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The Nematode Diversity from Sugarcane Fields in Aurangabad Region Maharashtra State, India

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Abstract : *The Plant parasitic nematodes of sugarcane are diversely reportable with the connected decline in sugarcane productivity. Soil nematodes were studied in Aurangabad region by choosing four totally different sites. The aim of this study was to seek out soil nematodes related to sugarcane fields. The soil samples were collected from the sugarcane root zones from the four totally different sugarcane fields. The Nematodes were extracted from soil samples by the Baermann's funnel technique. The Nematodes were identified up to Genus level and therefore the numbers of nematodes per 150grams of soil were determined. From the selected fields, eleven genera of nematodes were collected & identified from soils. The Nematodes known in soils collected from sugarcane root zones which are belongs to the genus, Iotonchus, Dorylaimus, Dorylaimoides, Indodorylaimus, Xiphinema, Eudorylaimus, Axonchium, Longidorus, Hemicycliophora, Monhystera, and Hoplolaimus. During this study, Dorylaimus acquire a highest position in diversity from all chosen sugarcane fields and lowest position in October month from Paithan and Aurangabad taluka similarly as Hoplolaimus and Xiphinema acquire the lowest position in July and December month from Phulambri and Khultabad taluka. The elaborate results mentioned within the text associated with the diversity of nematode in sugarcane fields.*

Keywords: *Aurangabad region; Diversity indices; Soil nematode diversity; Sugarcane fields*

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I. Introduction

India is the agriculture land country. Most of the population of India depends on the agriculture sector. In olden days traditionally farming was come out but in this year modern agriculture and scientific technology is adapted. A farmer uses/apply different varieties and made green revolution by modern man in agriculture area. In India different type of crops are cultivated such as Food grains (Rice, Wheat, Millets and Pulses), Commercial Crops (Sugarcane, Cotton and Oilseeds), Plantation Crops (Tea and Coffee). From this entire crops the sugarcane, cotton and oilseeds are the commercial crops of India which are cultivated in different areas of the country. India has the largest area under sugarcane cultivation in the world and the second largest producer next to Brazil. In India the sugarcane cultivation is distributed in three distinct geographical regions. These regions are: (i) The Satluj-Ganga plain from Punjab to Bihar containing 51% of the total area and 60% of the country's total production. (ii) The black soil belt from Maharashtra to Tamil Nadu along the eastern slopes of the Western Ghats. (iii) Coastal Andhra Pradesh and Krishna river valley. In India the largest sugar manufacturing state is the Uttarpradesh, and the second largest sugar manufacturing state in India that is Maharashtra. As a result of the Maharashtra state contributes the whole 34% of sugar production within the country. The Sugarcane crop is the most essential and necessary harvest of the tropics and sub tropics region [1]. The sugarcane crop is that the rather more essential and necessary as a result of with its nice potentials for interchange earnings. From the sugarcane the foremost necessary and main product sugar which can be used worldwide as sweetener, liquidizer and as preservatives. It is also the essential and main element of the many more diet, and nearly indispensible within the food industrialized and conjointly employed in pharmaceutical industries [2]. The family demand of sugar is close to concerning 22-23 million tonnes yearly, whereas to the opposite hand the assembly of sugar in India throughout last five years is close to concerning 24.3 to 26.3 Million ton. In India close to concerning 527 sugar factories can put in with the yearly sugar production capability close to concerning 242 large integer tonnes. Within the world the Sugarcane growing countries which can be situated between the latitude 36.7° north and 31.0°. The cultivation of the sugarcane all over the India from the latitude 8° N to 33° N, except Arunachal Pradesh, Himachal Pradesh and Kashmir because they are come under the cold hilly areas . Girei and Giroh (2012) established within the agriculture sector the various forms of factors are responsible for decline of sugarcane productivity from sugarcane fields. The nematodes are most responsible for the decline in sugarcane production [3]. The scientific report of elsewhere indicates that the various years of Monocropping that is responsible for occuring soil born pests and diseases. The diversity of the nematodes is usually largest in sugarcane crop than the other crop. From the root and Rhizosphere part of the

sugarcane crop the 310 species and 48 genera of ectoparasitic and endoparasitic nematodes is reported. worldwide the species Pratylenchus and Meloidogyne are the plant parasitic nematodes which can be extremely morbific to the sugarcane crop [4].The main aim of this study is to provide updated modernize data and information on the variety/diversity, of plant-parasitic nematodes coupled with sugarcane crop in Aurangabad region Maharashtra state of India.

II. Material and methods

2.1. EXPERIMENTAL DETAILS

The Aurangabad district is located in Maharashtra state, India (fig. 1) with an annual rain is 734 millimeter, and also the temperature vary is regarding 6–46 degree Celsius. The sugarcane plantation in Aurangabad is characterized by heat, Sandy soils to clay loams & significant clays that are usually irrigated. The experiment was conducted by collection the soil samples from the various sugarcane plantation fields located in Paithan (located at 19.4777° N, 75.3849° E), Aurangabad (located at 19.8762° N, 75.3433° E), Phulambri (located at 20.0886° N, 75.4176° E) and Khultabad (located at 20.0076° N, 75.1925° E) of Aurangabad region in Maharashtra state. (19° and 20° great circle, and 74° and 76° latitude) throughout May-2016 to April-2017. Shown in fig. 1.

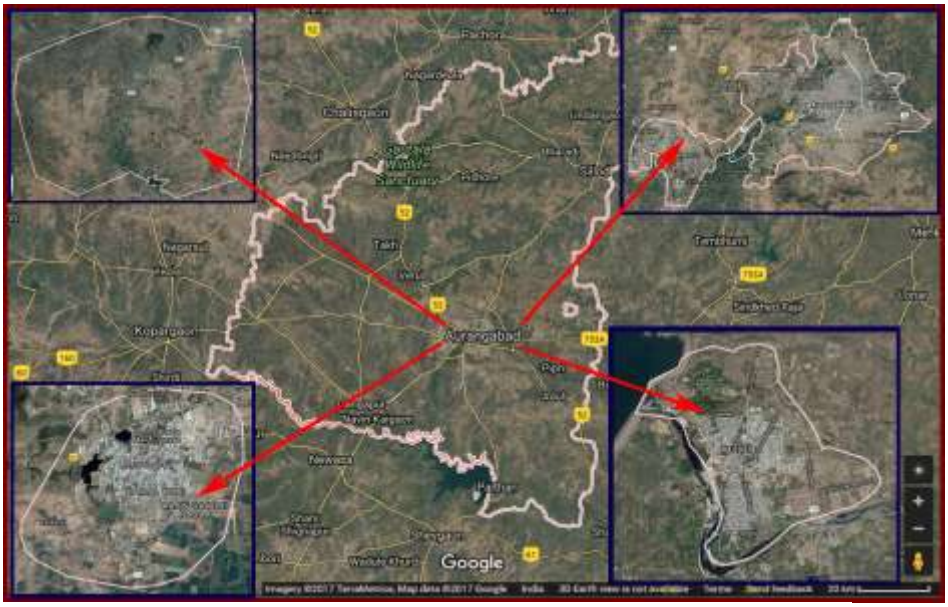

Fig. 1: Map Showing the Soil Sampling location sites from Aurangabad region.

2.2. SOIL SAMPLING

The Sugarcane fields were randomly selected for soil sampling from Aurangabad region as shown in Fig. 1. Total forty eight soil samples were collected from sixteen sites of 4 fields by employing a soil auger of diameter 1.9cm, from sugarcane plant to a depth of 15-20cm. The collected soil samples were sealed in a polyethylene luggage and unbroken alone from sun. The samples were properly tagged and carry to the Nematology research lab at Department of zoological, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (M.S.) for the extraction, processing and identification of nematodes.

2.3. NEMATODE EXTRACTION FROM SOIL

150gms of soil sample were taken for nematode extraction [5]. By Baermann funnel technique. One fifty gram soil was placed into a beaker and closes the beaker mouth by muslin cloth. Once closing the beaker it place within the Baermann funnel as inverted position and so more the water until up to the deep muslin cloth within the water and soil become weighted. This discovered unbroken to the safe place with none disturbance for 24 hours. After that, remove the beaker from Baermann funnel and take away the muslin cloth and soil was remove from beaker, and also the nematode suspension was poured into a nalgene wash bottle and allowed to settle [6]. Once the supernatant was removed, and also the remaining suspension that contain nematodes, then this suspension was poured into the nematode investigating dish for nematode investigation and examined under the stereo and light microscope [7].

2.4. COUNTING OF NEMATODES

With the nematode suspension in a 250 milliliter beaker, the specimens were allowed to settle for one hour. The amount of the suspension was adjusted to a hundred milliliter by adding up or retreating water; ten milliliter sub-sample of the suspension was withdrawn with a graduate twenty five milliliter measuring device and transfer to a tally dish. The plant parasitic nematodes diversity known with the assistance of magnifier that is named transmission dissecting magnifier, up to the generic level and also the diversity of the nematode genuses are counted by counter. The sub-sample was come back to the nematode suspension and also the tally technique was repetitively distributed for 2 additional times. All counts area unit multiply by ten, and also the normal range of specimens in every genus calculated.

2.5. PREPARATIONS OF SLIDES

The collected nematodes were placed into the Formalin- carboxylic acid (FA) for dehydration and unbroken in desiccators. When 3-6 weeks, the nematodes were totally getting dehydrated and when evaporation the nematodes remained in pure anhydrous alcohol. The slides were ready by taking single drop of glycerine at the center of a 1.25 mm thick glass slide. Then the 4-5 nematodes kept and properly arranged on the slides and cover glass is applied. The cover glass was sealed by using smart quality nail polish as stuff, finally the slide were properly labelled with its assortment knowledge.

2.6. NEMATODES IDENTIFICATION

Identification of collected plant parasitic nematodes was done with the help of simplified illustrative nematode key of [8, 9]

2.7. DATA ANALYSIS

The collected information was analyzed by applying the various diversity indices. With the help of these diversity indices we calculated the diversity of nematodes from a particular collection sites. The diversity indices viz.1. Simpson index diversity, 2. Shannon-Wiener index diversity (H), 3. Margalef index (Species richness) (M) and 4. Pielou index (J)

III. Results

During the study period from May-2016 to April 2017, from Aurangabad, Paithan, Phulambri and Khultabad taluka the total 2,714 nematodes was observed under the eleven genera which are belongs to the genus Iotonchus, Dorylaimus, Dorylaimoides, Indodorylaimus, Xiphinema, Eudorylaimus, Axonchium, Longidorus, Hemicycliophora, Monhystera and Hoplolaimus. From entire nematode population the highest population of the nematodes recorded from Aurangabad taluka with 918 number and lowest population of the nematodes recorded within the Khultabad taluka with the 426 number. (Table. 1). Among the collected total 11 genera the varieties is observed in the intensity and population. Dorylaimus shows highest intensity among all collected eleven genera's from different taluka of Aurangabad district but the intensity was highest during February, August and April month from Paithan, Aurangabad, Phulambri and Khultabad taluka respectively and the intensity was lowest during October, from Paithan and Aurangabad taluka respectively. During this study instead of Dorylaimus from Phulambri and Khultabad the Hoplolaimus and Xiphinema shows the lowest position in July and December month (Fig.2.). Out of 11 genera 7 genera was found in Paithan taluka which are belongs to Iotonchus, Dorylaimus, Dorylaimoides, Indodorylaimus, Xiphinema, Eudorylaimus and Hoplolaimus. From Paithan taluka we observed monthly diversity of nematodes. In Paithan taluka Dorylaimus acquire highest intensity in February month and lowest intensity in October month. The Dorylaimus also shows the highest intensity in June and July month but not larger than the Dorylaimus found in February month from Paithan taluka. From Paithan Dorylaimus in June and Xiphinema in April shows near about equal diversity. But the remaining genera of the nematodes in Paithan taluka show the diversity in number (Fig.2. (A)). In the Aurangabad taluka out of the eleven genera seven genera was found which are belongs to genus Indodorylaimus, Axonchium, Dorylaimus, Longidorus, Hemicycliophora, Hoplolaimus and Monhystera. From Aurangabad taluka the Dorylaimus shows the highest intensity in August month and lowest in October month. From Aurangabad Longidorus in August and Dorylaimus in September month shows near about equal diversity. Indodorylaimus, Axonchium, Dorylaimus, Longidorus and Hemicycliophora also shows the higher intensity but not larger than the Dorylaimus which are found in august month. (Fig.2. (B)). From the entire genera 7 genera was found in Phulambri taluka which are belongs to genus Dorylaimus, Dorylaimoides, Hoplolaimus, Indodorylaimus, Longidorus, Eudorylaimus and Xiphinema. Out of these 7 genera Dorylaimus shows the higher intensity in August month but instead of the Dorylaimus in Phulambri the Hoplolaimus shows the lowest intensity in July month. From Phulambri taluka the Dorylaimus, Indodorylaimus and Dorylaimoides shows near about equal diversity in august September and December month respectively. (Fig.2. (C)). We are also found the diversity of the nematodes from Khultabad taluka with the 7 genera which are belongs to genus Xiphinema,

Dorylaimoides, Monhystera, Longidorus, Hemicycliophora, Dorylaimus and Eudorylaimus. From Khultabad taluka the genus Dorylaimus shows the higher intensity in April month but instead of the Dorylaimus the Xiphinema shows the lowest intensity in December month. In this study the genus Monhystera and Longidorus in July and August month respectively shows the near about equal diversity. As well as the genus Dorylaimus in October, November and April month respectively shows the near about equal diversity from Khultabad taluka. (Fig.2. (D)). Finally we are find out the intensity of the nematodes from Aurangabad (918), Paithan (709), Phulambri (661) and Khultabad (426) taluka with descending order.

IV. Discussion

The present study revealed some interesting facts about the nematode diversity of the Aurangabad district. Around the sugarcane root zone we are identified eleven genera which are belongs to genus Iotonchus, Dorylaimus, Dorylaimoides, Indodorylaimus, Xiphinema, Eudorylaimus, Axonchium, Longidorus, Hemicycliophora, Monhystera, and Hoplolaimus. The nematode counts over the sampling sites ranged up to the 2,714 in number from all selected fields. Out of these eleven genera the genus Dorylaimus shows high frequency and dominance than the other genera from all selected fields. These genera also indicated their greater competence and cosmopolitan nature. Similar results were also published by [10]. The higher percentage of genus Dorylaimus indicates less human interfere in the field as well as a low percentage indicates the high interfere [11].

3.1. DIVERSITY INDICES STUDY

The diversity indices study of nematode from May-2016 to April 2017, the Simpson Index ranged from 8.270 to 11.134 indicating the sizeable quantity of Diversity, the higher Simpson index of diversity was recorded from Aurangabad (11.134), Khultabad (10.336), Phulambri (9.773) and Paithan taluka (8.270) respectively. Shannon-wiener Index was between 2.362.to 2.512 that indicated marginally high Diversity of nematodes. The higher Shannon-wiener Index was recorded from Aurangabad (2.512), Paithan (2.426), Khultabad (2.399) and Phulambri taluka (2.362), respectively. The evenness index was among the vary of 0.875 to 0.966 that indicated sizeable difference among the population of nematodes, the highest evenness of diversity was recorded from Khultabad (0.966), Aurangabad (0.952), Phulambri (0.951) and Paithan taluka (0.875), respectively and species richness was record from Paithan (2.285), Phulambri (1.694), Khultabad (1.817) and Aurangabad taluka (1.906) respectively (Table.1). Aurangabad shows the high Simpson index, of nematode diversity compare to sampling sites, Khultabad, Phulambri and paithan. And additionally, Aurangabad shows the high Shannon-wiener Index of nematode diversity compare to similar sampling sites. And therefore the sampling site Khultabad shows the high evenness index, of a nematode diversity than the Aurangabad, Phulambri, and Paithan. Similarly, as Paithan shows the high species richness than the opposite sampling sites like Phulambri, Khultabad and Aurangabad taluka. (Table. 2).

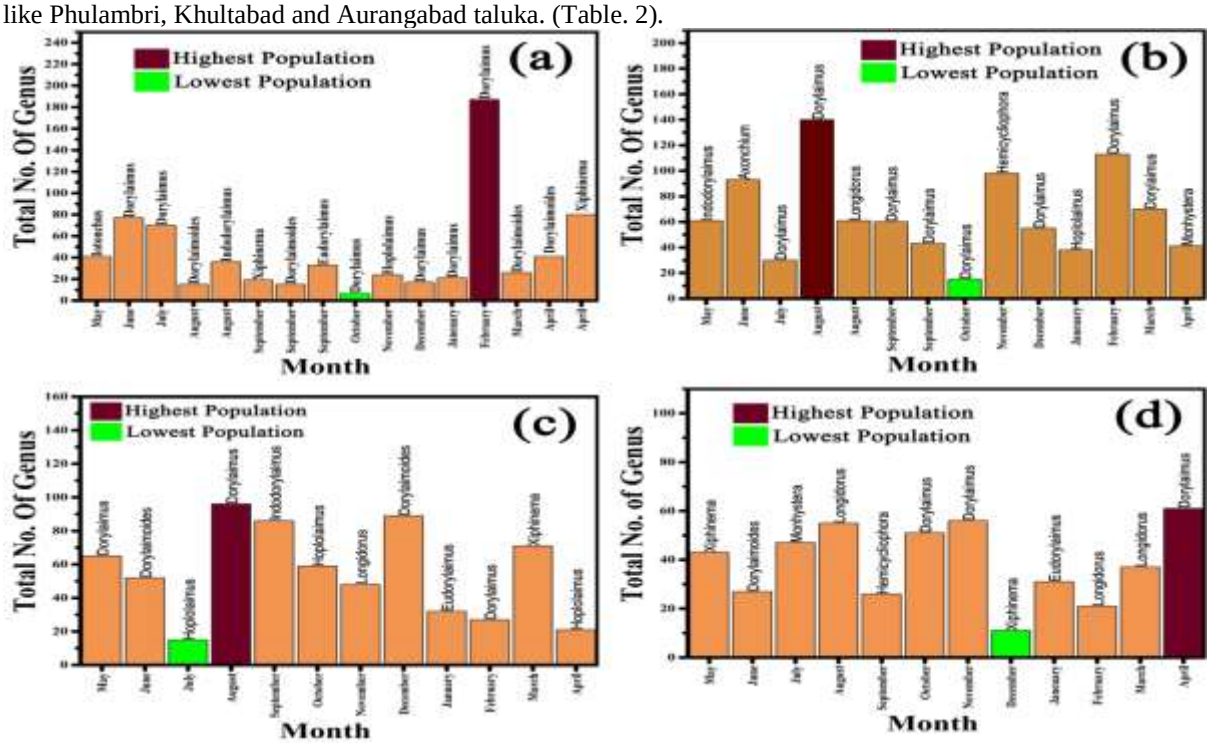

Fig. 2. The diversity of nematode (a) Paithan Taluka (b) Aurangabad Taluka (c) Phulambri Taluka and (d) Khultabad Taluka of Aurangabad region

Table. 1. Monthly diversity of nematodes from different talukas of Aurangabad district during May-2016-April-2017.

Aurangabad			Khultabad			Phulambri			Paithan		
Month	Genus Name	Total No. of Nematodes	Month	Genus Name	Total No. of Nematodes	Month	Genus Name	Total No. of Nematodes	Month	Genus Name	Total No. of Nematodes
May	Indodorylaimus	61	May	Xiphinema	43	May	Dorylaimus	65	May	Tetonchus	41
June	Axonchium	93	June	Dorylaimoides	27	June	Dorylaimoides	52	June	Dorylaimus	77
July	Dorylaimus	30	July	Monhystera	47	July	Hoplolaimus	15	July	Dorylaimus	70
August	Dorylaimus Longidorus	140 61	August	Longidorus	55	August	Dorylaimus	96	August	Dorylaimoides Indodorylaimus	15 36
September	Dorylaimus Dorylaimus	60 43	September	Hemicycliophora	26	September	Indodorylaimus	86	September	Xiphinema Dorylaimoides Eudorylaimus	19 15 33
October	Dorylaimus	15	October	Dorylaimus	51	October	Hoplolaimus	59	October	Dorylaimus	07
November	Hemicycliophora	98	November	Dorylaimus	56	November	Longidorus	48	November	Hoplolaimus	24
December	Dorylaimus	55	December	Xiphinema	11	December	Dorylaimoides	89	December	Dorylaimus	17
January	Hoplolaimus	38	January	Eudorylaimus	31	January	Eudorylaimus	52	January	Dorylaimus	21
February	Dorylaimus	113	February	Longidorus	21	February	Dorylaimus	27	February	Dorylaimus	187
March	Dorylaimus	70	March	Longidorus	37	March	Xiphinema	71	March	Dorylaimoides	26
April	Monhystera	41	April	Dorylaimus	61	April	Hoplolaimus	21	April	Dorylaimoides Xiphinema	41 80
Indices, (Aurangabad) Total no of all species =14. Total no of individual =918. Shannon-Wiener index diversity (H) =2.512. Simpson index diversity=11.134. Margalef index (Species richness) (Dd) =1.906. Pielou index (J) =0.952.			**Indices, (Khultabad)** Total no of all species =12. Total no of individual =426. Shannon-Wiener index diversity (H) =2.399. Simpson index diversity=10.336. Margalef index (Species richness) (Dd) =1.817. Pielou index (J) =0.966.			**Indices, (Phulambri)** Total no of all species =12. Total no of individual =661. Shannon-Wiener index diversity (H) =2.362. Simpson index diversity=9.773. Margalef index (Species richness) (Dd) =1.694. Pielou index (J) =0.951.			**Indices, (Paithan)** Total no of genera=16. Total no of individual =709. Shannon-Wiener index diversity (H) =2.426. Simpson index diversity=8.270. Margalef index (Species richness) (Dd) =2.285. Pielou index (J) =0.875.		

Table.2. Nematode Diversity Indices for assortment disbursed from Aurangabad region throughout May-2016-April-2017.

Sites	Simpson Index	Shannon Index	Species Evenness	Species Richness
Aurangabad	11.134	2.512	0.952	1.906
Khultabad	10.336	2.399	0.966	1.817
Phulambri	9.773	2.362	0.951	1.694
Paithan	8.270	2.426	0.875	2.285

V. Conclusion

In this study, the total 11genera was recorded with the total no, 2,714. This number shows the higher population of the nematodes in the sugarcane fields. As a result the population of nematodes in the sugarcane fields causes decline in sugarcane productivity. After communication with the sugarcane farmers, they say his opinion about decline in sugarcane productivity. On the basis of farmers opinion we decided the sugarcane productivity decreases due the higher population of nematode. The sugarcane productivity is mainly decline due to the higher intensity of the nematodes. The low productivity of sugarcane crop may be due to soil depletion as a result of many years of monoculture in the area. The highest nematode diversity was recorded of genus Dorylaimus from all selected fields. Most of the nematode diversity was recorded in February, August and April month from Paithan, Aurangabad, Phulambri and Khultabad taluka respectively. And as well as lowest nematode diversity also shows in October, July and December month from Paithan, Aurangabad, Phulambri and Khultabad taluka respectively. This subject needs any further investigation.

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