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# Studies on vermicompost mycoflora and its effect on growth and yield of *Brassica oleracea* var. *botrytis* L. and *Brassica oleracea* var. *capitata* L.

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The fungal load in the vermin compost was studied through the serial dilution method, and a significant amount of mycoflora was detected in the vermicompost, where the load of *Penicillium* spp. ($2.0x10^5$ CFU/g) and *Aspergillus* spp. ($1.5x10^5$ CFU/g) was maximum. Simultaneously, a pot experiment was conducted in the Department of Botany, Sidho-Kanho-Birsha University, Purulia, to observe the effect of different dosages of vermicompost on the growth and yield of *Brassica oleracea* var. *botrytis* and *Brassica oleracea* var. *capitata* during October 2024 to December 2024. The impact of vermicompost on different vegetative, reproductive and physiological characteristics like average number of leaves, plant height, root length, leaf area, days to knob initiation, fresh and dry weight curd/head, chlorophyll a and b content in leaf were taken into consideration. Experimental results revealed that a 40% vermicompost + 60% basal media mixture ($T_4$) in *Brassica oleracea* var. *botrytis* and a 30% vermin compost + 70% basal media mixture ($T_3$) in *Brassica oleracea* var. *capitata* showed the maximum positive effects in pot culture. Vermicompost application in *Brassica oleracea* var. *botrytis* and *Brassica oleracea* var. *capitata* cultivation maintains growth and productivity.

**Keywords :** *Brassica oleracea* var. *botrytis*, *Brassica oleracea* var.*capitata,* Mycoflora, Vermicompost

## INTRODUCTION

The local microbial community actively mediates the biodegradation and conversion process involving in composting. Fungi are extremely important because of their capacity to use complicated carbon sources and endure harsh environments. Vermicomposting is a primarily mesophilic method in which earthworms stabilize organic residuals by interacting with microorganisms. Earthworms selectively consume some types of fungi, affect the germination and spread of spores, and produce microsites that can either promote or hinder the growth of fungi (Tiunov and Scheu, 2000).

India produces a wide variety of fresh vegetable crops because of its unique climate, and it is the world's second-largest producer after China. In India, West Bengal is the largest producer of fresh vegetables, followed by Uttar Pradesh, Bihar, and Madhya Pradesh (Horticultural statisticsat a glance, 2018).

As the use of chemical fertilizers in vegetable or crop cultivation increases, the demand for organically produced crops is increasing day by day. Organic farming is not only beneficial for increasing yields, but it is also natural, safe, healthy, and maintain soil fertility. In addition to stimulating plant development, increasing crop output by 20% to 30%, and being cost-effective, organic farming also offers the best conditions for soil biological activity (Mahmoud and Hafez, 2010).

The use of organic waste by several earthworm species is known as vermicomposting (Huang *et al.* 2020), and it is prepared in a tub or container. Vermi compost is typically finely divided peat-like materials with high porosity, aeration, drainage, and water holding capacity. Vermicomposting is the process of producing organic fertilizer or biodegradable materials with earthworms. Composting with worms avoids difficulties

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associated with the disposal of food and vegetable wastes and converts them into high-quality compost. The earthworm is one of nature's pinnacle and is known as "soil scientists"(Medany, 2011).Worms of various species have been employed in vermincompost to break down and transform various combinations of organic waste materials into a product with additional value. Sewage sludge (Khwairakpam and Bhargava, 2009), cow farm waste (Plaza *et al*. 2008), poultry waste (Garg and Kaushik, 2005), bagasse (Pramanik *et al*. 2007), industrial waste (Subramanian *et al*. 2010), and residential garbage (Yadav *et al*. 2010) are among the many forms of organic matter that earthworms can decompose.

Vermicompost encourages the growth of roots, which improves the absorption of nutrients and water. Vermicompost increases soil fertility and boosts fruit weight, size, and nutritional value (Muhammad *et al*. 2016). Several researchers reported that vermicompost substantially enhances the growth, productivity, and quality of crop plants. Vermicompost also affects seed germination, seedling vigour, plant growth, flowering, fruiting, root development, colour, and quality of the economic products (Atiyeh *et al*. 2000; Suthar *et al*. 2005; Gupta *et al*. 2008).Therefore, the main objectives of the study were to determine the mycoflora of the vermicompost and the effect of different dosages of vermincompost on the growth and yield of cauliflower and cabbage.

## MATERIALS AND METHODS

### *Isolation and identification of fungal flora from the vermincompost*

The fungal flora of the vermincompost was isolated using the serial dilution technique. One gram of vermincompost was suspended in 9 ml of $Na_4P_2O_7.10H_2O$ for the organic colloids to disperse, followed by additional dilutions were made in physiological saline 0.9% NaCl (Anastasi *et al*. 2004). 1 ml from the dilutions ($10^{-3}$, $10^{-4}$ and $10^{-5}$) were spread on petri plates containing potato dextrose agar. The plates were incubated at 28ºC in an incubator for 4-5 days. The fungal colonies were identified through observation under a microscope (Leica DM 3000 LED) after staining with lactophenol cotton blue solution.

### *Experimental site*

Pot experiment was carried out inside the premises of the herbal garden of Sidho-Kanho-Birsha University, Purulia, West Bengal (23.360 N latitude and 86.330 E longitude). To assess the impact of vermicompost on the growth and yield of *Brassica oleracea* var. *botrytis* (cauliflower) and *Brassica oleracea* var. *capitata* (cabbage) was conducted from October to December 2024.

### *Preparation of soil and seedling plantation*

Soil was taken from the soil surface (0–15 cm) of the rice field adjacent to the University campus. The soil was coarse textured, acidic, with poor organic matter and available nutrients. The soil was spread over a plastic sheet for air drying and the pots were filled with soil with different amounts of vermicompost. Seedlings of cauliflower and cabbage varieties (Table 1) were placed in 10-inch clay pots, followed by judicious watering.

### *Analysis of growth and yield parameters*

The selected plant parameters of growth (number of leaves, plant height, leaf area, and root length), yield (days to knob initiation, fresh weight and dry weight of curd/head) and a physiological parameter *viz*. chlorophyll content were measured in both treated and untreated experimental sets at maturity.

### *Experimental sets*

Triplicate of each of the seven treatments, including the control treatment, were used in the experiment. The potting mixtures were prepared for each treatment using soil and varying proportions of vermicompost (Table 2).

### *Soil Analysis*

The pH, electric conductivity (EC), organic carbon, and NPK content of the potting soil and the different sets of soil-vermicompost mixture were analysed. Jackson (1973) method was used to measure the pH and EC, whereas the Walkley and Black (1934) method was applied to analyse the organic carbon. The method of Subbiah and Asija (1956) was adopted to measure the total nitrogen, whereas the method of Jackson (1973) and Olsen *et al.* (1954) was used to determine the available potassium and available phosphorus, respectively.

### *Statistical Analysis*

The F-test was applied to determine the significant influence of vermin compost treatment on plant parameters. Standard Error of Mean (SEM) was calculated for the reliability of sample means by adopting a complete randomised block design (Gomez and Gomez, 1984).

## RESULTS AND DISCUSSION

### *Mycoflora of vermicompost*

A total of 10 fungal genera were isolated from the vermicompost, among which 7 belong to Ascomycota and 3 to Mucoromycota. *Penicillium* and *Aspergillus* were the most dominant genera detected in the vermicompost (Fig.1). The load of *Penicillium* spp. in the vermicompost was about $2.0 \times 10^5$CFU/g, whereas the load of *Aspergillus* spp. was $1.5 \times 10^5$ CFU/g. The other isolated fungal genera, *Fusarium* spp. ($5.0 \times 10^4$ CFU/g), *Alternaria* spp. ($4.2 \times 10^4$CFU/g), *Cladosporium* sp. ($2.5 \times 10^4$CFU/g), *Trichoderma* sp. ($4.0 \times 10^3$CFU/g), and *Chaetomium* sp. ($2.2 \times 10^3$CFU/g) were from Ascomycota, whereas *Rhizopus* spp. ($4.5 \times 10^4$CFU/g), *Absidia* sp. ($2.5 \times 10^3$CFU/g) and *Cunninghamella* sp. ($2.0 \times 10^3$CFU/g) were from Mucoromycota. The prevalence of different species of *Penicillium* and *Aspergillus* from vermicompost was also reported by Anastasi *et al*. (2004), which supports the current observation. The increased fungal diversity could result from the beneficial activity of earthworms (Tiunov and Scheu, 2000), or a more diverse raw material composition, as well as the mesophilic conditions that are present during vermicomposting and support a wider variety of fungal species. The genera like *Aspergillus*, *Cladosporium*, and *Penicillium* are frequently considered the most prevalent in composting materials because of their thermo tolerance and/or ability to break down a variety of organic waste.

### *Soil nutrient status*

The pH of the pot soil was 5.2, but when amended with vermicompost, the pH was increased, and the maximum increase was observed in $T_5$(6.1) and $T_6$(6.3). The conductivity values in all treatment sets were found to be normal except $T_5$ where the EC was moderately high. The organic carbon was found to increase after application of vermincompost in all the sets, with a maximum enhancement noticed in $T_6$. Similar to organic carbon, the available nitrogen and available phosphorus were found to be elevated in vermincompost-supplemented sets in comparison to the control soil. The maximum elevation in nitrogen content was observed in $T_5$, whereas the maximum increase in phosphorus and available potassium content was detected in $T_6$ (Table 3).

### *Effect of vermicompost on growth and yield of cauliflower*

The treatment $T_4$ consistently showed significantly higher mean values for all the studied parameters than the other treatments and the control set $T_0$ (Table 4). For instance, leaf area increased from 68.83 cm² ($T_0$) to 166.33 cm² ($T_4$), and the fresh weight of curds increased from 510.00 g ($T_0$) to 616.67 g ($T_4$). Similarly, the dry weight of the curd was also enhanced in $T_4$(58.27 g) set under treatment of 40% vermicompost in comparison to control set $T_0$ (44.07 g). Ali *et al*. (2018) and Singh *et al*. (2024) reported that the application of vermicompost with recommended doses of inorganic fertilizers is suitable for the proper growth, maximum yield, and profit generation from the crop cauliflower. Goel and Kaur (2012) also observed that vermincompost treatment has a significant growth impact on plant height, number of leaves, fruits, flowers, and diameter of stem as compared to the control.

### *Effect of vermicompost on the growth and yield of cabbage*

In terms of cabbage production and vegetative development, treatment $T_3$ consistently ranks first. The leaf area was increased to 181.17 cm² under 30% vermincompost treatment ($T_3$) from the control set, where the leaf area was 117.00

**Table 1**: Details of the cultivated crops

| Vegetable | Variety | Family | Producer |
|---|---|---|---|
| Cauliflower (*Brassica oleracea* var. *botrytis*) | Dawn 175 | Brassicaceae | Bayer Seminis |
| Cabbage (*Brassica oleracea* var. *capitata*) | Cabbage, CF_S3141 | Brassicaceae | Cloud Farm |

**Table 2.** Treatment design for cauliflower and cabbage cultivation

| Treatment | Composition |
|---|---|
| $T_0$ (Control) | 100% Basal medium |
| $T_1$ | 10% Vermicompost + 90% Soil |
| $T_2$ | 20% Vermicompost + 80% Soil |
| $T_3$ | 30% Vermicompost + 70% Soil |
| $T_4$ | 40% Vermicompost + 60% Soil |
| $T_5$ | 50% Vermicompost + 50% Soil |
| $T_6$ | 60%Vermicompost + 40% Soil |

**Table 3.** Physicochemical parameters of different treatment sets

| Treatment | pH | EC ($dSm^{-1}$) | OC (%) | N ($Kgha^{-1}$) | $P_2O_5$ ($Kgha^{-1}$) | $K_2O$ ($Kgha^{-1}$) |
|---|---|---|---|---|---|---|
| $T_0$ (Control) | 5.2 | 0.23 | 0.47 | 209 | 70 | 380 |
| $T_1$ | 5.4 | 0.36 | 0.66 | 347 | 115 | 392 |
| $T_2$ | 5.4 | 0.41 | 0.72 | 357 | 121 | 398 |
| $T_3$ | 5.7 | 0.44 | 0.93 | 568 | 137 | 417 |
| $T_4$ | 5.9 | 0.43 | 1.13 | 580 | 210 | 428 |
| $T_5$ | 6.1 | 1.45 | 1.16 | 672 | 235 | 470 |
| $T_6$ | 6.3 | 0.49 | 1.21 | 654 | 246 | 520 |

cm² ($T_0$). Simultaneously, the fresh weight of the head was also enhanced from 890 g ($T_0$) to 1150 g ($T_3$) and the dry weight of the head was found to increase from 79.33 g ($T_0$) to 107.48 g ($T_3$) when 30% vermicompost was applied (Table 5). Alam *et al*. (2017) and Devi and Singh (2012) reported that the cabbage production with the addition of vermincompost is not only supportive for increasing growth and yield but also has the opportunity to improve the status of soil organic matter.

## CONCLUSION

A simple and secure method for producing and recycling organic wastes is vermicomposting, which also improves soil fertility and promotes healthier plant growth and productivity. A

**Table 4** : Effect of vermin compost on the growth and yield of cauliflower

| Treatment | Nos of leaves\ plant | Plant height (cm) | Root length (cm) | Leaf area ($cm^2$) | Days to flower knob initiation | Fresh weight of the curd (g) | Dry weight of curd (g) | Chlorophyll a (mg/g) in 60 days | Chlorophyll b (mg/g) in 60 days |
|---|---|---|---|---|---|---|---|---|---|
| $T_0$ (Control) | 17.00 ± 1.00 | 35.20 ± 1.00 | 8.10 ± 0.20 | 68.83 ± 50.52 | 66.00 ± 2.65 | 510.00 ±4.08 | 44.07 ±1.03 | 6.22±0.02 | 12.73±0.17 |
| $T_1$ | 18.00 ± 0.00 | 37.37 ± 0.90 | 8.43 ± 0.42 | 115.67 ± 4.93 | 60.67 ± 3.51 | 527.00 ±2.16 | 45.63 ±0.17 | 6.36±0.02 | 13.24±0.03 |
| $T_2$ | 19.00 ± 0.00 | 38.67 ± 0.72 | 9.37 ± 0.81 | 79.67 ± 64.76 | 60.00 ± 1.00 | 551.67 ±6.24 | 44.97 ±1.20 | 8.78±0.02 | 13.45±0.02 |
| $T_3$ | 20.67 ± 1.15 | 41.83 ± 1.10 | 10.80 ± 1.57 | 143.17 ± 19.28 | 54.33 ± 0.58 | 550.00 ±8.16 | 45.47 ±2.33 | 9.21±0.03 | 15.52±0.04 |
| $T_4$ | 26.00 ± 1.00 | 44.13 ± 1.11 | 12.23 ± 0.74 | 166.33 ± 13.25 | 56.33 ± 2.89 | 616.67 ±6.24 | 58.27 ±0.98 | 9.91±0.03 | 15.90±0.02 |
| $T_5$ | 23.33 ± 0.58 | 41.03 ± 1.01 | 11.23 ± 0.06 | 159.17 ± 12.41 | 61.67 ± 0.58 | 518.33 ±6.24 | 47.30 ±7.38 | 6.61±0.01 | 12.59±0.03 |
| $T_6$ | 22.33 ± 1.15 | 42.43 ± 1.10 | 11.13 ± 0.35 | 153.50 ± 7.55 | 63.00 ± 1.00 | 501.67 ±8.50 | 46.03 ±0.62 | 5.48±0.49 | 12.25±0.03 |
| SEM | 0.85 | 1.00 | 0.76 | 32.79 | 2.08 | 1.68 | 0.81 | 0.05 | 0.12 |
| F-test | 42.89* | 29.56* | 12.80* | 4.32* | 10.75* | 76.84* | 5.27* | 177.96* | 22.34* |

*Represents that the F test was significant at $p < 0.05$. SEM represents the standard error of the mean.

**Table: 5** : Effect of vermin compost on the growth and yield of cabbage

| Treatment | Nos of leaves\ plant | Plant height (cm) | Root length (cm) | Leaf area ($cm^2$) | Days to knob initiation | Fresh weight of head (g) | Dry weight of head (g) | Chlorophyl l a (mg/g) in 60 days | Chlorophyl l b (mg/g) in 60 days |
|---|---|---|---|---|---|---|---|---|---|
| $T_0$ (Control) | 6.67 ± 0.58 | 34.85 ± 0.56 | 7.77 ± 0.91 | 117.00 ± 1.00 | 65.00 ± 1.73 | 890 ± 0.05 | 79.33 ±3.54 | 5.86 ± 0.69 | 12.11 ± 0.30 |
| $T_1$ | 8.33 ± 0.58 | 36.34 ± 1.04 | 8.40 ± 0.56 | 101.50 ± 3.28 | 64.33 ± 3.06 | 940 ± 0.05 | 83.22 4.01± | 6.48 ± 0.23 | 13.15 ± 0.92 |
| $T_2$ | 9.67 ± 0.58 | 39.06 ± 0.71 | 8.90 ± 0.36 | 113.17 ± 0.58 | 60.67 ± 1.15 | 1030 ± 0.01 | 93.15 ±3.36 | 8.14 ± 1.26 | 13.20 ± 1.04 |
| $T_3$ | 11.00 ± 0.00 | 43.50 ± 3.32 | 13.10 ± 0.46 | 181.17 ± 6.03 | 56.67 ± 1.53 | 1150 ± 0.08 | 107.48 ±8.25 | 9.56 ± 0.36 | 15.46 ± 0.30 |
| $T_4$ | 9.33 ± 0.58 | 40.50 ± 0.00 | 10.97 ± 0.68 | 156.67 ± 5.35 | 60.33 ± 3.06 | 990 ± 0.06 | 87.81 ±4.00 | 8.19 ± 1.70 | 14.28 ± 0.69 |
| $T_5$ | 8.67 ± 0.58 | 40.54 ± 0.30 | 9.77 ± 0.42 | 176.25 ± 8.84 | 64.00 ± 2.65 | 950 ± 0.03 | 84.55 ±2.18 | 9.10 ± 0.21 | 14.64 ± 0.28 |
| $T_6$ | 9.33 ± 1.15 | 40.20 ± 0.10 | 10.10 ± 0.69 | 169.67 ± 4.65 | 65.67 ± 1.15 | 970 ± 0.03 | 86.06 ±2.03 | 8.51 ± 0.31 | 14.09 ± 0.50 |
| SEM | 0.65 | 1.36 | 0.61 | 4.60 | 2.19 | 0.04 | 1.15 | 0.87 | 0.64 |
| F-test | 12.44* | 13.50* | 25.98* | 150.60* | 6.64* | 8.21* | 9.21* | 7.19* | 8.89* |

*Represents that the F test was significant at $p < 0.05$. SEM represents the standard error of the mean.

significant amount of fungal flora was detected in the vermicompost, among which *Penicillium* spp. and *Aspergillus* spp. were the most prevalent, which can help in the degradation of the complex organic raw ingredients of the vermicompost into a simplified form. The results indicated that $T_4$ significantly improves multiple growth as well as yield parameters in cauliflower over the control whereas in cabbage, under the treatment set $T_3$(30% vermincompost), maximum enhancement in all the parameters was noticed. The increasing demand for organically produced crops supports the adoption of vermicompost as a valuable tool for enhancing the marketable quality of cauliflower and cabbage. For the optimization of the benefits of vermincompost for

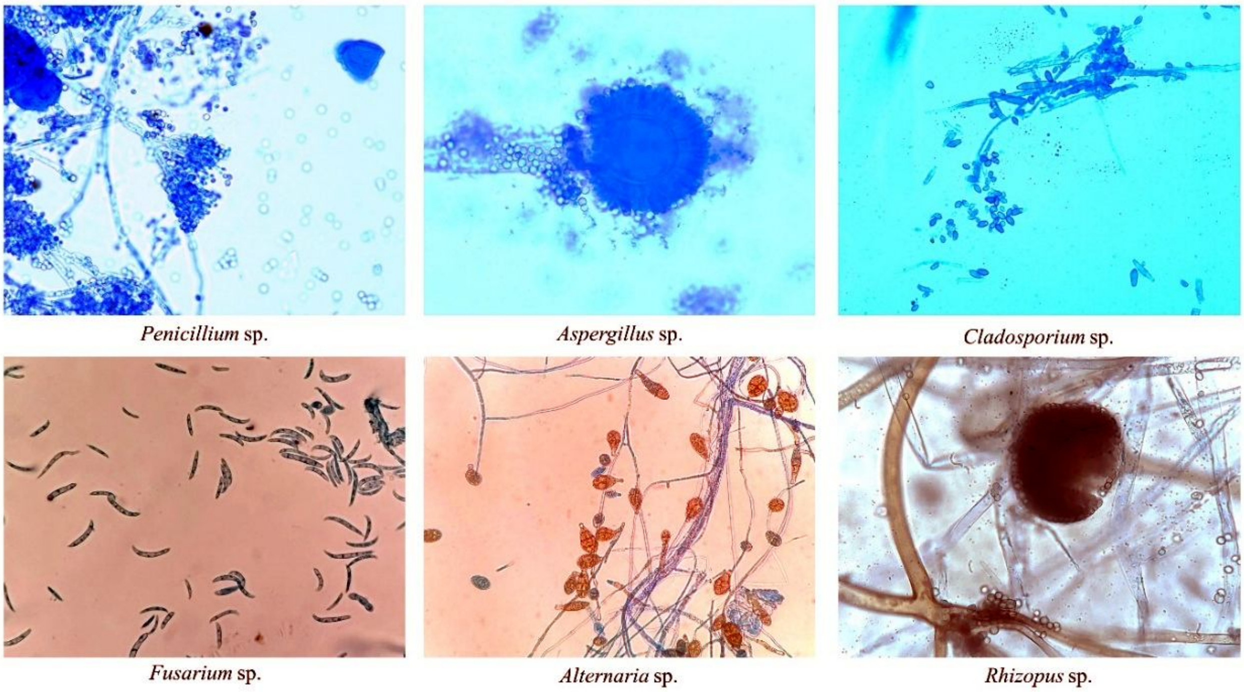


**Fig. 1:** Microscopic view of some fungal isolates

cauliflower and cabbage, future research should focus on determining optimal application rates, evaluating the impact of vermincompost on specific quality parameters like nutrient content and disease resistance, by comparing vermincompost with other organic and inorganic fertilizers.

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