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Occurrence of different Pesticides in Sediment Samples of River Godavari during different Seasons

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ABSTRACT: The concentration of different insecticides and fungicides in Godavari river sediment at Nasik during different seasons was investigated in the present study. The pesticides were determined by proper procedures and protocols. Gas chromatography was used to know the concentration of pesticides. Different types of insecticides and fungicides were found in the sediment samples of Godavari River. The primary sources of pesticides were agricultural runoff from the adjacent agricultural fields. This is the first study that has been conducted in this area. Hence, it is recommended that pesticide use should be limited and use of bio-pesticides may be encouraged. The Chemical Control and Management Centre of the Environmental Protection Agency should check possible faking and adulteration of banned organochlorine pesticides.

Keywords: Insecticides, fungicides, agricultural runoff, Godavari River.

INTRODUCTION

Insecticides, herbicides, and fungicides are the most often used pesticides in agricultural and urban environments (Montagner *et al*., 2014; Wani *et al*., 2018). Herbicides, which are weed-killing compounds, are often used in conjunction with plant growth regulators to kill weeds. It is common practice to apply insecticides to keep pests under control on farms, in food storage facilities, and even in household gardens. Fungicides are used to prevent fungal contamination of plants or seeds. Fungicides are sprayed either before or after a fungus has infected a plant species in order to prevent fungal contamination Croll (1991). There are a number of different ways pesticides may be labelled depending on their method of action on the pests.

Pesticides enter streams via a variety of mechanisms, including non-point sources and environmental variables. The source of all online pollution may be traced back to a single place, whether it is due to improper storage, loading, or disposal, or to pesticides that have been sprayed inappropriately near rivers (Yadav and Sehrawat 2011). Pesticide spills and incorrect insecticide disposal are the most common reasons for pesticides to infiltrate water wells and contaminate the water supply, according to the Environmental Protection Agency Malik *et al.* (2009). In metropolitan settings, the use of insecticides is referred to as a point supply pesticide. Pesticides spread across broad regions of the watershed and finally made their way into our bodies as a result of non-point sources of contamination Kumar *et al.* (2013). Agriculture practices that rely on runoff and erosion events to leach insecticides into the ground and surface water are responsible for the delayed leaching of insecticides into ground and surface water Mishra *et al.* (2018).

For the pollution of water with insecticides, the persistent chemical compounds of pesticides emitted by agricultural activities, city use, and pesticide manufacturing facilities are to blame Bora and Goswami (2017). Agriculturalists are the most frequent consumers of pesticides, which they liberally apply to their crops in order to increase yields while also protecting them from pests. To treat the raw cloth, timber treatment firms use a considerable amount of insecticide, which is environmentally friendly Xu *et al.* (2020). According to the pesticide's characteristics despite the widespread use of pesticides in agriculture, chemical contamination in urban areas, particularly in home gardening for pest control, is a serious problem. When compared to other pesticides such as herbicides and fungicides, the insecticide is more readily detectable in urban contexts than these other pesticides. Since the industrial revolution, the increased use of pesticides has prompted a rise in the manufacture of pesticide formulations (Battaglin and Hay 1996; Wolfram *et al*., 2019). There will inevitably be some level of point-source pesticide contamination as a result of the pesticide leaching methods that are used throughout the pesticide manufacturing process, as well as at disposal sites and wastewater effluents. Finally, pesticides in groundwater come from pesticide-treated fields, while pesticides in surface water originate from runoff events, air deposition, wastewater discharge and spills, as well as pesticide manufacturing plants, among other sources (Zhang *et al.,* 2020). The aim of this study is to find the concentration of Fungicides and Insecticides in sediment samples of River Godavari at different sampling stations during different seasons as no similar work has been conducted so far to best of our knowledge.

METHODOLOGY

A. Study Site

In order to conduct the analysis, eight sample sites were chosen, namely (SI-SVIII) at Nasik (Godavari river). A total of eight samples were collected in amber colored vials, twice in triplicate. Drinking water samples were collected on a regular basis from chosen sampling sites for pesticide analysis.

B. Sample Collection

In order to conduct pesticide analyses water samples were collected from two sampling sites during the first week of each month. The samples were analyzed in the laboratory. In each sampling station, the reported value was determined by taking the average of two samples acquired in three replicates at that sampling station and averaging those results together.

C. Extraction for Pesticide Analysis

Eight sampling sites were used to gather sediment samples for pesticide analysis purposes. It was decided to use the locations of Godavari at Nasik. A 200-ml sample of sediment sample was extracted three times in a separating funnel, each time with 20 ml of ether/hexane solution (6:94, 15:85, and 50:50v/v, respectively), each time with 20 ml of ether/hexane solution. Following each extraction, the organic layers were collected in a 250-ml Erlenmeyer flask containing 5g of anhydrous Na_2SO_4 and stored at room temperature. In a rotavapor (Heidolph VV2001) operating at 90 rpm and 30 degrees Celsius, the extract was concentrated to 10 millilitres. After that, the extract was kept until it could be subjected to chromatographic analysis. Purification was accomplished by passing the extracts down a glass column (diameter 20 cm, inner diameter 0.8 mm) packed with florisil (10 cm) and Na_2SO_4 (2 cm), which was then eluted with ether/hexane solutions: 40 ml at 6:94v/v, 30 ml at 15:85v/v, and 20 ml at 50:50v/v. Following that, the extracts were concentrated to a final volume of 5 ml under the same circumstances as previously reported.

D. Gas Chromatography-Mass Spectrometry Analysis

The concentrated extract was evaluated using a split less injection gas chromatography–mass spectrometer (GC–MS) operating in the mass spectrometry mode, according to the protocol. To analyze all pesticides, we used a gas chromatograph interfaced to an Accu TOF GCV ion trap mass detector with data system software to conduct calibration, acquire GC–MS spectra, and analyze the data.

E. Statistical Analysis

Analysis of variance was used to determine if there were statistically significant variations in mean values across sample locations and seasons (ANOVA). Significant difference and very significant difference were classified as p0.05 and p0.01, respectively, for statistical significance and highly significant difference.

RESULTS AND DISCUSSIONS

The concentration of Fungicides and Insecticides in sediment during winter 2020-21 at different sites is represented in Table 1-4. Almost every pesticide investigated in the present study were present in the sediment at one or the other site, except α-BHC and β-BHC in the River Godavari during winter 2020-21. Further, HCB, α-BHC, α-endosulfan, p, p-DDE, Iprovalicarb, o,p-DDD, Spinosad A, pp-DDT1, pp-DDD, ethion, malathion and parathion were detected at every site in the sediment of the River Godavari during winter 2020-21. However, Triadimefon and, Penconazole was not detected at Site I, II, III and kresoxim methyl was not detected at Site II, III, IV as well (Table 1).

Pesticide contamination of runoff water from paddy fields is a significant source of pesticide pollution in the research region. There were greater concentrations of cyanide in paddy field sediments compared to those in non-agricultural regions. The existence of substantial human activities around Godavari River, as well as the cumulative influence of river runoff and wastewater discharge from paddy fields, may explain the variability in pesticide residue amounts in the non-agricultural region.

The presence of fungicides in the Nasik River was discovered to be seasonal, peaking during the pre-monsoon season. This may have resulted in a reduction in the flushing of pesticides during the pre monsoon and post monsoon seasons, resulting in an increase in pesticide concentrations during the pre monsoon and post monsoon seasons. The opening of the barrier during the monsoon season serves as a natural mechanism for flushing out the chemicals that have collected over the course of the year. In the agricultural paddy-field sediments, pesticide concentrations were greater than in the agricultural regions, indicating that agricultural runoff plays a role in regulating pesticide concentrations in the research area. The pre monsoon season, which has a pH that is comparably low, has been shown to slow the process of pesticide breakdown, resulting in higher amounts of pesticides being recorded during this season. OP insecticides are biodegradable substances, and their decomposition in the Godavari River is influenced by both abiotic and biotic transformation processes, as well as the presence of bacteria. Understanding transport processes allows for the development of a relevant evaluation of the existing and future possible effect of altering land use on sediment and pollutant loads in the sediments of the Godavari backwaters. The information acquired from this research is significant in understanding the dynamics of contamination caused by various fungicides found in the sediments of the Godavari River. It has been shown that pesticide exposure is related with a broad range of negative health consequences in humans. Human exposure to pesticides and industrial pollutants via food intake is the most major route of exposure for humans, surpassing drinking water, oral inhalation, and cutaneous exposure. In India, insecticides have been extensively used for many years, and fish eating has been more popular in recent years. When compared to other places, the concentration of pesticides and fungicides observed in our samples is often greater or equal to the quantities seen in other areas.

A highly significant difference was observed among the mean values of Fenamidone during winter and summer 2020-21. According to the researchers, the presence of Triadimefon in water samples is due to the usage of Triadimefon in agricultural crops, as well as the use of Triadimefon by homes to kill mosquitoes in regions next to the Godavari River. The usage of triadimefon to kill a swarm of mosquitoes during the summer season may have resulted in an increase in the concentration of pesticide in the Godavari River. Site VIII had the highest concentration of p- triadimefon in all four seasons, followed by site VII which had the lowest concentration. The presence of triadimefon in water samples has the potential to create neurophysiological and mental problems in the Nasik district's population. Despite the fact that this herbicide has been outlawed in India, farmers in Maharashtra continue to use it (Kaware and Manzoor 2022).

It was discovered that the insecticide iprovalicarb had a very high concentration during all four seasons of the year, and that it was followed by isomers of triadimefon and the pesticide DDD. During the winter season, it was discovered that the content of pyraclostrobin was elevated. The concentration of iprovalicarb, on the other hand, was shown to be highest during the summer and pre-monsoon seasons.

Pesticide concentrations in sediment samples are generally higher in summer when compared to winter; this fact may be due to two major reasons: the first, which was also reported in a similar study run in surface and groundwater is attributed to the prompt raining after the treatment period of most dry farming lands, which will result in more wash out of such pesticides towards the river, while the second reason may be due to the increased amount of pesticides present in the soil.

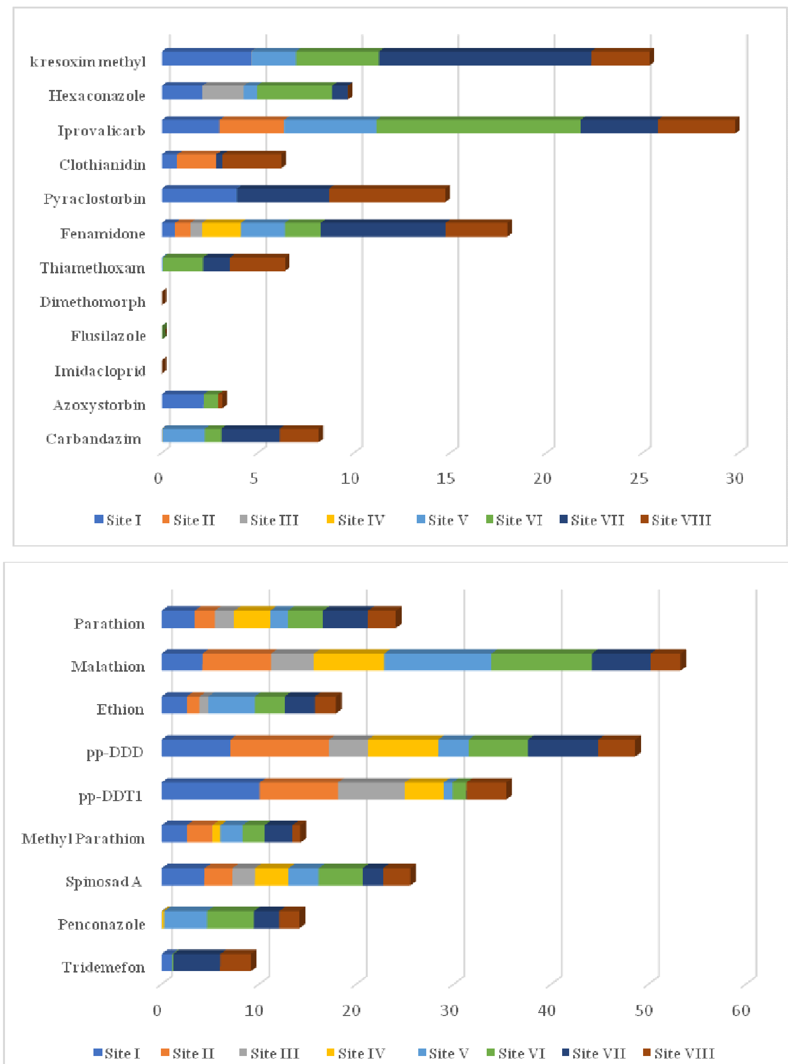


Fig. 1. a & b: Concentration (ng/l) of Fungicides and Insecticides in sediment samples of River Godavari at different sampling stations during the pre-monsoon 2020-21.

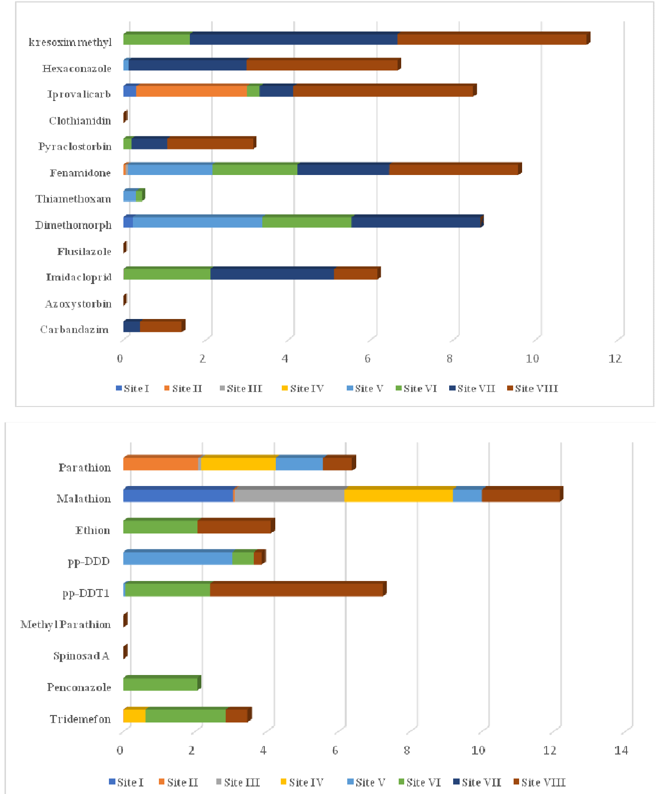


Fig. 2 a & b: Concentration (ng/l) of Fungicides and Insecticides in sediment samples of River Godavari at different sampling stations during the post monsoon 2020-21.

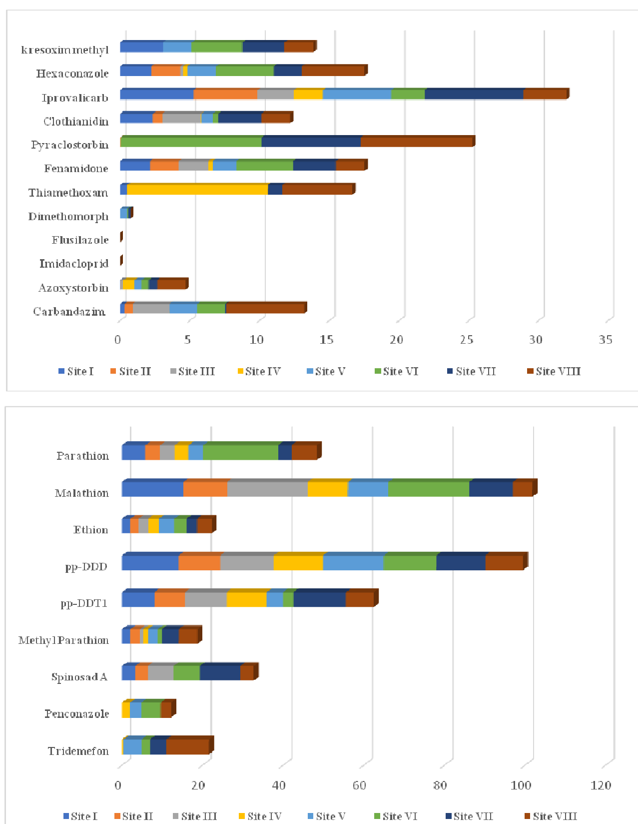
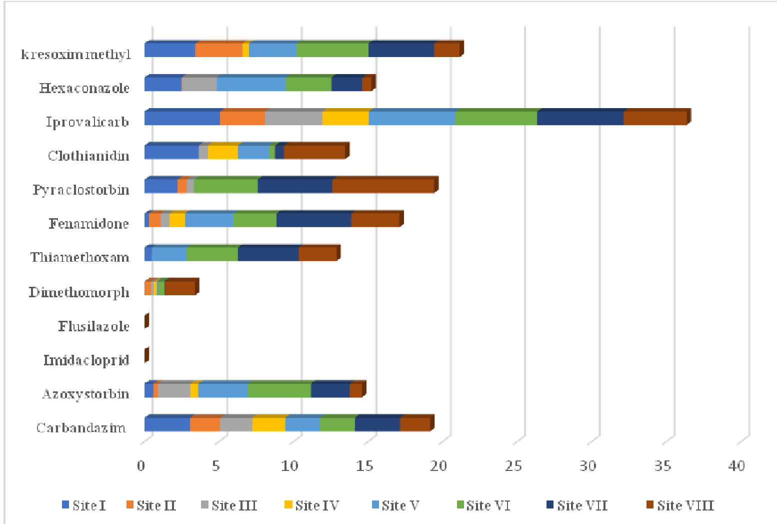


Fig. 3 a & b: Concentration (ng/l) of Fungicides and Insecticides in sediment samples of River Godavari at different sampling stations during the winter 2020-21.



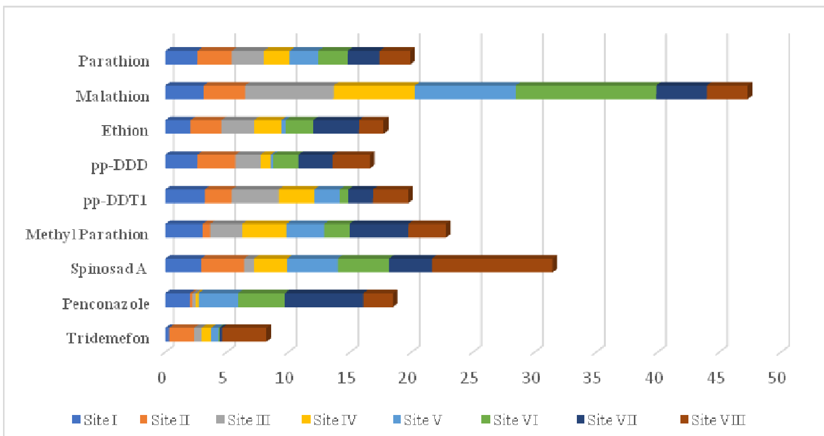


Fig. 4 a & b: Concentration (ng/l) of Fungicides and Insecticides in sediment samples of River Godavari at different sampling stations during the summer 2020-21.

Table 1: Concentration (ng/g) of Fungicides and Insecticides in sediment samples of River Godavari at different sampling stations during the winter 2020-21.

Analytes	Site I	Site II	Site III	Site IV	Site V	Site VI	Site VII	Site VIII
Carbandazim	0.30 ± 0.1	0.60 ± 0.01	2.61 ± 0.0	0.004 ± 0.01	2.007 ± 0.01	2 ± 0.01	0.07 ± 0.2	5.6 ± 0.01
Azoxystrobin	0.039± 0.01	0.003 ± 0.00	0.20 ± 0.01	0.80 ± 0.008	0.50 ± 0.03	0.51 ± 0.01	0.62 ± 0.006	2.03 ± 0.02
Imidacloprid	-	-	-	-	-	-	-	-
Flusilazole	-	-	-	-	-	-	-	-
Dimethomorph	-	-	-	-	0.50 ± 0.02	0.072 ± 0.003	0.150 ± 0.10	-
Thiamethoxam	0.50 ± 0.002	-	-	-	-	-	1.06 ± 0.04	5.004 ± 0.02
Fenamidone	2.13 ± 0.01	2.06 ± 0.2	2.13 ± 0.005	0.30± 0.001	1.708 ± 0.02	4.07± 0.01	3.07 ± 0.01	2.06±.01
Pyraclostrobin	0.004 ± 0.02	0.04 ±0.03	-	-	-	10.08 ± 0.1	7.08 ± 0.003	8.05 ± 0.02
Clothianidin	2.34 ± 0.002	0.660 ± 0.02	2.78 ± 0.01	0.04 ±0.04	0.80 ± 0.02	0.40± 0.001	3.09 ± 0.07	2.08 ± 0.01
Iprovalicarb	5.25 ± 0.004	4.64 ± 0.01	2.6 ± 0.02	2.08 ± 0.02	4.97 ± 0.3	2.4 ± 0.2	7.07 ± 0.01	3.09 ± 0.01
Hexaconazole	2.23± 0.001	2.07 ± 0.01	0.20± 0.01	0.30±0.02	2.08 ± 0.001	4.12 ± 0.001	2.02 ± 0.03	4.51 ± 0.05
kresoxim methyl	3.07± 0.03	-	-	-	-	3.62 ± 0.1	3.02 ± 0.01	2.07 ± 0.01
Triadimefon	-	-	-	0.39 ± 0.01	4501± 0.02	2.08± 0.01	4.06 ± 0.02	10.64 ± 0.03
Penconazole	-	-	-	2.01 ± 0.001	2.83 ± 0.02	4.87 ±0.03	-	-
Spinosad A	3.36 ± 0.03	3.06 ± 0.002	6.42 ±0.02	2.06 ± 0.03	10.21 ± 0.002	6532± 0.001	10.03 ± 0.01	3.36 ± 0.04
Methyl Parathion	2.09 ± 0.04	2.38 ± 0.02	0.79 ±0.03	-	-	1.01 ± 0.002	4.21± 0.001	4.64 ± 0.01
pp-DDT1	8.03 ± 0.02	7.62 ± 0.1	10.32± 3.0	9.96 ± 0.01	4.02 ± 0.2	2.61 ±0.02	13.03± 0.001	6.92 ± 0.03
pp-DDD	14.08 ± 0.06	10.32 ± 0.03	13.32 ± 0.002	12.21 ± 1.03	15.06 ± 0.03	13.08 ± 0.12	12.08 ± 0.01	09.41 ± 0.001
Ethion	2.1 ± 0.01	2.03 ± 0.02	2.42 ± 0.001	2.61 ± 0.01	3.87 ± 0.01	3.02 ± 0.01	2.61 ± 0.01	3.61 ± 0.01
Malathion	15.26 ± 0.002	10.87 ± 0.02	20.02 ± 0.19	10. ± 0.03	10.04 ± 0.002	20.06 ± 0.01	10.8 ± 0.02	4.87 ± 0.01
Parathion	5.82 ± 0.02	3.67± 0.02	3.62 ± 0.02	3.46± 0.01	3.67 ± 0.02	18.6 ± 0.04	3.31 ±0.08	6.31± 0.02

Table 2: Concentration (ng/g) of Fungicides and Insecticides in sediment samples of River Godavari at different sampling stations during the summer 2020-21.

Analytes	Site I	Site II	Site III	Site IV	Site V	Site VI	Site VII	Site VIII
Carbandazim	3.06 ± 0.001	2.02± 0.002	2.15 ± 0.001	2.2 ± 0.01	2.34 ± 0.02	2.34 ± 0.2	3.03 ± 0.01	2.01 ± 0.01
Azoxystrobin	0.59± 0.01	0.30 ± 0.03	0.802 ± 0.01	0.51± 0.02	3.32 ± 0.01	4.23 ± 0.02	2.63 ± 0.01	0.80 ± 0.02
Imidacloprid	-	-	-	-	-	-	-	-
Flusilazole	-	-	-	-	-	-	-	-
Dimethomorph	0.03 ± 0.0	0.39 ± 0.02	0.20 ± 0.01	0.20 ± 0.01	0.10 ± 0.02	0.40 ± 0.02	0.039 ± 0.01	2.03 ± 0.01
Thiamethoxam	0.50± 0.01	-	-	-	2.31 ± 0.02	3.46 ± 0.01	4.06 ± 0.01	2.54 ± 0.02
Fenamidone	0. 3 ± 0.01	0.79 ± 0.03	0.59 ± 0.001	1.02 ± 0.001	3.28 ± 0.002	2.87 ± 0.001	5.02 ± 0.001	3.23 ± 0.001
Pyraclostrobin	2.21 ± 0.02	0.60 ± 0.40	0. 51 ± 0.01	-	-	4.26 ± 0.01	5.02 ± 0.01	6.81 ± 0.02
Clothianidin	3.64 ± 0.01	-	-	2.02± 0.01	2.1 ± 0.01	0.40 ± 0.001	0.60± 0.01	4.1 ± 0.02
Iprovalicarb	5.08 ± 0.02	3 ± 0.02	3.85± 0.01	3.11± 0.21	5.87 ± 0.02	5.53 ± 0.2	5.86 ± 0.21	4.21 ± 0.01
Hexaconazole	2.48 ± 0.02	0.030 ± 0.03	2.32 ± 0.01	-	-	3.061 ± 0.01	2.08 ± 0.01	0.60 ± 0.01
kresoxim methyl	3.43 ± 0.01	3.14± 0.02	0.03± 0.01	0.40± 0.01	3.21 ± 0.02	4.82 ± 0.01	4.42 ± 0.01	1.72 ± 0.04
Triadimefon	0.30± 0.02	2.04± 0.02	0.60± 0.21	0.78± 0.01	0.60± 0.01	0.10± 0.01	0.20 ± 0.2	3.64 ± 0.01
Penconazole	2 ± 0.01	0.20 ± 0.01	0.30± 0.01	0.20 ± 0.02	3.19 ± 0.01	3.89 ± 0.01	6.46 ± 0.01	2.42 ± 0.0
Spinosad A	2.97± 0.01	3.54± 0.02	0.81 ±0.02	2.79 ± 0.01	4.09 ± 0.01	4.16 ± 0.02	3.53 ± 0.01	09.86 ± 0.01
Methyl Parathion	3.03 ± 0.01	0.60 ± 0.02	2.643 ± 0.12	3.61 ± 0.01	3.06± 0.01	2.06 ± 0.01	4.89 ± 0.02	3.03 ± 0.01
pp-DDT1	3.21 ± 0.01	2.2 ± 0.02	3.81 ± 0.02	2.93 ± 0.01	2.07 ±0.0	0.70 ± 0.01	2 ± 0.01	2.87 ± 0.02
pp-DDD	2.63 ± 0.03	3.1 ± 0.01	2.06 ± 0.02	0.80 ± 0.02	0.29 ± 0.01	2.06 ± 0.01	2.8± 0.03	3 ± 0.01
Ethion	2.05 ± 0.01	2.51 ± 0.01	2.65± 0.01	2.2± 0.03	0.354 ± 0.02	2.25 ± 0.01	3.7± 0.1	2.02 ± 0.001
Malathion	3.12± 0.01	3.36 ± 0.01	7.21 ± 0.01	6.67± 0.03	8.2± 0.01	11.4 ± 0.01	4.16 ± 0.01	3.34 ± 0.001
Parathion	2.66 ± 0.01	2.8 ± 0.01	2.61 ± 0.01	2.47 ± 0.02	2.32 ± 0.02	2.47± 0.03	2.65 ± 0.01	2.52 ± 0.02

Table 3: Concentration (ng/g) of Fungicides and Insecticides in sediment samples of River Godavari at different sampling stations during the pre-monsoon 2020-21.

Analytes	Site I	Site II	Site III	Site IV	Site V	Site VI	Site VII	Site VIII
Carbandazim	1.031 ± 0.001	1.21± 0.01	1.3 ± 0.01	1.3 ± 0.01	1.51 ± 0.02	1.4 ± 0.01	3.82 ± 0.002	1.51 ± 0.001
Azoxystrobin	1.25 ± 0.01	-	-	-	-	2.17 ± 0.01	0.61± 0.01	0.62± 0.01
Imidacloprid	-	-	-	-	-	-	-	-
Flusilazole	-	-	-	-	-	-	-	-
Dimethomorph	-	-	-	-	-	-	-	-
Thiamethoxam	0.13± 0.01	0.41± 0.01	-	-	0.25 ± 0.02	0.87 ± 0.01	2.86 ± 0.001	1.08 ± 0.02
Fenamidone	-	-	1.05± 0.001	2.62 ± 0.02	2.13 ± 0.02	2.51 ± 0.01	5.02 ± 0.001	3.32 ± 0.02
Pyraclostrobin	0.69 ± 0.02	-	-	-	-	-	1.824 ± 0.01	2.28 ± 0.02
Clothianidin	N.D	1.043 ± 0.02	0.21± 0.02	-	-	-	0.54 ± 0.01	1.14 ± 0.01
Iprovalicarb	1.87 ± 0.02	0.89 ± 0.01	1.07 ± 0.01	0.018± 0.02	3.813 ± 0.21	4.79 ± 0.02	6.02 ± 0.32	3.25 ± 0.01
Hexaconazole	0.96 ± 0.02	0.11± 0.2	0.87 ± 0.01	0.56 ± 0.02	1.01 ± 0.01	0.76 ± 0.01	1.01 ± 0.05	0.32 ± 0.002
kresoxim methyl	0.78± 0.02	-	-	-	-	2.57 ± 0.01	10.2 ± 0.01	1.87 ± 0.01
Triadimefon	1.097 ± 0.01	-	-	-	-	0.131 ± 0.01	3.821 ± 0.02	4.131 ± 0.01
Penconazole	0.62 ± 0.01	-	0.32± 0.2	0.36 ± 0.01	2.87 ± 0.01	3.821 ± 0.01	2.02 ± 0.01	6.82 ± 0.01
Spinosad A	2.86 ± 0.02	2.34 ± 0.01	2.62 ±0.01	3.36 ± 0.01	2.51 ± 0.01	5.04 ± 0.02	4.21 ± 0.01	3.79 ± 0.01
Methyl Parathion	1.79 ± 0.0	1.67± 0.02	1.021 ± 0.01	1.61 ± 0.01	1.5 ± 0.01	1.43 ± 0.01	2.881 ± 0.01	1.31 ± 0.01
pp-DDT1	11.061 ± 0.02	4.72 ± 0.01	3.64± 0.02	2.98 ± 0.01	1.98 ±1.01	2.14± 0.01	1.97 ± 0.01	3.26 ± 0.02
pp-DDD	10.4 ± 0.01	9.67 ± 0.01	7.78 ± 0.01	7.28 ± 0.02	5.76 ± 0.02	8.25 ± 0.01	7.81 ± 0.01	5.17 ± 0.2
Ethion	2.14± 0.02	2.308 ± 0.01	3.02 ± 0.01	3.16± 0.01	3.86 ± 0.01	11.6± 0.3	5.72 ± 0.02	4.26± 0.2
Malathion	5.92 ± 0.2	5.98± 0.23	2.03 ± 0.01	5.91± 0.02	6 ± 0.01	6.06 ± 0.01	5.29 ± 0.001	3.14± 0.01
Parathion	4.46± 0.02	4.21 ± 0.01	3.68± 0.12	5.12 ± 0.01	3.72 ± 0.02	6.01 ± 0.001	4.07 ± 0.01	5.61 ± 0.0

Table 4: Concentration (ng/g) of Fungicides and Insecticides in sediment samples of River Godavari at different sampling stations during the post monsoon 2020-21.

Analytes	Site I	Site II	Site III	Site IV	Site V	Site VI	Site VII	Site VIII
Carbandazim	-	-	-	-	-	-	0.428±0.02	N.D
Azoxystrobin	-	-	-	-	-	-	-	-
Imidacloprid	-	-	-	-	-	-	-	-
Flusilazole	-	-	-	-	-	-	-	-
Dimethomorph	-	-	-	-	-	-	-	-
Thiamethoxam	-	-	-	-	0.94±0.2	2.16±0.10	-	-
Fenamidone	-	-	0.71±0.01	-	-	2.61±0.003	3.13±0.25	**3.03±0.07**
Pyraclostrobin	-	-	-	-	0.27±0.06	0.41±0.10	0.47±0.01	0.37±0.3
Clothianidin	-	-	-	-	0.58±0.22	-	-	2.14±0.09
Iprovalicarb	2.21±0.32	2.682±0.30	2.08±0.02	2.67±0.001	3.06±0.30	2.21±0.06	2.91±0.36	3.13±1.03
Hexaconazole	-	-	-	-	0.76±0.04	-	-	3.66±0.21
kresoxim methyl	-	-	-	-	0.54±0.02	3.13±0.01	4.03±0.06	2.97±0.05
Triadimefon	0.37±0.004	0.20±0.01	-	-	-	-	0.002±0.002	0.807±0.5
Penconazole	0.72±0.04	0.06±0.01	0.12±0.002	0.31±0.04	0.07±0.004	3.26±0.01	2.76±0.01	2.32±0.05
Spinosad A	2.62±0.02	2.74±0.04	2.80±0.002	2.87±0.02	3.23±0.001	4.01±0.006	2.85±0.05	3.32±0.02
Methyl Parathion	0.84±0.02	0.81±0.04	2.02±0.01	2.34±0.02	3.15±0.7	3.21±0.01	3.21±0.1	3.86±0.06
pp-DDT1	2.02±0.33	2.65±0.03	1.03±0.04	2.67±0.02	7.02±0.02	5.36±0.03	5.41±0.05	4.89±0.08
Ethion	0.13±0.1	0.54±0.05	0.53±0.07	2.03±0.05	0.79±0.1	3.45±0.30	4.32±0.83	5.69±0.05
Malathion	2.56±0.04	2.41±0.04	3.1±0.12	4.01±0.08	3.65±0.09	2.05±0.07	4.64±0.07	7.06±0.1.24
Parathion	0.33±0.02	2.06±0.6	3.65±0.09	2.92±0.07	2.45±0.03	4.61±0.08	2.25±0.01	2334±0.91

CONCULSIONS

This investigation indicated that Godavari river systems under consideration are polluted by pesticides, with the presence of Carbandazim, Azoxystrobin, Imidacloprid, Flusilazole, Dimethomorph, Thiamethoxam, Fenamidone, Pyraclostrobin, Clothianidin, Iprovalicarb, Hexaconazole, kresoxim methyl, Triadimefon, Penconazole, Spinosad A, Methyl Parathion, pp-DDT1, pp-DDD, Carbandazim, Azoxystrobin, Imidacloprid, Ethion, Malathion, Parathion being particularly widespread. The concentration levels of these popular pesticides are discovered to be greater than the required regulatory limits, demonstrating the unenthusiastic state of the river systems and posing a threat to the water's environment.

FUTURE SCOPE

The study can be conducted with other pesticides and their quantification.

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