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"Population Abundance and Distribution of *Xiphinema sp.* Cobb, 1913 in relation to Soil abiotic factor in mulberry field at Aurangabad, Maharashtra, India."

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Abstract:
In the present study, Population abundance and distribution of *Xiphinema sp.* Cobb, 1913 in relation to Soil abiotic factors namely temperature, pH and moisture in mulberry field. Correlation coefficients (r) and regression analysis between mean population shows a trend of negative correlation between fluctuations of population abundance of *Xiphinema sp.* with soil temperature and pH. On the other hand, a directly proportional relation found between the population abundance and soil moisture with positive correlation in Aurangabad mulberry field.

Key-words:
Correlation coefficients (r), Population abundance, *Xiphinema sp.*

Introduction:
Among all the Sericultural plants, mulberry (Morus spp.) is that the popular in India. Mulberry leaf protein is that the source for the silkworm (Bombyx mori L.) to biosynthesise the silk, which is formed from proteins like fibroin and sericin. Hence, good quality leaves are essential for the assembly of quality silk. The main restriction within the cultivation of mulberry and production of quality mulberry leaves are the attack of pests and diseases including plant parasitic nematodes. The plant parasitic nematodes have a good range of host plants and cause economic damage to many agricultural crops. Few plant parasitic nematode species belonging to different genera are encountered within the rhizospheric soil of mulberry gardens. Mulberry being a perennial crop, the nematodes readily perpetuate and spread within the entire rootage causing

rottening and decaying of roots. Sometimes, they also aggravate the intensity of the disease by associating with other plant pathogens. The root knot nematodes, dagger nematodes and spiral nematodes were reported to cause significant losses in mulberry production. (Loukrakpam bina chanu, 2011).

About 42 species belonging to 24 genera are related to mulberry in several mulberry growing in world-wide. The severity of attack and damage depends on the soil and climatic conditions of different areas (Ramkrishnan and Senthikumar, 2003). The statistical analysis of population of plant and soil nematodes started in the last decades of this century. The interspecific correlation and multivariate analysis of population densities of *Tylenchorhynchus* spp. *Rotylenchus reniformis* and *Hoplolaimus indicus* were studied by Gaur and Haque (1986). The population density of nematode varies considerable due to several factors like availability of host plant, soil type, soil moisture, soil temperature, rainfall and many other extrinsic factors (Norton, 1979). Since the nematode inhibit the soil microenvironment, the soil factors like temperature, moisture and pH have an important role to influence them, even in managing the nematode population. Jairajpuri et al., (1974) studies on the effect of pH and salt concentration on the survivality of different nematodes. The nematode populations vary in response to the pressure and challenges imposed by external factors, and so they develop a structure and show properties of growth to such factors namely rainfall, temperature, soil type and host plant and to show precisely how each factor affects biological processes (Patrick Queneherve, 1988).

The present investigation study shows that, there is variation in Xiphinema sp. Cobb, 1913 was observed in relation to Soil temperature, moisture and pH as well as correlation and regression analysis of population densities of nematode population in mulberry field during the study. The objective of the study is to understand the influence and effect of these soil abiotic factors on the population of these plant parasitic nematodes.

Material and methods:

Soil sample collection and nematode extraction for count: The soil samples were collected from the different Mulberry garden from Aurangabad tehsil of Aurangabad Districts. In various soil variables such as Temperature, pH and Soil moisture are noted at time of soil sampling take place. The soil samples for this study were collected from mulberry farm of various farmers during 2009-2011. Two hundred cubic centimeter of soil were sampled at depth 0-15 cm. Soil samples from various farm were pooled, thoroughly mixed before taken 200 cm^3 of the

representative sample for nematode extraction using Cobbs sieving and decanting method with Baermann techniques. The sample method is very simple i.e., pooled two samples from random sampling method from collection site of mulberry garden and further procedure as above. Then note down their mean value as nematode count.

Preservation and mounting of nematode: Batches of the extracted nematodes were inactivated in water bath at 60-70 ºC, fixed in FA 4:1 fixative cleared in a glycerol-ethanol solution by slow evaporation of the ethanol and stored in anhydrous glycerol. Microscopic examination and photographing of the nematodes were done in glycerol mounts.

Estimation of soil abiotic factors of mulberry field: A portion of soil samples, collected from mulberry selected for ecological studies was kept separate to estimate the soil abiotic factors like soil moisture, pH and temperature. The methods of estimation as follows:

Preparation of soil for testing: The soil samples were thoroughly air dried under shade, grinded into fine particles, and was passed through 2mm pore size sieve. The soils were stored in containers with label of locality and month of collection for subsequent analysis.

Estimation of Soil Temperature: Soil temperature was recorded every month from Mar. 2009-Apr. 2011 from mulberry field at the time of collecting soil samples between 11 AM to 12 PM with the help of soil thermometer. The thermometer was pushed into soil at least up to 10 cm depth keeping there until a constant temperature was reached and the temperature was reached and the temperature was recorded.

Estimation of Soil pH: With the help of soil pH meter the pH of soil is note on the field during the soil samples collection time.

Estimation Soil moisture: Weighing 10 gm of soil then take it in the oven at temperature around 105°C overnight and re-weight.

$$\text{Soil moisture (\%)} = \frac{\text{Wet soil weight (gm) - Dry soil weight (gm)}}{\text{Dry soil weight (gm)}} \times 100$$

Statistical analysis with the estimated data: Finally, the data obtained from monthly population count of the *Xiphinema sp.* Cobb, 1913 belonging to the order Dorylaimida along with the estimated soil abiotic factors from the respective mulberry field were subjected to appropriate statistical analysis of correlation and linear regression analysis, to realize the relation between them by using Minitab 16 software.

Results and Discussion:

In Aurangabad tehsil mulberry garden, the maximum total population abundance, i.e., the totality of all (Juveniles and adults) *Xiphinema sp.* nematodes, was observed in month of September among all twenty-four months of observations, the mean of total population being 68 / 250 gm of soil in September 2009, 69/ 250 gm in September 2010. The minimum total population was recorded in the month of April and May 2010-11, the mean population being 6 and 5, 6 and 5 respectively. The data regarding the monthly population fluctuation of *Pratylenchus spp*. nematodes in Aurangabad mulberry garden is shown in **Figure. 1.**

The most abundant population densities of *Xiphinema sp.* occurred in months of June, July, August and September when the soil temperature, moisture and pH were ranging between 25-28^{o}C, 26-36% and 6.2-6.5 respectively. They reached the lowest level of their abundance in March, April and May when the soil factor ranged between 29-34^{o}C, 8-14% and 6.6-6.8 respectively **(Figure. 1)** in rest of months population fluctuated without any abrupt increase or decrease in presence of comparatively lower temperature, and moisture with higher pH.

In the present investigation, high population density was discovered in optimum temperature and in high moisture share, thus Gantait *et al.,* (2010) during an ecological investigation from March 2004 to February 2006, 8 nematode species of order Dorylaimida have been encountered from rhizosphere of a banana plantation in Paschim Medinipur district of West Bengal, India. All the species exhibited a bimodal pattern of population fluctuation. They maintained a high level of population during monsoon and in the spring but low level occurred at the time of winter and summer season. Sundarababu *et al*., (1995) has similar results on the population prevailed under field conditions in the soils around west Indian cherry trees for a period of one year indicated two peak Periods of increased nematode population, the first being in the months of November to February and the second in April and May. In the soils of mulberry maintained under micro plot condition, similar trend was noticed viz., two peak periods of nematode population in the months of November to January and April to June.

Pathak and Chandra (2011) also show similar results for Monthly variations in soil temperature and soil moisture during 2008-2009 and 2009-2010 at Mohebawala and Majri grant localities. Soil moisture was comparatively less during the summer months and increases in monsoon and again in post – monsoon season it decreases. On the contrary, the temperature was more when soil moisture was less. Nematode trophic group abundance showed a negative relationship with

temperature, especially in the L layer. Moisture was correlated positively with the number of nematodes. Essentially, temperature and water content are two independent variables, because in a temperate marine climate there may be rainfall in both warm and cold seasons. The independence of temperature and moisture was also confirmed by the lack of a statistical interaction effect. In general, temperatures below 25^{o}C do not seem to be very detrimental to nematodes (Sohlenius 1968, 1973; Anderson and Coleman 1982; Rossner and Nagel 1984).

Yu-xi *et al.,* (2009) has results of different studies looking at the influence of pH on plant parasitic nematodes are not consistent. Anand and Matson (1995) studied the stability of resistance to Soybean cyst nematode of different soybean genotypes to various soil pH values and found that Soybean cyst nematode reproduction was higher in pH 6.5 and 7.0 soil than that in pH 5.5 soil. In neutral soil, which pH value is 6.5, the Soybean cyst nematode population reached to the greatest. Other reports showed that low pH value positively affected the foundation of a thick cork layer in soybean roots thus diminishing infection by nematodes (Ruan *et al*. 2002). On the other hand, conditions with low pH value (lower than 6) and high pH value (higher than 8) both inhibit growth of nematodes.

Fluctuations of nematode populations of *Xiphinema americana* in relation to soil temperature and moisture was studied for crop management of strawberry and cherry (B. F. Lownsberry, A. R. Maggenti, 1963). Ghosh and Manna *et al.,* (2008) shows that the soil moisture maintained almost a constant correlation with the nematode population even in continuous follow period of paddy crop field to frequent rainfall in West Bengal. It may be concluded that due to enemy crop, the soil moisture could not help to build – up the nematode population and the correlation was negatively insignificant in both years under study.

The correlation (r) shows a trend of inverse relationship between fluctuations of population density of *Xiphinema* sp. therewith of soil temperature (r = -0.322; P=0.125) drawn by the linear regression equations, Y= -1.505+59.67x and pH (r = -0.001; P=0.001) drawn by the linear regression equations, Y=-34.00+277.1x (**Figure No. 2 and 3**) within the total amount of study with a major negative correlation. On the other hand, a directly proportional relation found between the population abundance and soil moisture with positive correlation (r = 0.671; P= 0.00) drawn by the linear regression equations, Y=-12.94+1.246x. (**Figure No.4**).

The population behavior of plant parasitic nematodes associated with mulberry plants was conducted by (Loukrakpam Bina and Naorem Mohilal, 2020) have shown analysis of correlation

co-efficient between the nematodes and the environmental parameters taken into consideration in the study showed that there was significant positive correlation (significant at 95% level of significance and above) with soil contents of pH, but present study differed from this findings shows negative correlation with pH. Patrice Cadet *et al.,* (2004) has shown similar results from the coinertia analysis, the correlation was not significant for the free-living nematodes and pH, but it was significant between numbers of *Xiphinema.* However, in places with high pH, more individuals of the free-living nematode group were present and vice-versa. This result is surprising, apart from physical factors; pH can also influence nematode abundance [Cadet *et al.,* (1994), Korthals *et al.,* (1996), Norton *et al.,* (1989)].

The population growths of Dorylaimids were positively correlated with the moisture content of the soil at a significant level ($P \leq 0.05$) whereas, the tylenchid population showed significant relationship ($P \leq 0.05$). Pathak and Chandra (2011) also show similar results for Correlation coefficient of soil temperature and soil moisture to *T. semipenetrans* population was calculated for each locality and it was as follows – For soil temperature, it is significant in both the localities but for soil moisture it is insignificant at both the sites. Further, Correlation coefficient of soil temperature and soil moisture to *Tylenchulus semipenetrans* population was significant in both the localities.

Youssef (1998) additionally shows same results on seasonal fluctuation of plant nematodes *Rotylenchus reniformis* related to mulberry shows negatively correlative ($r = 0.03$) with the current soil temperature. Population of *Paratylenchus* sp., showed a peak in June, May and July that was negatively correlative ($r = 0.01$) with soil temperature. The present study shows conformality that Correlation coefficients (r) and regression analysis between mean population shows a trend of negative correlation between fluctuations of population abundance of *Xiphinema sp.* with soil temperature and pH. On the other hand, a directly proportional relation found between the population abundance and soil moisture with positive correlation in Aurangabad mulberry field.

Figure No. 1: Mean population size (adults and juveniles) of each of the *Xiphinema sp.* / 250 gm of soil in mulberry garden at Aurangabad tehsil.

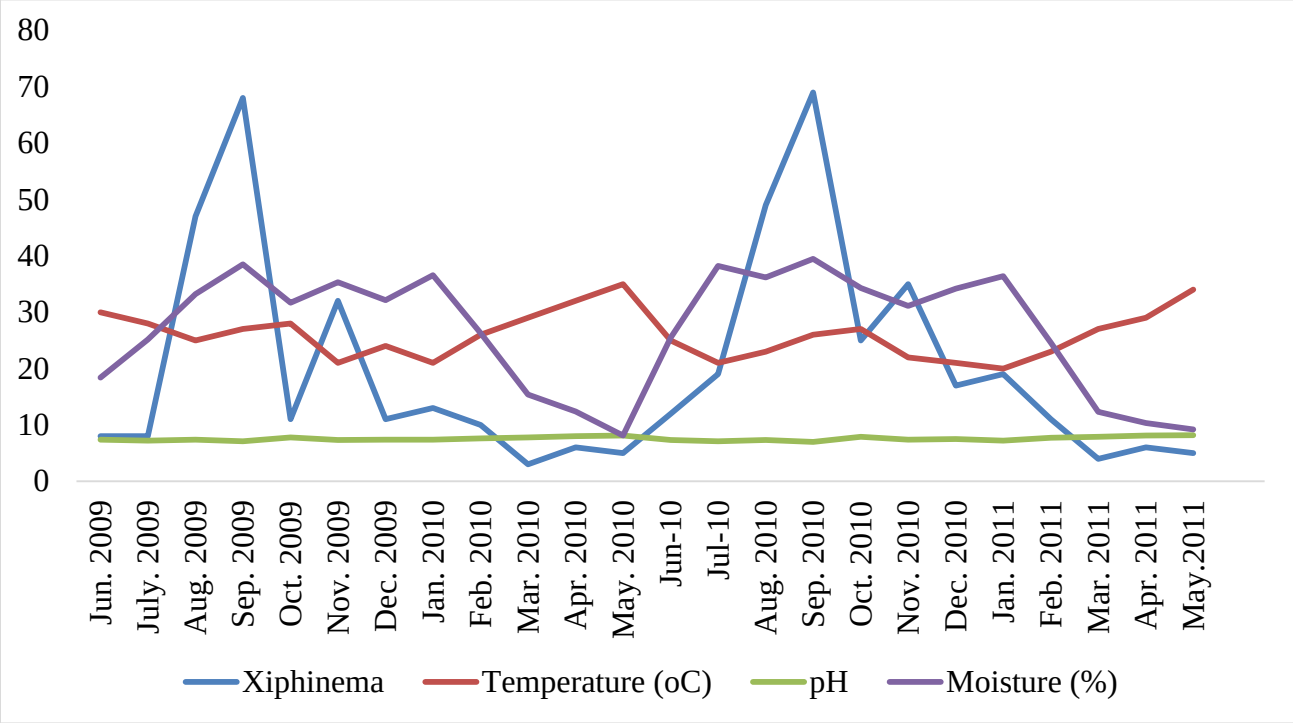
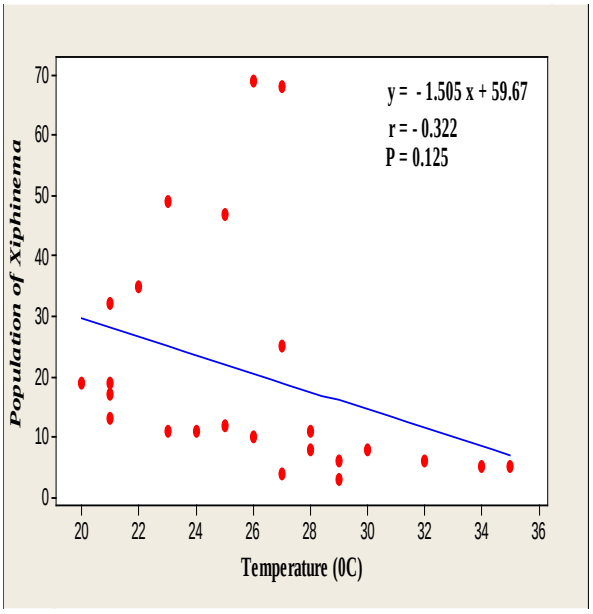
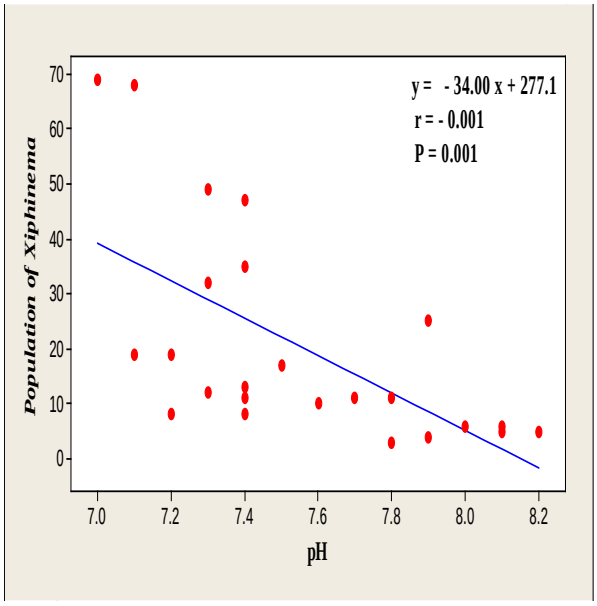
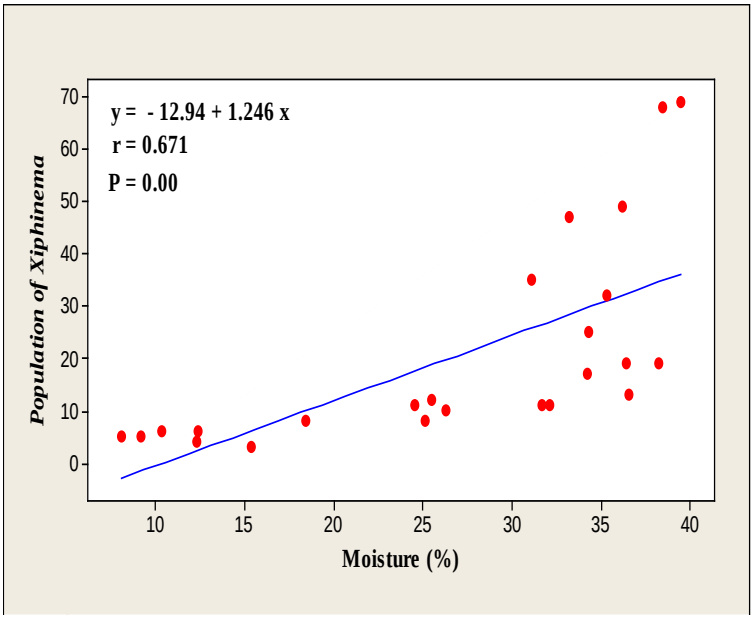


Figure No. 2, 3 and 4: Correlation coefficients (r) between Mean population *Xiphinema sp.* and different soil abiotic factors Temperature, pH and Moisture in Aurangabad Mulberry garden. (* Significant correlation ≤ 0.05).







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