and CI-1(0.34 g). Different pH and strains in respect to dry mycelial weight was studied and it is clear from Table 4.15 that CI-5 produced maximum (0.67g) dry mycelial weight at 6pH and it was significantly superior to other combinations. The range of 6.0- 7.0 pH found to be favourable for dry mycelium weight of *C. indica*. The findings are in agreements with the result of Krishnamoorthy (1995) ^[4], Krishnamoorthy (1997) ^[3] and Shukla (2003) ^[11] and Varshney (2007) ^[13] they obtained highest dry mycelial weight of *C. indica* in slightly acidic to alkaline medium.

Conclusion

Potato dextrose agar medium was excellent for mycelial growth and biomass of *C. indica*. The highest mycelial growth of *C. indica* was recorded at 25 °C but 28 °C was most suitable for maximum biomass production. Relative humidity of 80-90 percent was found to be most suitable for mycelial growth and biomass of *C. indica*. 12 hrs. darkness alternatively and continuously light was found to be most suitable for radial growth and biomass of *C. indica*. Maximum radial growth and biomass of *C. indica* was obtained at pH 6.0.

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