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Research Article

IN SITU APPLICATION OF EARTHWORM *LAMPITO MAURITII* KINBERG ON BIOACCUMULATION OF HEAVY METALS (LEAD, NICKEL AND CADMIUM) FROM SOIL, ANIMAL DUNG AND WHEAT (*TRITICUM AESTIVUM* L.) GRAINS

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ABSTRACT
The release of heavy metals affects soil biodiversity and ecological balance, and it poses health concerns to humans, animals, and the environment. The present research emphasizes the essential role of the earthworm species *Lampito mauritii* in bioaccumulating lead (Pb), nickel (Ni), and cadmium (Cd) from soil, animal waste, and wheat (*Triticum aestivum* L.) grains. The research indicates that the earthworm's ability to stabilize heavy metals results in a considerable ($p < 0.05$) decrease in metal contents in the final vermicompost. The bioaccumulation in earthworm tissues supports their use as bioindicators for monitoring soil contamination. Lead (Pb) and nickel (Ni) concentrations declined by 26.65% and 40.55%, respectively, when the soil was amended with buffalo and goat dung and vermicompost inoculated with *Lampito mauritii*. Cadmium (Cd) concentrations declined by 68.43% when using cow dung vermicompost. Heavy metal levels in wheat grains were reported to be lower when soil was combined with animal waste vermicompost, based on analyses conducted before and after harvest. In earthworm body tissue, Pb increased by 13.78% with cow dung vermicompost, whereas Ni and Cd increased by 36.47% and 88.72%, respectively, with vermicompost of the combination of cow and buffalo dung. The results indicate that vermicomposting with *Lampito mauritii* is an efficient method for reducing heavy metals in wheat field soil, which protects human, animal, and environmental health.

Keywords: *Grains, Heavy metals, Lampito mauritii, Triticum aestivum, Vermiremediation, Vermicomposting*

INTRODUCTION
Concerns about possible threats to human health and the environment continue to be raised by soil contamination by heavy metals (Hubeny *et al*., 2021; Fatima *et al*., 2024). According to Shetty *et al*. (2025), the critical nature of the detrimental effects of heavy metal exposure on the environment and public health is being emphasized in Asian nations, including China, Bangladesh, India, and Pakistan. A variety of man-made and natural mechanisms and sources enable metals to infiltrate the biosphere (Ondrasek *et al*., 2025; Anas *et al*., 2025). On a global scale, agriculture is the primary human-caused contributor to metal emissions, while natural sources comprise metal corrosion, erosion, eruptions, parent rock weathering, and sediment resuspension (Briffa *et al*., 2020). Due to rapid urbanization and industrialization, agricultural soil, and water bodies have been contaminated with possibly hazardous elements such as nickel (Ni),

chromium (Cr), cadmium (Cd), and lead (Pb) (Fatima and Singh, 2023a; Aslam *et al*., 2023; Khan *et al*., 2023; Ngo *et al*., 2024). According to Zhao *et al*. (2025), trace levels of heavy metals (HMs) frequently do not affect the environment. Cytotoxic dosages of Pb and Cd directly affect the ability of microorganisms, plants, and animals to thrive (Manoj *et al*., 2020; Sahito *et al*., 2023). The physicochemical and nutritional properties of soil are adversely affected by higher Pb concentrations, which additionally threaten soil species' habitats and reduce soil production (Wu *et al*., 2024). Mainly affecting staple foods like wheat, rice, and vegetables, these metals enter the food chain via crops irrigated with polluted water or cultivated in contaminated soil (Haq *et al*., 2023; Laboni *et al*., 2023; Rahman *et al*., 2023).

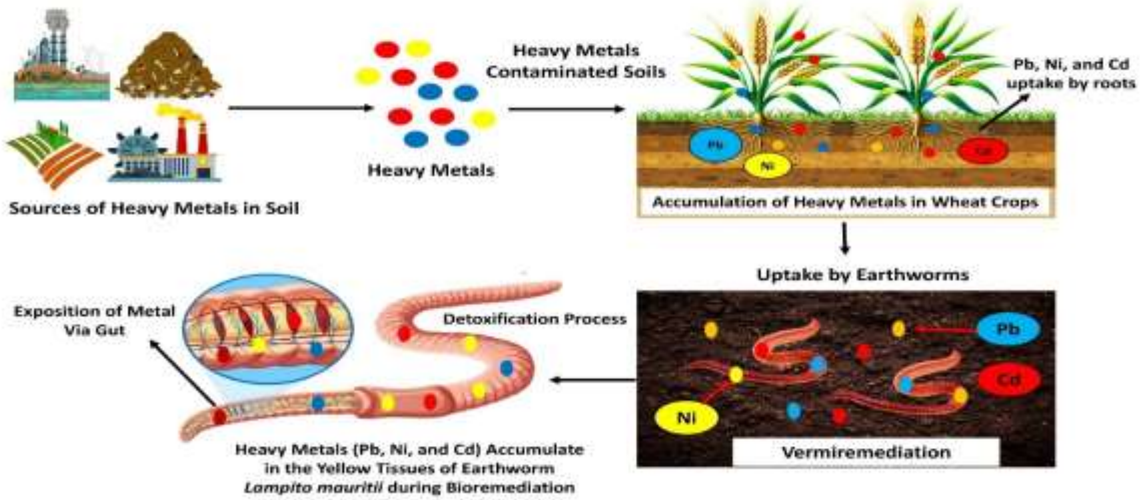
Wheat (*Triticum aestivum* L.) is an essential grain consumed by 50% of the world's population, which constitutes nearly 20% of daily caloric and protein consumption (Giraldo *et al*., 2019; Dolijanović *et al*., 2019). Expanding human populations in both agriculturally productive and unproductive areas contribute to a global increase in wheat demand (Giraldo *et al*., 2019; Dolijanović *et al*., 2019). One of the main issues with metal contamination in the human food chain is grain contamination, particularly in wheat (Orisakwe *et al*., 2012; Liu *et al*., 2017). Lead (Pb) bioaccumulation in wheat (*Triticum aestivum*) increased lipid peroxidation and proline levels in the roots while also causing chlorophyll damage, as reported by Anas *et al*. (2024). Nickel (Ni) contamination of wheat (*Triticum* sp.) decreased translocation efficiency and nutrient absorption, hindered nutrient acquisition and root elongation, raised the translocation factor in susceptible cultivars, and raised ROS production, which led to oxidative damage (Anas *et al*., 2023). However, in wheat crops, cadmium (Cd) caused significant oxidative stress from ROS overproduction, slowed development, decreased shoot and root length, and nutritional imbalance (Anas *et al*., 2024).

Soil remediation relies substantially on earthworms, often referred to as "ecosystem engineers," who are among the most important soil organisms (Singh and Fatima, 2022; Fatima *et al*., 2024). Through their digging, ingesting, and excretion, earthworms improve the physicochemical properties of soil and establish diverse microhabitats in both surface and belowground ecosystems (Wurst, 2010). In polluted soils, earthworm activity considerably boosts the mobility and bioavailability of heavy metals, as reported by numerous research studies (Huang *et al*., 2020; Liu *et al*., 2020; Leveque *et al*., 2014).

Vermicompost (VC), a combination of decomposing veggies, food waste, and vermicast, is the end outcome of the decomposition process utilizing earthworm species, often red wigglers and other earthworms (Iqbal *et al*., 2024; Singh *et al*., 2024). In comparison to conventional composting, buffalo dung vermicomposting using earthworms gives a more microbially processed end product (Ngo *et al*., 2011). A nutrient-rich fertilizer known as vermicompost has gained popularity for restoring heavy metal-impacted fields (Wang *et al*., 2018; Zhang *et al*., 2020). Vermicompost can be utilized as an in-situ absorbing agent for Cd-contaminated soil, as evidenced by its highest absorption rate of 170.65 mg/g of cadmium (Zhu *et al*., 2017). Vermicompost improves the physical properties of soil, including drainage, durability of aggregates, aeration, and porosity. It also allows microorganisms and earthworms to secrete mucus. These substances, together with polysaccharides, aid in crop sprouting of roots and plant nutrient absorption (Lim *et al*., 2015; Hussain *et al*., 2021). Heavy metals build up in *Lampito mauritii* intestines as a result of the synthesis of metallothionein, which is rich in cysteine and can bind toxic metals (Maity *et al*., 2009; Stürzenbaum *et al*., 2013). The *Lampito mauritii* species are highly adapted to metal-affected (Pb and Zn) environments and are ideal species to metabolize electrophilic substances (Maity *et al*., 2008). According to Ananthakrishnasamy *et al*. (2009), *Lampito mauritii* could be an ideal earthworm species for mitigating the negative effects of metals.

The present study assessed the levels of toxic metals (Pb, Ni, and Cd) in wheat grains, earthworm body tissue, and vermicomposts made from various animal dung mixtures (goat, cow, and buffalo) in both the initial feed mixture and final vermicompost throughout the earthworm *Lampito mauritii* vermicomposting process.

Graphical Representation of Plan and Objective



MATERIALS AND METHODS

Animal Waste Collection: The dung of cows, buffaloes, and goats was collected from several Gorakhpur City farmhouses.

Collection of Earthworms: At D.D.U. Gorakhpur University in Gorakhpur, the anecic earthworm *Lampito mauritii* had been raised in the Vermiculture Research Laboratory of the Department of Zoology. A controlled laboratory atmosphere with consistent aeration and temperatures between 20°C and 30°C was used for culturing the earthworms. The moisture level was kept between 50% and 70% RH to promote the earthworms' optimal growth and survival.

Vermicomposting Procedures: The vermicomposting method was performed on a cement surface. Different animal waste combinations were mixed in 1:1, 1:2, and 1:3 ratios with kitchen litter and municipal solid waste. All vermibeds were 1 m x 1 m x 9 cm in size. After construction, we added one kilogram of cultured *Lampito mauritii* to each vermibed, and then we moistened it. To maintain ideal moisture content, the vermibeds were covered with jute sacks and received frequent irrigation for 40 to 50 days. The contents of the beds were manually aerated once a week for the first three weeks. A tea-like granular substance appeared on the vermibed surface after 50 to 60 days. The resulting vermicompost, along with the inoculated earthworms, was subsequently utilized for experimental purposes.

Experimental Design for Crop Cultivation: In the Zoology Department's research building at Deen Dayal Upadhyaya Gorakhpur University in Gorakhpur, six 1 m × 1 m beds were set aside specifically for wheat development. To improve the soil, 1kg of vermicompost produced from different animal dung was added to each bed. Fifty fully mature earthworms (*Lampito mauritii*) were then introduced into every bed. Standard agricultural practices were employed in the field, excluding the application of pesticides and fertilizers. We selected the wheat variety *Triticum aestivum* (PBW-343) for the experimental study because of its importance as a fundamental food source for human consumption.

Evaluation of Heavy Metals

Evaluation of heavy metals in soil, crop grains, vermicompost, and the initial feed combination: Heavy metal levels (Pb, Ni, and Cd) in the initial feed mixture, vermicompost, soil (both before and after crop harvest), and (wheat) *Triticum aestivum* (PBW-343) grains were measured using the Maboeta and van Rensburg (2003) research method. One gram of the initial feed combination, vermicompost, and soil was collected for the necessary tests before inoculation and after the crop was harvested. After being heated on a hot plate for four hours at temperatures ranging from 90 to 100°C, the samples were digested in a 1:1 ratio with a surplus of nitric acid. The digestion process was constantly monitored to make sure the samples didn't dry up. Every sample was transferred to a 100 ml volumetric flask after digestion and filtered through

Whatman No. 41 filter paper. The levels of heavy metals in the prepared samples were then measured using a Shimadzu Model AA-7000 flame atomic absorption spectrophotometer.

Detection of heavy metals in earthworm body tissues: The percentages of heavy metals in earthworm body tissue were studied using the techniques used by Katz and Jennies (1983). First, several preparatory steps were taken, including drying, grinding, and burning the earthworms to ash. In a 15 ml test tube, the ash was then combined with 55% nitric acid. The sample was left at room temperature for up to 12 hours. Following this incubation period, the sample underwent heating for two hours to a temperature of 40 to 60°C before being allowed to cool to room temperature. In this process, 1 ml of 70% perchloric acid was poured into the sample after it had been heated to 90 to 95 degrees Celsius. After cooling, 5 ml of distilled water was added to the sample. The sample started to emit white vapors when it was heated to 130°C. This was followed by another cooling period before the sample was subjected to microfiltration. Using Whatman No. 41 filter paper, the resultant solution was filtered before being put into 100 ml glass vials for flame atomic absorption spectroscopy testing.

Statistical Evaluation: We calculate the mean ± standard deviation (SD) of the data set using six replicates for each variable. The body tissue of the earthworm *Lampito mauritii* during both inoculation and post-vermicomposting, the wheat (*Triticum aestivum*) grain yield before and after the experiment includes the analysis of the earthworm's body tissue, and significant differences ($p < 0.05$) between the initial and final vermicompost were assessed using a Student's t-test (Sokal and Rohlf, 1973).

RESULTS AND DISCUSSION

After inoculation of the earthworm *Lampito mauritii*, the concentrations of the heavy metals lead (Pb), nickel (Ni), and cadmium (Cd) in the final vermicompost were much lower compared to the initial feed combination (Table 1). When integrated with buffalo dung, the amounts of lead (Pb), nickel (Ni), and cadmium (Cd) were all substantially reduced; the largest reductions were 73.19%, 64.04%, and 71.00%, respectively. The accumulated level of heavy metals (lead, nickel, and cadmium) in the yellow tissues of earthworms (*Lampito mauritii*) adhering to the vermicomposting of different animal dung is presented in Table 2. The highest levels of lead and nickel in the body of *Lampito mauritii* were found when it was inoculated in the vermibed of buffalo dung, reaching approximately 45.36% and 78.27%, while the cadmium concentration in the body tissue of *Lampito mauritii* increased by about 9.38% when it was inoculated in the vermibed of cow dung. Earthworms are essential to the breakdown of organic soil substances, the breakdown of litter, and the formation of soil texture (Ganault *et al*., 2024). When earthworms perform in vermicompost, they break down waste using both biological and physical processes. Vermicompost makes the physical composition of the soil better and strengthens plant nutrient absorption (Rehman *et al*., 2023). The anecic earthworm *Lampito mauritii* is a species that is beneficial in recycling organic waste (Tripathi and Bharadwaj, 2004). Researchers have discovered that earthworms may significantly remediate heavy metal-contaminated soil (Ahadi *et al*., 2020; Yuvaraj *et al*., 2020). Earthworms have metallothioneins, which are proteins that bind a variety of metals and have a very high metal-binding capacity. Earthworms' chloragogen cells seem to accumulate heavy metals, which debris vesicles and tiny spheroidal chloragosomes in the cells and then make them immobile (Fatima and Singh, 2023a). The earthworm species *Lampito mauritii* may accumulate heavy metals through microbial activities during vermicomposting, which also aids in the mineralization of inorganic compounds. Earthworm tissues had greater concentrations of Pb (8.81-9.69 mg Kg-1), Cd (2.31-2.71 mg Kg-1), Cr (20.7–35.9 mg Kg-1), and Cu (9.94-11.6 mg Kg-1), as reported by Suthar *et al*. (2014). Zhang *et al*. (2015) concluded that lead (Pb) bioaccumulation lowered in *Eisenia fetida* by following a specific hierarchy: cell debris (57.3-72.2%) > granules (24.4-30.0%) > cytosol. Also, resulting from the vermicomposting process assisted by the earthworm *Lampito mauritii*, Fatima and Singh (2023b) observed that the number of heavy metals, such as cobalt (Co), chromium (Cr), lead (Pb), nickel (Ni), and cadmium (Cd), significantly reduced in all animal dung and municipal solid waste combinations.

Table 1: The levels of lead, nickel, and cadmium (mg/kg) have been assessed in different mixtures of animal waste within the initial feed formulation, as well as in the vermicompost produced by the earthworm *Lampito mauritii*

Biological Waste	Heavy Metals (mg/kg)								
	Lead (Pb)			Nickel (Ni)			Cadmium (Cd)		
	BV	AV	% Reduced	BV	AV	% Reduced	BV	AV	% Reduced
BD	3.454 ± 0.007	0.926 ± 0.009*	73.19	1.955 ± 0.006	0.703 ± 0.008*	64.04	2.204 ± 0.005	0.639 ± 0.007*	71.00
CD	1.562 ± 0.003	0.703 ± 0.005*	54.99	0.889 ± 0.004	0.455 ± 0.007*	48.81	1.837 ± 0.006	0.901 ± 0.008*	50.95
GD	0.915 ± 0.004	0.525 ± 0.008*	42.62	0.376 ± 0.004	0.228 ± 0.005*	39.36	0.708 ± 0.004	0.353 ± 0.004*	50.14

Before vermicomposting (BV), after vermicomposting (AV), buffalo dung (BD), cow dung (CD), and goat dung (GD) are defined in this study.
Each reported value represents the mean ± standard deviation (SD) derived from six replicates.
The t-test indicated a statistically significant difference ($p < 0.05$) between the before vermicomposting and after vermicomposting.

Table 2: Concentrations of lead, nickel, and cadmium (mg/kg) in the body tissue of the earthworm *Lampito mauritii* after undergoing vermicomposting with different types of animal waste

Biological Waste	Heavy Metals (mg/kg)								
	Lead (Pb)			Nickel (Ni)			Cadmium (Cd)		
	BC	LmAFV	% Rise	BC	LmAFV	% Rise	BC	LmAFV	% Rise
BD	3.827 ± 0.004	5.563 ± 0.005*	45.36	1.192 ± 0.002	2.125 ± 0.003*	78.27	8.204 ± 0.003	8.951 ± 0.006*	9.10
CD	3.827 ± 0.004	4.705 ± 0.006*	22.94	1.192 ± 0.002	1.546 ± 0.005*	29.70	8.204 ± 0.003	8.974 ± 0.004*	9.38
GD	3.827 ± 0.004	4.243 ± 0.004*	10.87	1.192 ± 0.002	1.476 ± 0.004*	23.82	8.204 ± 0.003	8.553 ± 0.005*	4.25

BD = buffalo dung, CD = cow dung, and GD =goat dung.
BC = control group of earthworm body tissue, while LmAFV = Lampito mauritii body after final vermicomposting.
Each reported value is expressed as the mean ± standard deviation (SD) derived from six replicates.

The t-test stated a statistically significant distinction ($p < 0.05$) between the body tissue of the earthworms in the control group and those of the earthworms after the final vermicompost formed.

As demonstrated in Table 3 and Figure 1, the level of lead (Pb) in the soil and soil treated with vermicompost from various animal waste, as well as in the grains after the wheat (*Triticum aestivum*) crop was harvested, significantly reduced. However, when the earthworm *Lampito mauritii* was inoculated with vermicompost in the soil, a notable increase in its body tissue was observed. The highest amount of lead was reduced by 26.65% (from 5.617 ± 0.002 mg/kg to 4.120 ± 0.002 mg/kg) when buffalo dung vermicompost and the earthworm *Lampito mauritii* were inoculated into the soil. We have also observed lead levels in wheat grains. The combined application of soil and vermicompost derived from goat dung resulted in the greatest reduction in lead levels (58.50%, from 1.270 ± 0.003 to 0.527 ± 0.003 mg/kg). Conversely, when soil and vermicompost from cow dung were combined, the infested earthworm *Lampito mauritii* demonstrated a significant increase in lead (Pb) concentrations (13.78%, from 12.846 ± 0.003 to 14.617 ± 0.005 mg/kg). When soil was mixed with cow dung vermicompost, the infested earthworm *Lampito mauritii* body had the greatest concentration of Ni (36.47%) (Table 4 and Figure 1). The highest Cd decrease (68.43%) was observed in the soil combination including cow dung vermicompost treated with the earthworm *Lampito mauritii*. However, the maximum amount of cadmium (Cd) in the body tissue of the inoculated earthworm increased significantly (88.72%, from 1.880 ± 0.004 to 3.548 ± 0.011 mg/kg) after applying soil containing a buffalo dung vermicompost mixture (Table 5 and Figure 1). The earthworm *Lampito mauritii* was among the most efficient species in retrieving heavy metals from different combinations of soil and vermicompost from different animal waste, according to the data obtained after wheat crops were harvested.

Table 3: Lead concentration (mg/kg) in the soil sample, wheat grain, and earthworm body before and after crop (wheat) harvest when the soil was inoculated with earthworm *Lampito mauritii* and embedded with vermicompost from various animal excrement

Particulars	Lead Concentration (mg/kg)								
	Sample soil			Wheat grains			*Lampito mauritii* body tissue		
	Pre sowing	Post-harvest	% Reduced	Pre sowing	Post-harvest	% Reduced	Pre sowing	Post-harvest	% Elevated
Soil (CG)	5.567 ± 0.003	5.388 ± 0.004	3.21	1.270 ± 0.003	0.840 ± 0.004*	33.85	-	-	-
Soil + BDV + Lm	5.617 ± 0.002*	4.120 ± 0.002*	26.65	1.270 ± 0.003	0.647 ± 0.005*	49.05	12.846 ± 0.003	14.547 ± 0.003*	13.24
Soil + CDV + Lm	5.610 ± 0.005*	3.859 ± 0.005*	31.21	1.270 ± 0.003	0.620 ± 0.002*	51.18	12.846 ± 0.003	14.617 ± 0.005*	13.78
Soil + GDV + Lm	5.623 ± 0.003*	4.170 ± 0.002*	25.84	1.270 ± 0.003	0.527 ± 0.003*	58.50	12.846 ± 0.003	14.520 ± 0.003*	13.03

CG = Control group, BDV = buffalo dung vermicompost, CDV = cow dung vermicompost, GDV = goat dung vermicompost, Lm = Lampito mauritii

The data is expressed in mean ± standard deviation (SD) of six replicates.

The results of tests taken before and after wheat grain harvest, the mean concentrations of heavy metals in the soil, soil amended with various animal waste vermicompost, and earthworm body tissue show significant differences at $p < 0.05$, based on a t-test.

Table 4: Nickel concentration (mg/kg) in the soil sample, wheat grain, and earthworm body before and after crop (wheat) harvest when the soil was inoculated with earthworm *Lampito mauritii* and embedded with vermicompost from various animal excrement

Particulars	Nickel Concentration (mg/kg)								
	Sample soil			Wheat grains			*Lampito mauritii* body tissue		
	Pre sowing	Post-harvest	% Reduced	Pre sowing	Post-harvest	% Reduced	Pre sowing	Post-harvest	% Elevated
Soil (CG)	1.511 ± 0.002	1.286 ± 0.003	14.89	0.852 ± 0.003	0.717 ± 0.006*	15.84	-	-	-
Soil + BDV + Lm	1.535 ± 0.004*	1.121 ± 0.003*	26.97	0.852 ± 0.003	0.433 ± 0.004*	49.17	3.323 ± 0.002	4.410 ± 0.004*	32.71
Soil + CDV + Lm	1.525 ± 0.003*	0.930 ± 0.004*	39.01	0.852 ± 0.003	0.408 ± 0.003*	52.11	3.323 ± 0.002	4.535 ± 0.003*	36.47
Soil + GDV + Lm	1.539 ± 0.002*	0.915 ± 0.002*	40.55	0.852 ± 0.003	0.425 ± 0.002*	50.11	3.323 ± 0.002	4.528 ± 0.002*	36.26

CG =Control group, BDV =buffalo dung vermicompost, CDV = cow dung vermicompost, GDV = goat dung vermicompost, Lm = Lampito mauritii

The data is expressed in mean ± standard deviation (SD) of six replicates.

The results of tests taken before and after wheat grain harvest, the mean concentrations of heavy metals in the soil, soil amended with various animal waste vermicompost, and earthworm body tissue show significant differences at $p < 0.05$, based on a t-test.

Table 5: Cadmium concentration (mg/kg) in the soil sample, wheat grain, and earthworm body before and after crop (wheat) harvest when the soil was inoculated with earthworm *Lampito mauritii* and embedded with vermicompost from various animal excrement

Particulars	Cadmium Concentration (mg/kg)								
	Sample soil			Wheat grains			*Lampito mauritii* body tissue		
	Pre sowing	Post-harvest	% Reduced	Pre sowing	Post-harvest	% Reduced	Pre sowing	Post-harvest	% Elevated
Soil (CG)	3.243 ± 0.011	3.021 ± 0.009	6.84	0.611 ± 0.003	0.527 ± 0.008*	13.74	-	-	-
Soil + BDV + Lm	3.474 ± 0.020*	1.391 ± 0.012*	59.96	0.611 ± 0.003	0.322 ± 0.004*	47.30	1.880 ± 0.004	3.548 ± 0.011*	88.72
Soil + CDV + Lm	3.523 ± 0.006*	1.112 ± 0.004*	68.43	0.611 ± 0.003	0.574 ± 0.005*	6.05	1.880 ± 0.004	2.412 ± 0.007*	28.29
Soil + GDV + Lm	3.329 ± 0.008*	1.152 ± 0.005*	65.40	0.611 ± 0.003	0.433 ± 0.003*	29.13	1.880 ± 0.004	2.380 ± 0.003*	26.60

CG = Control group, BDV =buffalo dung vermicompost, CDV =cow dung vermicompost, GDV = goat dung vermicompost, Lm = Lampito mauritii

The data is expressed in mean ± standard deviation (SD) of six replicates.

The results of tests taken before and after wheat grain harvest, the mean concentrations of heavy metals in the soil, soil amended with various animal waste vermicompost, and earthworm body tissue show significant differences at $p < 0.05$, based on a t-test.

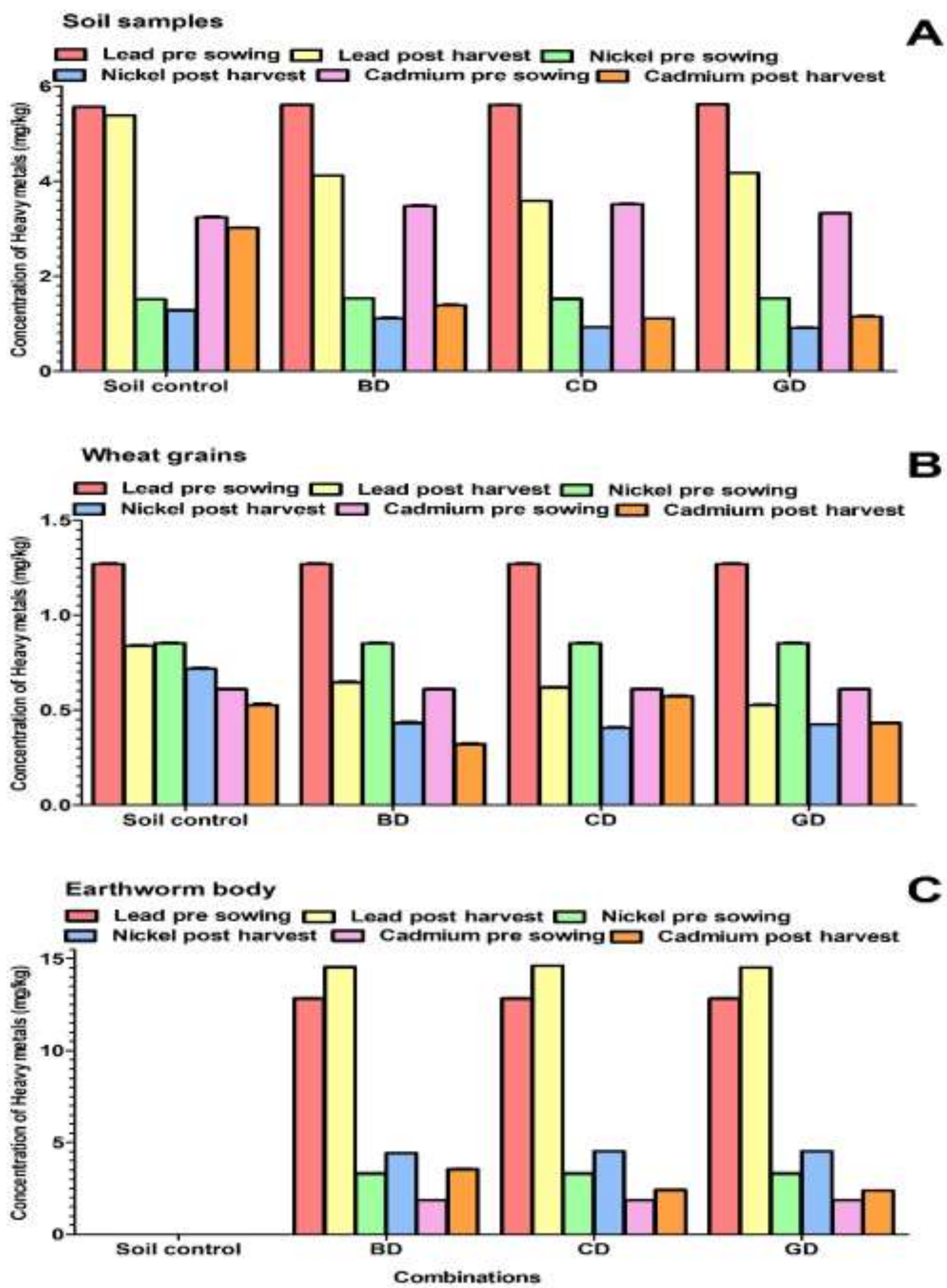


Figure 1. Lead (Pb), nickel (Ni), and cadmium (Cd) levels (mg/kg) were measured in sample soil (A), wheat grains (B), and *Lampito mauritii* body tissue (C) before and following wheat harvest

Several varieties of crops retain and accumulate heavy metals, which then make their way into the human food chain (Zarei and Rokni, 2024; Wang *et al*., 2025). Lead accumulation in wheat grains is more reactive to the absorption and dispersal of heavy metals in wheat ears than in roots (Liu *et al*., 2023). Health risk evaluations revealed that the estimated daily intake (EDI) of heavy metals (HMs) was minimal for cadmium and highest for zinc among youngsters and adults consuming wheat (*Triticum aestivum* L.) grains. Hazard quotient values for all the HMs were more than one, as stated by Kumar *et al*. (2025). Metal pollution may be effectively monitored by *Lampito mauritii* (Maity *et al*., 2011). Utilizing match industry waste as the growing medium, *Lampito mauritii* accumulated cadmium in its body tissue to a dosage of 0.2610 mg kg^{-1}, six times greater than the values at the initial phase of the study (Govindarajan *et al*., 2011). *Lumbricus terrestris* earthworms have been discovered to have 90-180 mg/kg dry weight of lead (Pb) bioaccumulation in their tissues; *Lumbricus rubellus* and *Dendrobaena rubida*, on the other hand, had concentrations of 2600 mg/kg and 7600 mg/kg, respectively (Ireland, 1983). According to Barrera *et al*. (2001), earthworm body tissue contains more nickel than topsoil. When soil nickel (Ni) concentrations increased, *Eisenia fetida* expanded its body tissue absorption of nickel, as stated by Yan *et al*. (2011). After harvesting rice (*Oryza sativa*) grains, Fatima and Singh (2023c) observed that adding goat dung vermicompost to the soil reduced the most significant levels of Co, Cr, and Pb.

CONCLUSION

The results of the study reveal that the earthworm species *Lampito mauritii* has an excellent ability to remove heavy metals from a variety of substrates, including lead (Pb), nickel (Ni), and cadmium (Cd). The earthworms show a considerable tolerance and capacity for bioaccumulating lead and nickel; however, the accumulation of cadmium was comparatively limited, which may suggest potential toxicity at elevated concentrations. Moreover, vermicomposting helped stabilize heavy metals and promote the breakdown of organic matter, which decreased the bioavailability of those metals in the final vermicompost. By employing this technique, the amounts of heavy metals in wheat (*Triticum aestivum*) grains were significantly lower than those in the soil before cultivation. However, it also resulted in an increase in metal concentrations within the body tissues of earthworms during their vermicomposting process. These findings reveal the potential of *Lampito mauritii* as a bioindicator species for assessing heavy metal contamination and highlight its utility in bioremediation strategies.

CONFLICT OF INTEREST

None

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