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THE IMPACT OF IRON POLLUTION ON INSECT DIVERSITY IN THE SHANKHANI-DANKANI RIVER SOUTH BASTAR DANTEWADA, CHHATTISGARH

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Abstract: An industrial effluent has been shown to significantly disrupt biodiversity through the modification and fluctuation of the physicochemical properties inherent to various water bodies, thereby leading to detrimental ecological consequences. The effluent discharged from the NMDC iron ore processing facility has been observed to adversely influence both the physicochemical characteristics and the biological composition of the Shankhani-Dankani river system located in the region of Bastar, which is of particular concern to environmental scientists and ecologists alike. Notably, these two rivers converge in the vicinity of Dantewada town, a location where various environmental assessments are critical for describing regional biodiversity. The Shankhani River, in particular, is characterized by its elevated levels of iron effluent, which raises important questions regarding the sustainability of aquatic life. In order to thoroughly assess the health status river, several physicochemical parameters—including temperature, pH, dissolved oxygen (DO), total dissolved solids (TDS), electrical conductivity, chloride concentration, fluoride levels, and iron content—were meticulously measured in conjunction with entomological studies focusing on insect populations. While the concentrations of chloride and fluoride were found to remain within acceptable normal ranges, the notably high levels of iron present in the water have resulted in a calculated Simpson diversity index (D) of 0.68 for the insect population, which serves as a compelling indicator of the deteriorating ecological condition of the aquatic environment in question.

Keywords: Bastar, Industrial Polltion, Biological indicator, Aquatic insect, Iron Pollution, Heavy Metal.

Introduction: Due to pollution most of the water bodies have been changed of physicochemical nature such as temperature, total dissolved solid, pH, Dissolve oxygen, total solid suspension, alkalinity, conductivity, and mineral compositions. Alternation of water quality is greatly influenced the biodiversity especially the aquatic insects, lies in the water, since some of them are highly sensitive to disturbance (Arimoro, F.O. and Ikoni, R.B. 2008). The macrobenthic invertebrates, which include aquatic insects, constitute a significant portion of the biota. These aquatic insect are categorized among them they are utiliaed as biomonitoring tools primarily due to their diverse range, distinct life cycles sedentary behaviors (Augustine O. Edegbene et al. 2015). Aquatic insects

are very good indicator of water quality because of their different ecological disturbance tolerant levels (Arimoro, F.O. and Ikoni, R.B.,2008). By the time biological indicators like aquatic insect provides an integrated comprehensive assessment of the water body (Karr, J.R., 1998). Stream biomes that the insect could be largely enluenced by habnitat and microhabitat. Metalic elements are generally abundant in industrial areas where thier effluents are drainage into the water bodies without treatment. it directly affects the biome (Dallas, H.F., 1997). These foul play of human activities disturbs the fabrication of nature. Colloidal form of metalic element deposited in the body of aquatic organisms like annelids, crustaceans, molluscs and fishes. aquatic insects are lies in the base of lotic trophic level as primary and secondary consumer therefore they shows hughest degree of biological indicators. (Tabinda, et al. 2013).

In present study two rivers Shankhani and Dankani from dense forest area of middle India Bastar region, confluence together; one of them Shankhani is polluted by Iron ore mining by NMDC plant and other one is Dankani in untouched from human activities. aquatic insecs used as tool for examine the degree of pollution from iron ore plant in comparison by one non polluted river with a pollutted river.

Materials & Methods:

Study Area: The Shankhani-Dankni River is an important ecological and cultural resource in Bastar, India. These rivers meet near Dantewada to form the Dantewada River, which provides essential water for the local communities. The area is rich in biodiversity, with various species of flora and fauna dependent on the health of the river. However, industrial activities, especially iron ore processing by the NMDC plant directly into the river, have changed the Physico-chemical properties of the water.

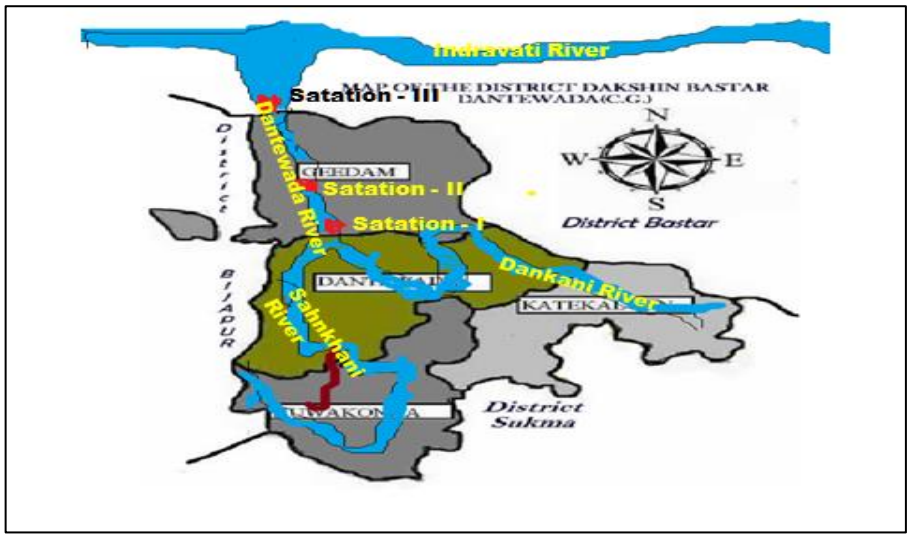


Fig.-1 Map of District Dantewada showing flow of rivers

Station I Surbhi Colony - This collection centre is situated beneath the holy Danteshwari temple behind Surbhi colony of Dantewada. This is located at $18^0$54'07.07"N$81^0$20'33.63"E and 350m. a.s.l. it is about 2 k.m. away from station 3 and station 6 after 1 k.m. after confluence of Shankhani and Dankani rivers. The drainage of Surbhi colony is getting rid in this station as well as the tourists of Danteshwari temple also gave sanitation in this collection station.

Station II Purantarai: This station is situated between two villages Purantarai and Faraspal at $18^0$55'09.59"N $81^0$20'33.63"E and 340.1m. a.s.l. 5k.m. away from station I. The water of this station is affected only by sanitation and other human activities of local people.

Station III Nelasnar : It is last collection station situated near village Nelasnar just before 5 k.m. from confluence of Shankhani-Dankani or Dantewada river into the Indravati river. It is located at

$19^0$00'43.00"N$81^0$13'38.01"E and 326.7m.a.s.l. in dense forest area of edge of Bhairamgarh wild life sanctuary.

Collection, Preservation and Identification of Sample: Samples were collected on monthly basis from October 2014 to September 2015 throughout the year. It was very difficult to collect insect samples during midnight after 10:00 pm onward due to violent naxalite problem. Insects go deep in water during day time due to sunlight as well as increasing atmospheric temperature. Five samples were taken from around 100 meter area of each collection station 3-4 hour after sunset 10:30 midnight onwards.

Devices used for sample collection were entomological net, round net, mosquito net, fish net, surber sampler net in inflow of water, observation of debris in settled water, digging of sand at the bank of river over one square meter area. Collected specimens were quickly preserved in 5% formol solution in five plastic boxes with suitable coding. After collection from all stations specimens were scrutinized by studying the morphological features and identification keys. (Imms, 1976 , Subramanium et al, 2007).

After identification and enumeration of specimen, insect diversity was calculated following Simpson diversity index and Wilhm-Dorris diversity index. Correlation coefficient was also computed. Samples of water for physico-chemical analysis were also collected from each collection station every month in replicate of five. Temperature, DO, pH, were estimated at the site while collecting samples, TDS, Conductivity, Chloride, Fluoride and Iron were also analyzed by following APHA Protocol.

Results and Discussion:

The Physico-chemical alteration from sample site I – Surbhi Colony Dantewada also showed major variation in different parameters throughout year viz. the temperature was reported maximum 30.56 ±1.2^{0}C in the month of May 2014 and minimum 18.03 ±1.2^{0}C in the month of January 2015. The pH was reported maximum 7.78 ±0.1 in the month of December 2014 and minimum 6.52 ±0.1 in the month of May 2015. The conductivity was reported maximum 678.5 ±69.1 m.v. in the month of June 2015 and minimum 55.8 ±69.1 m.v. in the month of September 2015. TDS was directly related with conductivity therefore it was reported maximum 983.4 ±69.1mg/l in the month of June 2015 and minimum 80.9 ±69.1 mg/l in the month of September 2015. DO was reported maximum 32.0 ±2.2 μs/cm^{-1} in the month of June 2015 and minimum 7.07 ±2.2 μs/cm^{-1} in the month of May 2015. Chloride was reported maximum 323.4 ±39.3 mg/l in the month of May 2015 and minimum 0.0 ±39.3 mg/l in the month of August 2015. Fluoride was reported maximum 0.7 ±0.06 mg/l in the month of January 2015 and minimum 0.0 ±0.06 mg/l in the month of July 2015. Iron was reported maximum 1.1 ±0.1 mg/l in the month of December 2014 and minimum 0.0 ±0.1 mg/l in the month of July 2015. (Table-1)

The physicochemical alteration from sample site II – village Purantarai Dantewada also showed major variation in different parameters throughout year viz. the temperature was reported maximum 30.58 ±1.2^{0}C in the month of April 2015 and minimum 18.0 ±1.2^{0}C in the month of January 2015. The pH was reported maximum 7.81 ±0.2 in the month of December 2014 and minimum 6.51 ±0.2 in the month of June 2015. The conductivity was reported maximum 636.2 ±61.6 m.v. in the month of April 2015 and minimum 74.0 ±61.6 m.v. in the month of September 2015. TDS was directly related with conductivity therefore it was reported maximum 922.0 ±61.6 mg/l in the month of April 2015 and minimum 107.0 ±61.6 mg/l in the month of September 2015. DO was reported maximum 31.7 ±2.0 μs/cm^{-1} in the month of June 2015 and minimum 6.0 ±2.0 μs/cm^{-1} in the month of July 2015. Chloride was reported maximum 375.0 ±35.7 mg/l in the month of February 2015 and minimum 0.0 ±35.7 mg/l in the month of March 2015. Fluoride was reported maximum 0.05 ±0.05 mg/l in the month of February and July 2015 and minimum 0.0 ±0.05 mg/l in the month of October, December 2014 June and August 2015. Iron was reported maximum 1.0 ±0.1 mg/l in the month of February and September 2015 and minimum 0.02 ±0.1 mg/l in the month of December 2014. (Table-2)

The physicochemical alteration from sample site III – Village Nelasnar Dantewada also showed major variation in different parameters throughout year viz. the temperature was reported maximum 30.4 $\pm 0.1^0$C in the month of May 2015 and minimum 19.2 $\pm 0.1^0$C in the month of January 2015. The pH was reported maximum 8.1 ±0.15 in the month of October 2014 and minimum 6.65 ±0.15 in the month of June 2015. The conductivity was reported maximum 595.2 ±38.1 m.v. in the month of February 2015 and minimum 333.0 ±38.1 m.v. in the month of August 2015. TDS was directly related with conductivity therefore it was reported maximum 862.6 ±38.1 mg/l in the month of February 2015 and minimum 482.6 ±38-1 mg/l in the month of August 2015. DO was reported maximum 40.14 ±2.88 $\mu s/cm^{-1}$ in the month of June 2015 and minimum 0.5 ±2.88 $\mu s/cm^{-1}$ in the month of July 2015. Chloride was reported maximum 264.0 ±27.5 mg/l in the month of February 2015 and minimum 0.0 ±27.5 mg/l in the month of March and April 2015. Fluoride was reported maximum 1.06 ±0.08 mg/l in the month of March 2015 and minimum 0.0 ±0.08 mg/l in the month of January, June and August 2015. Iron was reported maximum 1.5 ±0.13 mg/l in the month of September 2015 and minimum 0.0 ±0.13 mg/l in the month of February 2015. (Table-3)

Biological study:

Station I – Surbhi colony, Dantewada (SDSCL) of Shankhani-Dankani River: From study site Surbhi colony, Dantewada of Shankhani-Dankani River total 280 individuals of 12 families have been reported throughout year, among them maximum diversity (82%) was reported for family Cordulegastridae followed by family Nepidae (5.3%). Maximum diversity of Cordulegastridae was reported in the month of September 2015 (39) followed by December 2014 (32) and minimum in the month of May 2015 (08). Minimum diversity from the study area was reported for Members of families Chlorocyphidae and Hydromatidae. Both represented by only one individual. Heptagenidae, Tridactylidae, Gryllotalpidae, Forficulidae, Gerridae, Hydrophilidae, Syntelidae, Staphylinidae, Chrysomelidae, Hydraenidae and Notaridae were not found from the site throughout year. The Simpson diversity index (D) was calculated 0.68 and Wilhm-Dorris diversity index (Δ) was calculated 0.82.

Among different families from the study site statistically a high degree correlation of two tailed bivariate was reported between Elmidae and Hydromatidae. Thus there was a good ecological correlation among insect families was reported from Surbhi colony, Dantewada of Shankhani-Dankani River.

Station II – Purantarai of Shankhani-Dankani River: From study site Purantarai of Shankhani-Dankani River total 294 individuals of 17 families have been reported throughout year, among them maximum diversity (67%) was reported for family Cordulegastridae followed by Elmidae (7%) and Gomphidae (4.75%). Maximum diversity of Cordulegastridae was reported in the month of April 2015 (49) followed by September 2015 (38) and minimum in the month of May 2015 (02). Minimum diversity from the study area was reported for Members of families Tridactylidae and Hydromatidae. All represented by only one individual. Heptagenidae, Gryllotalpidae, Forficulidae, Syntelidae, Staphylinidae and Notaridae were not found from the site throughout year. The Simpson diversity index (D) was calculated 0.46 and Wilhm-Dorris diversity index (Δ) was calculated 1.39.

Among different families from the study site statistically a high degree correlation of two tailed bivariate was reported between Tridactylidae and Hydromatidae, Tetrigidae and Stenopsychidae, Tetrigidae and Elmidae, Chlorocyphidae and Hydraenidae, Elmidae and Stenopsychidae, Hydrophilidae and Hydraenidae, Hydrophilidae and Dysticidae, Dysticidae and Hydraenidae. Thus there was a moderate ecological correlation among insect families was reported from Purantarai of Shankhani-Dankani River.

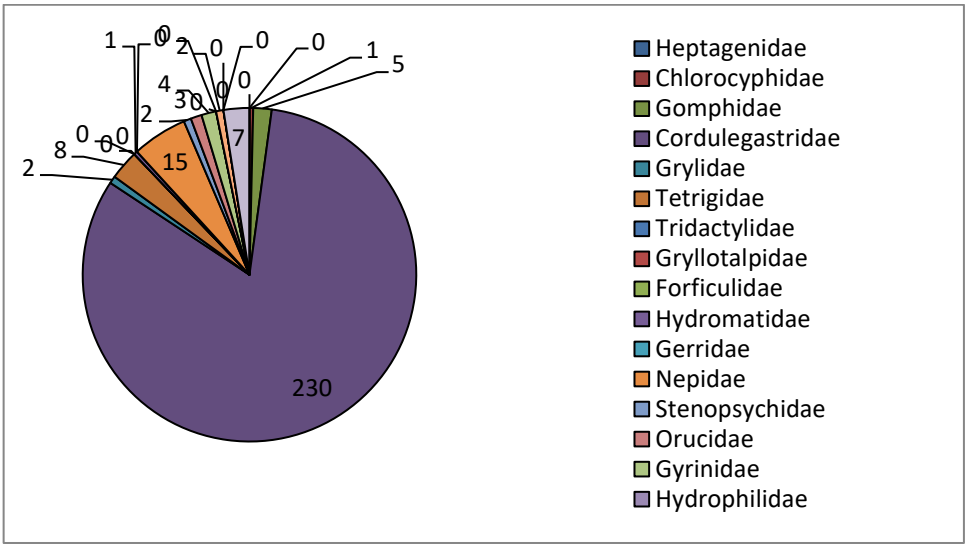
Station III –Nelasnar (SDNSR) of Shankhani-Dankani River: From study site Nelasnar of Shankhani-Dankani River total 291 individuals of 18 families have been reported throughout year, among them maximum diversity (62.5%) was reported for family Cordulegastridae followed by

Gomphidae (7%) and Heptagenidae (5.5%). Maximum diversity of Cordulegastridae was reported in the month of September 2015 (37) followed by April 2015 (23) and minimum in the month of October 2014 (03). Minimum diversity from the study area was reported for Members of families Gryllotalpidae, Gerridae, and Hydrophilidae. All represented by only one individual. Chlorocyphidae, Forficulidae, Hydromatidae, Syntelidae and Notaridae were not found from the site throughout year. The Simpson diversity index (D) was calculated 0.4 and Wilhm-Dorris diversity index (Δ) was calculated 1.5.

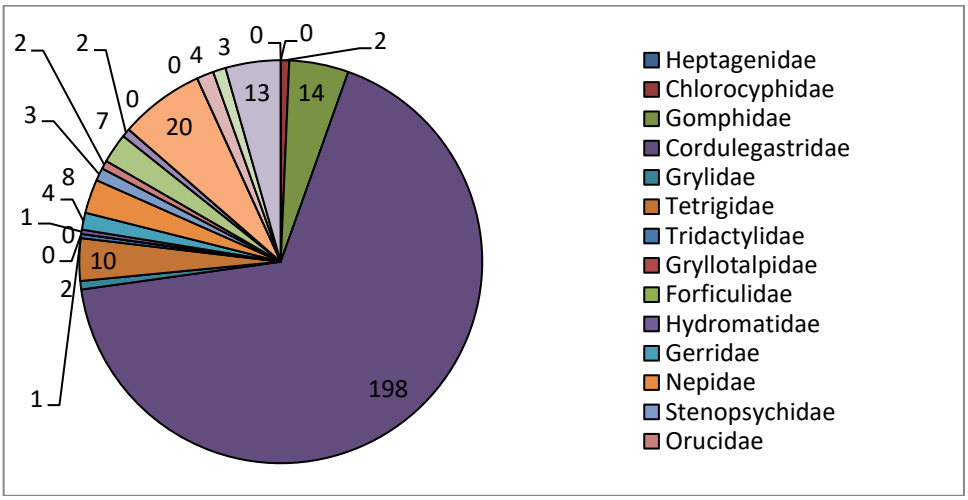
Among different families from the study site statistically a high degree correlation of two tailed bivariate was reported between Heptagenidae and Stenopsychidae, Heptagenidae and Staphylinidae, Heptagenidae and Chrysomelidae, Heptagenidae and Hydraenidae, Gerridae and Hydrophilidae, Staphylinidae and Stenopsychidae, Chrysomelidae and Stenopsychidae, Stenopsychidae and Hydraenidae, Chrysomelidae and Staphylinidae, and Chrysomelidae and Hydraenidae Thus there was also a moderate ecological correlation among insect families was reported from Nelasnar of Shankhani-Dankani River.

Conclusion: Environmental monitoring includes the important aspect of water quality testing. When there is poor water quality, not only aquatic life but also the surrounding ecosystem is affected (Abdullah Al Ryhan et al. 2021). Community dynamic studies conducted by several workers using benthic macro invertebrats, recorded a reduction in diversity at the pollution zones (Harrel, 1966; Ewing, 1964; Wilhm et al., 1978). Analysis of the species composition and abundance of individual organisms in various stretches of the river and streams constitute a valuable measure for evaluating their role as indicators of pollution (Lackey, 1938; Bartsch, et al. 1948). They have also reported that in Khan river distribution and number of species and individuals occurring in the grossly polluted, recovery and clean water zones were different from each other. The community of benthic macroinvertebrats especially insects that was most characteristics of grossly polluted zone in Khan river consisted of sludge worm, midget larvae, stone fly, may flies and caddis flies.

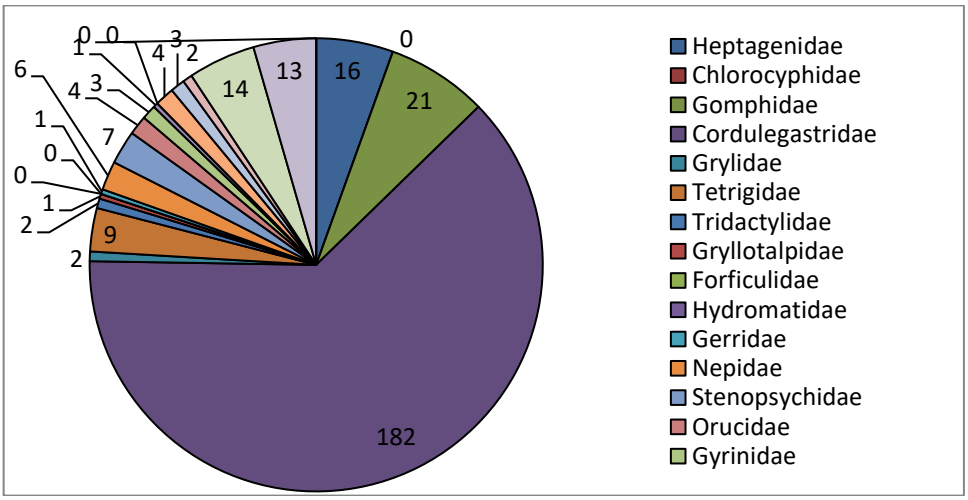
It is clear from the above analysis that when the rivers Shankhani and Dankani, flowing in the dense forest area of Bastar, enter Dantewada city, the confluence of the two rivers is known as Shankhani-Dankani or Dantewada river. Due to pollution in Dantewada city, the water is found in a highly polluted state at the first station of the river. Due to the excessive amount of iron found by the NMDC plant in the Shankhani river joining it from the west, the amount of iron in the river water increases. Also, due to the presence of the Danteshwari temple at the confluence of the rivers, the first station is highly polluted due to the filth generated by the devotees, but due to the temple administration banning this area in the month of April, the condition of the water improved a lot. The river becomes cleaner in the second and third experiment stations as it flows. This shows the self-perpetuation state of the river. The fluent of iron is released into the river by the NMDC iron ore plant without treatment, due to which the amount of iron in the river increases. And the residents have to face many diseases.



Abundance of Insects in Station –I Surbhi Colony



Abundance of Insects in Station –II Purantarai



Abundance of Insects in Station –III Nelasnar

	Parameters	Oct-2014	Nov-2014	Dec-2014	Jan-2015	Feb-2015	Mar-2015	Apr-2015	May 2015	June 2015	July 2015	Aug-2015	Sep-2015	Annual Mean Value	SD	SE
1.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	Temperature	26.94	22.84	22	18.03	24.42	19.2	28.2	30.56	27.56	28.16	20.79	18.23	23.91	4.3	1.2
2.	Ph	6.88	7.27	7.78	6.8	7.21	6.73	6.93	6.52	6.53	6.75	6.93	6.77	6.92	0.33	0.1
3.	Conductivity	531.3	426.4	489.9	518.7	462.3	497.4	393.3	500.3	678.5	305.7	677.2	55.8	461.4	239.4	69.1
4.	TDS	770	618	710	751.8	670	720.8	570	725	983.4	443	981.4	80.9	668.7	239.4	96.1
5.	DO	7.5	8.62	7.11	7.42	7.5	7.35	18.5	7.07	32	17.7	14.18	11.22	12.18	7.5	2.2
6.	Chloride	60	38	220	322.6	300	251.2	78	323.4	0.02	306	0	35.04	161.18	136.3	39.3
7.	Fluoride	0.2	0.5	0.2	0.7	0.16	0.32	0.1	0.22	0.16	0	0.18	0.1	0.28	0.2	0.06
8.	Iron	0.9	0.5	1.1	0.38	0.3	0.04	0.4	0.02	0.38	0	0.34	0.46	0.4	0.3	0.1

Table No 01: Showing Physicochemical alterations from study station I Surbhi Colony of Shankhani-Dankani river

	Parameters SDPRN	Oct-2014	Nov-2014	Dec-2014	Jan-2015	Feb-2015	Mar-2015	Apr-2015	May 2015	June 2015	July 2015	Aug-2015	Sep-2015	Annual Mean Value	SD	SE
1.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	Temperature	27.16	24.98	20.8	18	24.4	20.7	30.58	30.42	28.1	28	21.03	22.54	24.73	4.1	1.2
2.	Ph	7.7	7.62	7.81	7	7.2	6.93	6.86	6.97	6.51	7.16	6.9	7.8	6.96	0.96	0.2
3.	Conductivity	351.9	447.1	345	563	536.8	380.9	636.2	395.1	574.2	464.1	477.1	74	437.1	213.5	61.6
4.	TDS	510	648	500	816	778	552	922	572.6	832.2	672.6	683.6	107	632.6	213.5	61.6
5.	DO	6.83	8.17	7.4	7.58	7.87	7.14	11.8	7.72	31.7	6	8.44	10.34	29.45	6.98	2
6.	Chloride	51	21	110	252	375	0	100	231.2	25	250.8	25.8	25	122.23	123.7	35.7
7.	Fluoride	0	0.3	0	0.2	0.5	0.06	0.08	0.16	0	0.5	0	0.34	0.18	0.2	0.05
8.	Iron	0.5	0.04	0.02	0.34	1	0.3	0.46	0.58	0.2	0.04	0.42	1	0.41	0.3	0.1

Table No. 02 Showing Physicochemical alterations from study station II Purantarai of Shankhani- Dankani river

	Parameters SDNSR	Oct-2014	Nov-2014	Dec-2014	Jan-2015	Feb-2015	Mar-2015	Apr-2015	May 2015	June 2015	July 2015	Aug-2015	Sep-2015	Annual Mean Value	SD	SE
1.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	Temperature	27.24	22.44	22.66	19.2	24.1	22.82	27.82	30.4	27.44	28.46	21.3	27.62	25.13	3.4	0.1
2.	Ph	8.1	7.67	7.73	6.8	7.04	6.72	6.52	7.1	6.65	7.06	6.98	6.73	7.09	0.52	0.15
3.	Conductivity	517.5	550.6	462.7	503.7	595.2	435.7	346.4	556.1	541.8	395.4	333	359	466.4	131.9	38.1
4.	TDS	750	798	670.4	730	862.6	631.4	502	806	785.2	573	482.6	520	675.9	131.9	38.1
5.	DO	6.18	7.81	7.02	7.63	7.03	7.6	17.2	7.09	40.14	0.5	10.48	9.68	10.61	10	2.88
6.	Chloride	52	66	212	150	264	0	0	224.2	36.4	23.4	20	35.8	90.32	95.41	27.5
7.	Fluoride	0.02	0.16	0.02	0	0.1	1.06	0.08	0.1	0	0.12	0	0.28	0.09	0.3	0.08
8.	Iron	0.46	0.34	0.47	0.32	0	1.4	0.5	0.92	0.4	0.1	0.28	1.5	0.56	0.47	0.13

Table No 03: Showing Physicochemical alterations from study station III Nelasnar of Shankhani- Dankani river

S.No.	Order	Suborder	Family	Station-I	Station-II	Station-III	Total
1.	2.	3.	4.	5.	6.	7.	8.
1.	Ephameroptera	Heptagenoidae	Heptagenidae	0	0	16	16
2.		Zygoptera	Chlorocyphidae	1	2	0	3
3.	Odonata	Anisoptera	Gomphidae	5	14	21	40
4.		Anisoptera	Cordulegastridae	230	198	182	610
5.	Orthroptrea	Saltatoria	Grylidae	2	2	2	6
6.			Tetrigidae	8	10	9	27
7.			Tridactylidae	0	1	2	3
8.			Gryllotalpidae	0	0	1	1
9.			Forficulidae	0	0	0	0
10.	Hemiptera		Hydromatidae	1	1	0	2
11.		Gerromorpha	Gerridae	0	4	1	5
12.		Nepomorpha	Nepidae	15	8	6	29
13.	Trichoptera		Stenopsychidae	2	3	7	12
14.	Hymenoptera	Apocrita	Orucidae	3	2	4	9
15.	Coleoptera	Polymorpha	Gyrinidae	4	7	3	14
16.			Hydrophilidae	0	2	1	3
17.			Syntelidae	0	0	0	0
18.			Elmidae	2	20	4	26
19.			Staphylinidae	0	0	3	3
20.			Chrysomelidae	0	4	2	6
21.			Hydraenidae	0	3	14	17
22.		Adephaga	Dysticidae	7	13	13	33
23.			Notariae	0	0	0	0
Total				**280**	**294**	**291**	865

Diversity Indices	Simpson(H')			**.68**	**.46**	**.4**	
	Wilhm-Doris(Δ)			**.82**	**1.39**	**1.5**	

Table No. 04 : Diversity indices of insects from all collection stations

Name of collection station	S. No.	Family I	Family II	Degree of significance	Two tailed bivariate level of Significance
Surbhi colony	1	Elmidae	Hydromatidae	1	0
	2	Nepidae	Orucidae	0.758	0.004
	3	Grylidae	Chlorocyphidae	0.674	0.016
	4	Tetrigidae	Chlorocyphidae	0.634	0.026
	5	Gyrinidae	Hydromatidae	0.629	0.029
	6	Staphylinidae	Gyrinidae	0.629	0.029
Purantarai	1	Tridactylidae	Hydromatidae	1	0
	2	Tetrigidae	Stenopsychidae	0.961	0
	3	Tridactylidae	Gerridae	0.806	0.002
	4	Tetrigidae	Elmidae	0.9	0
	5	Chlorocyphidae	Hydraenidae	0.939	0
	6	Chlorocyphidae	Dysticidae	0.782	0.003
	7	Gerridae	Hydromatidae	0.806	0.002
	8	Elmidae	Stenopsychidae	0.852	0
	9	Hydrophilidae	Hydraenidae	0.887	0
	10	Hydrophilidae	Dysticidae	0.855	0
	11	Dysticidae	Hydraenidae	0.887	0
	12	Grylidae	Nepidae	0.632	0.027
	13	Chlorocyphidae	Hydrophilidae	0.674	0.016
	14	Cordulegastridae	Gyrinidae	0.655	0.021
	15	Tetrigidae	Chrysomelidae	0.598	0.04
	16	Gyrinidae	Grylidae	0.595	0.041
	17	Gyrinidae	Nepidae	0.634	0.027
	18	Chrysomelidae	Stenopsychidae	0.594	0.042
Nelasnar	1	Heptagenidae	Stenopsychidae	0.986	0
	2	Heptagenidae	Staphylinidae	0.887	0
	3	Heptagenidae	Chrysomelidae	1	0
	4	Heptagenidae	Hydraenidae	0.997	0
	5	Gerridae	Hydrophilidae	1	0
	6	Staphylinidae	Stenopsychidae	0.867	0
	7	Chrysomelidae	Stenopsychidae	0.986	0
	8	Stenopsychidae	Hydraenidae	0.982	0
	9	Chrysomelidae	Staphylinidae	0.887	0
	10	Chrysomelidae	Hydraenidae	0.997	0
	11	Gryllotalpidae	Tridactylidae	0.674	016
	12	Gyrinidae	Tetrigidae	0.692	0.013

Table No. 05: Correlation among families

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