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DIFFERENT PATTERNS AND ECOLOGICAL STATUS OF MOTHS AROUND NASHIK DISTRICT FROM SAHYADRI REAGION (SAVALGHAT) MAHARASHTRA

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Abstract

Generally, moths are Phytophagous, multicultural, agricultural pests, nighttime pollinators, typically nocturnal, and viable bio-indicators, moths are phytophagous, cosmopolitan, agricultural pests, nighttime pollinators, and capability bio-indicators. The cutting-edge studies could be the primary to have a take observe the variety, composition, abundance, and distributional sample of moth fauna inside the Sahyadri Range in Savalghat. Several moth specimens have been collected from 3 separate sites inside the Sahyadri Range i.e Savalghat for the duration of the survey length of 2018-2021, representing 20 species, 12 genera belonging to 05 families, and thirteen subfamilies. The Sphingidae own circle of relatives has the maximum genera (9), whilst the Crambidae own circle of relatives had the least genera (2). The own circle of relatives Sphingidae, with thirteen species, became the maximum numerous.

Keywords:-Moth, Savalghat(Sahyadri ranges),Peth, PAST 4.03, Bray Curtis similarity index, Shannon index

Introduction:-

Mostly invertebrates play a vital role in diversity in completely types of ecosystems, e.g., species, population, and individual (Cardinale et al., 2006; Bashir, 2019; Shakeel, 2019). Members of Phylum Arthropoda play a dynamic part in ecological services (Rathore and Jasrai, 2013; Abou-Shaara, 2021; Karar, 2020). Also, record more successful Phylum, they govern all types of habitats except for the marine benthic zone (Jamal, 2021; Abrol, 2019). Lepidoptera is the peak diverse group, representing 1, 57,424 described species globally. Moths are placed in Order Lepidoptera, the body is covered with drably colored scales, the foreleg is covered by an epiphysis, and they are nocturnal. Moths are very delicate and sensitive shows highly variation to the climatic condition and alternation of vegetation all these facts are making them monitor climate and habitat changes.

Material and Method:-

Maharashtra is globally known for its diverse flora and fauna, it has a typical monsoon climate with hot, rainy, and cold weather seasons. Tropical conditions prevail all over the state, and even the hill stations are not that cold. Dew, frost, hail can also happen. The climate of Savalghat is changed according to the weather such as in summer the temperature rises between 35ºC to 42ºC, in the winter season its drops up to 5ºc to 8ºc .

The present study was conducted in Savalghat (Sahyadri ranges) Nashik district which is located between 20.251422° N, 73.587204° E. The forest with tropical includes teak and Acacia and others. The changes in weather and topographic situations affect diverse biota. The Nashik district covers 15 tehsils i.e. Nandgaon, Nashik, Chandwad, Kalvan, Satana, Yeola, Surgana, Peth, Dindori, Sinner, Malegaon, Deola, Trimbak, Igatpuri, and Niphad. Nashik's climate is classified as tropical. The summers are much rainier than the winters in Nashik. According to Köppen and Geiger, this climate is classified. In Nashik, the average annual temperature is 24.1 °C | 75.3 °F. In this study, we are going to select the Peth and Dindori Tehsil, Nashik district cover 928. 88 km2 (358.64 sq.) The tree flora of the city comprises 150 angiosperms species belonging to 122 genera and 48 families.

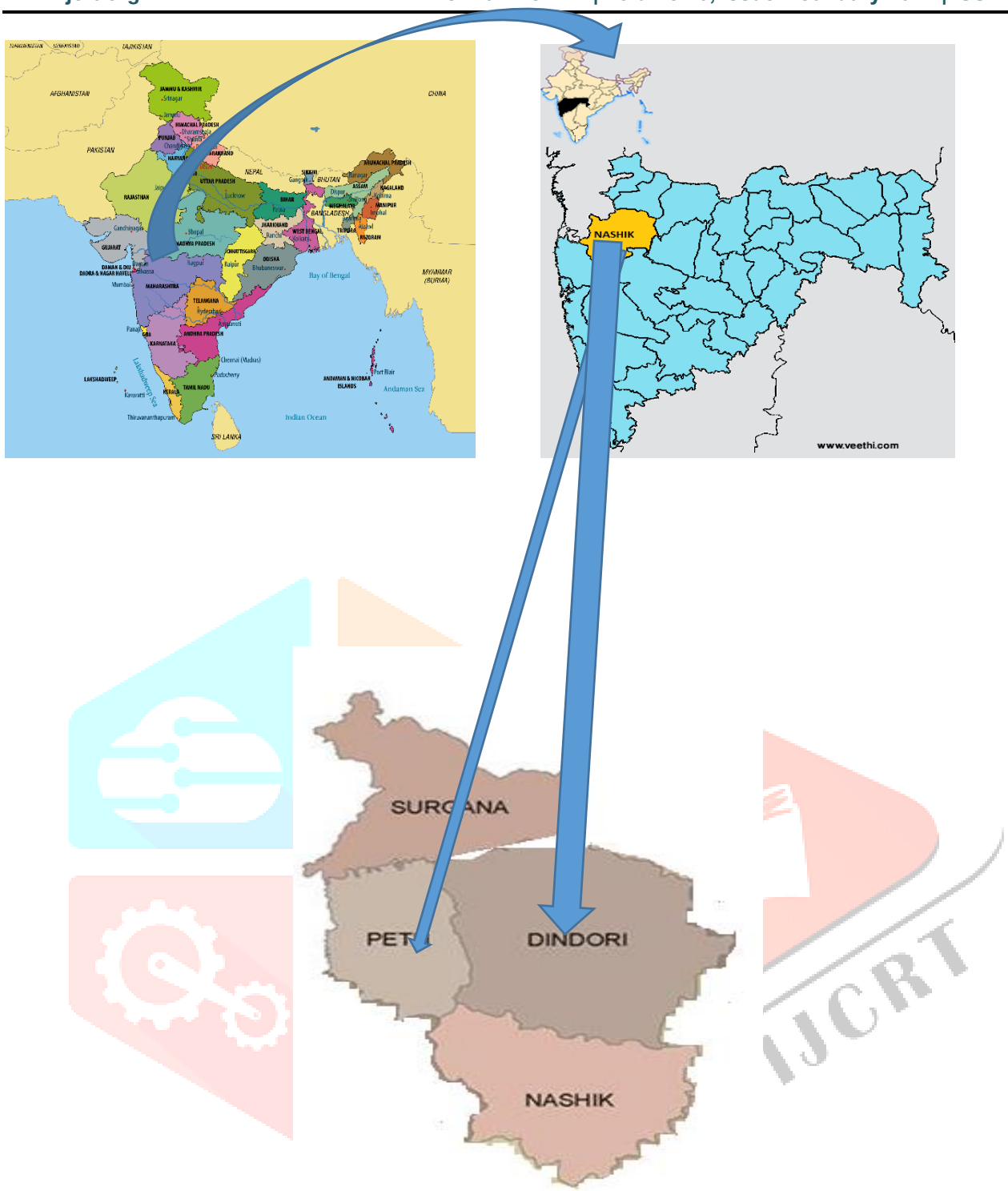


Fig.1.Map of sampling area

Collection and Identification:-

Daily collections were taken at night from 10.00 pm to 1.00 am. In this method we used a bamboo sheet which has a 40-meter gap between them, a white color cotton curtain is hanging on them, a Mercury lamp (250 W) is used behind the white cotton curtain, the light is an important part to attract the moth. The collected moth was identified with the help of modern taxonomic keys. The classification system adapted as per van Nieukerken et al. (2011)[10].Diversity indices were calculated with the help of PAST 4.04 software.

In our present study, 707 samples of moths have observed 20 species belonging to five families and 12, and 13 subfamilies. The no. of individuals of dissimilar species of moths are presented. Out of 707 sample species of moth, 321 specimens related to the family Erebhidae, next to 195 sample species belongs to Sphingidae, 131 species, next by Erebidae with 11 species, the family Sphingidae was most dominant with 11 species, next to by Erebidae by 11 species, Saturniidae and Nocuridae with 04 sample species.

The Sahyadri Hill Range (Savalghat) of Maharashtra has a diversified topography, consisting of different types of habitats for animals and plants to flourish and survive. Variants in slopes, wind velocity, the slant of sunshine, altitudes, and water filtration influence the vegetation of a specific type to grow. It consists of thin vegetation having seasonal variations in existence, evolution, and expansion. Climate changes have a straight influence on the profusion and incidence of moths. If everything is going well and good then, it will show a positive effect on the plenty of moth species. High species diversity is seen in high rainfall in India. Low species diversity is seen in dry areas and low rainfall areas. The extreme species abundance in the Sahyadrighat ranges there is max rainfall which results in maximum vegetation. Collection-cum-survey tour was conducted from September ending to December ending at Inambari Dam which is located at the foot of Sahyadri Western Ghat ranges 20.251422° N, 73.587204° E.

Statistical Analysis:-

For statistical data analysis, we use PAST 4.03 and MS-EXCEL WIDOWS 2010 8.1 software.

Diversity Index

A.Shannon index:-

H' the variety of species was calculated by using the Shannon index which combines the no. of species within a location virtual plenty of individually species [1,2,3,4]. The statistics were studied to understand α & β variety in the Shannon Index, which combines the no.of species within a site with the comparative plenty of individually species.

$$H' = -\sum_{i=I}^{R} pi \ln pi$$

Here pi is the proportion of the i^{th} species in the community and their evenness in abundance (or equitability) are the two parameters that define H'.

B. Pielou's Evenness index:-

(Equitability) or J'. The species evenness is the comparative profusion or proportion of individuals among the species. Evenness of species reveals how their relative abundance is distributed in a particular sample or site [5, 6].

$J' = H'/\ln S$

Here, S is the number of species present in the site. The value of J' ranges from 0 to 1.

Sørensen's similarity Index: $\beta = 2c / (S1 + S2)$

Where, S1 = the total no. of species noted in the 1st civic, S2 = the total no. of species noted in the 2nd civic, and c = the no. of species common to both communities. Sørensen's index21 is a simple measure of bet diversity, ranging from a value of 0 if no species overlap between the communities to a value of 1 when the same species are initiate in both communities.

The observation and identification were done by used the literature [7, 8, and 9].

1. **Bray Curtis similarity Index**.

Measurable data was rummage-sale to calculate percent resemblance, using Bray Curtis resemblance index [8]. Dendrograms were set to comprehend site-wise trends.

1. **Index of Berger-Parker**:

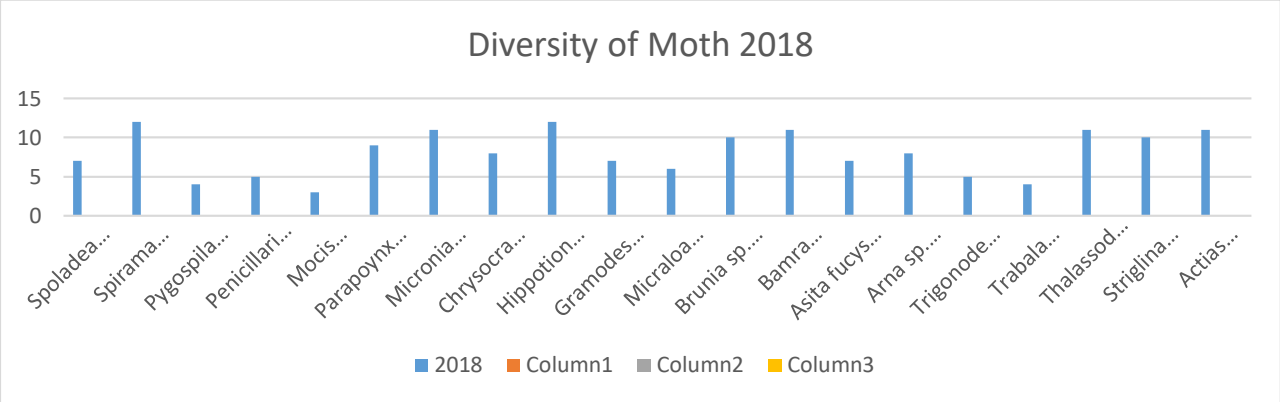
Berger-Parker index is the most significant method. The grouping of several species in a given area tells the most dominant species proportion.

= [nmax/N] is the procedure for determining the index.

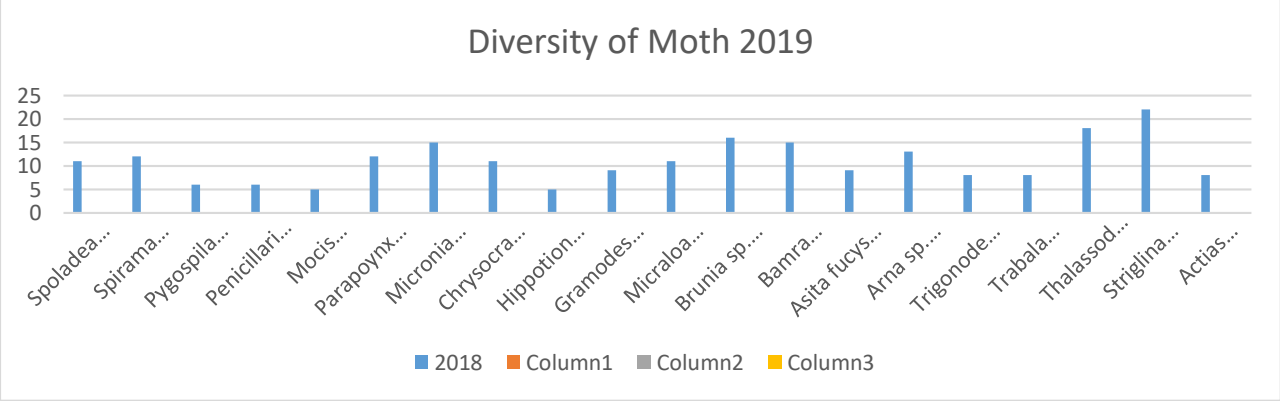
Where nmax indicates the frequency of the dominant species, and N shows the total number of species.

Table 1. Data illustration for Sahyadri (Savalghat.Peth). Number of species per year

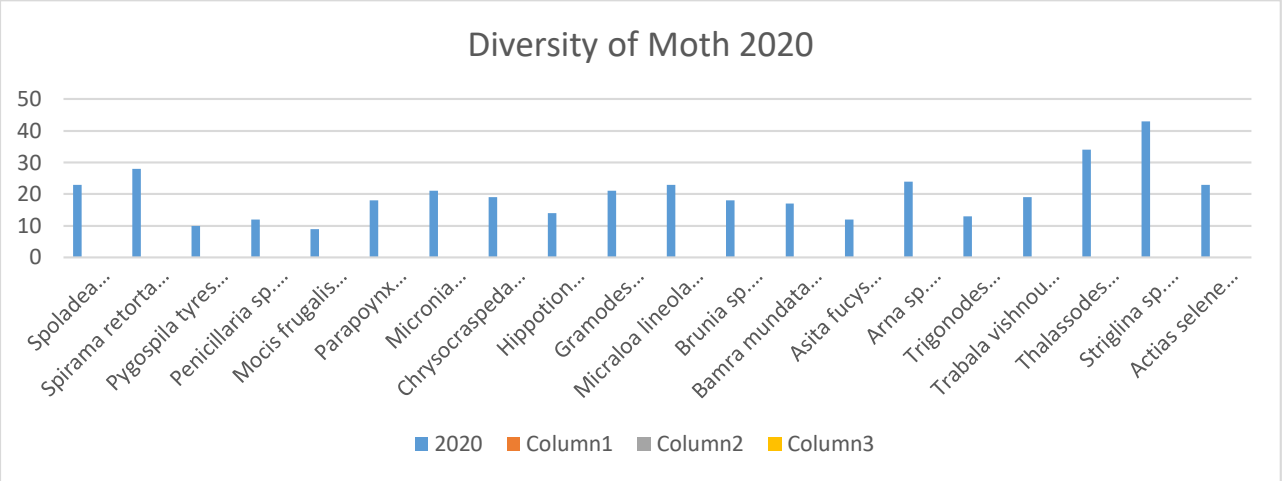
Sr.No	Species name with Families	Number Of Individuals Per Years				
		2018	2019	2020	2021	%
1	Spoladea recurvalis Crambidae	7	11	23	34	4.809052
2	Spirama retorta Erebidae	12	12	28	42	5.940594
3	Pygospila tyres Crambidae	4	6	10	12	1.697313
4	Penicillaria sp. Euteliidae	5	6	12	18	2.545969
5	Mocis frugalis Erebidae	3	5	9	14	1.980198
6	Parapoynx sp.Crambidae	9	12	18	21	2.970297
7	Micronia aculeata Uraniidae	11	15	21	34	4.809052
8	Chrysocraspeda sp. Geometridae	8	11	19	23	3.253182
9	Hippotion rosetta Sphingidae	12	5	14	28	3.960396
10	Gramodes geometrica Erebidae	7	9	21	38	5.374823
11	Micraloa lineola Erebidae Arctiinae	6	11	23	42	5.940594
12	Brunia sp. Erebidae .Arctiinae	10	16	18	40	5.657709
13	Bamra mundata Erebidae	11	15	17	27	3.818953
14	Asita fucys Erebidae	7	9	12	32	4.526167
15	Arna sp. Erebidae,Lymantriinae	8	13	24	54	7.637907
16	Trigonodes disjuncta Erebidae	5	8	13	32	4.526167
17	Trabala vishnou Lasiocampidae	4	8	19	41	5.799151
18	Thalassodes dissita Geometridae	11	18	34	65	9.193777
19	Striglina sp. Thyrididae	10	22	43	76	10.74965
20	Actias selene Saturniidae	11	8	23	34	4.809052
	Total Individuals	161	220	401	707	



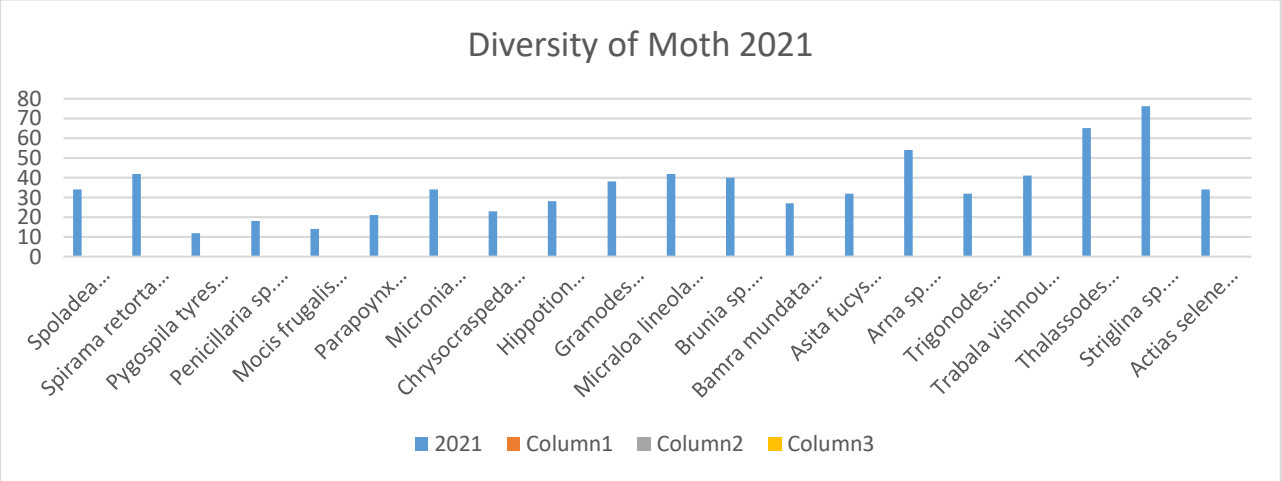
Graph1. Graphically representation of Moth family at the Sahyadri (Savalghat). Peth.Dindori(2018)



Grap2. Graphically representation of Moth family at the Sahyadri (Savalghat). Peth.Dindori(2019)



Graph3. Graphically representation of Moth family at the Sahyadri (Savalghat). Peth.Dindori(2020)



Graph4. Graphically representation of Moth family at the Sahyadri (Savalghat). Peth.Dindori(2021)

Table 2. Data illustration for Sahyadri (Savalghat). Peth.Dindori. Number of species in the year 2018 to 2021by using A.Shannon index-, Taxa_S, Dominance_D, Simpson_1-D, Shannon_H, Evenness_e^H/S, Brillouin. Menhinick, Margalef, Equitability_J, Fisher_alpha, Berger-Parker and Chao-1 respectively.

	2018	2019	2020	2021
Taxa_S	20	20	20	20
Individuals	161	220	401	707
Dominance_D	0.05613	0.05806	0.058	0.05968
Simpson_1-D	0.9439	0.9419	0.942	0.9403
Shannon_H	2.93	2.917	2.921	2.903
Evenness_e^H/S	0.9366	0.9245	0.928	0.9111
Brillouin	2.711	2.744	2.812	2.833
Menhinick	1.576	1.348	0.9988	0.7522
Margalef	3.739	3.523	3.17	2.896
Equitability_J	0.9781	0.9738	0.9751	0.9689
Fisher_alpha	6.018	5.346	4.428	3.829
Berger-Parker	0.07453	0.1	0.1072	0.1075
Chao-1	20	20	20	20

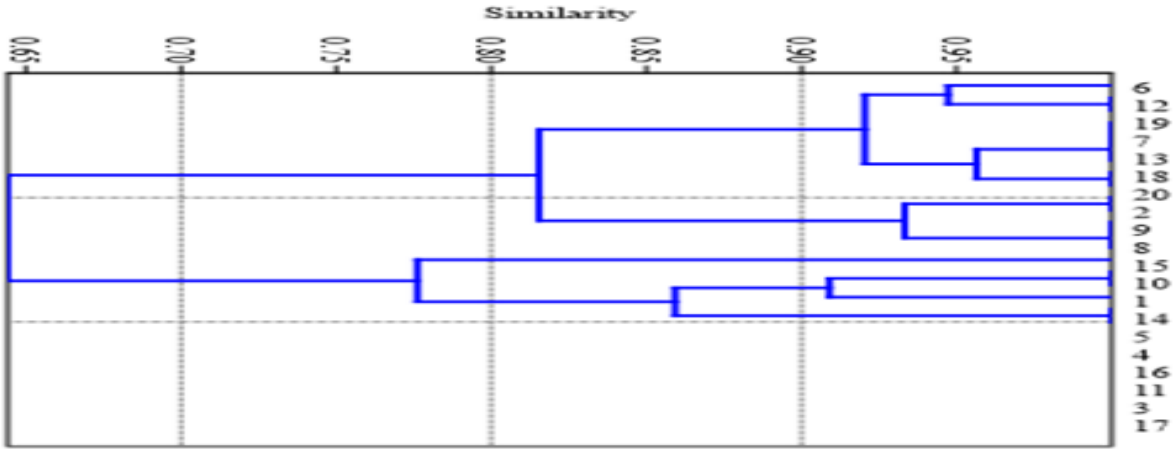


Figure 1:- Bray Curtis similarity index of the year 2018 from Savalghat (Sahyadri)

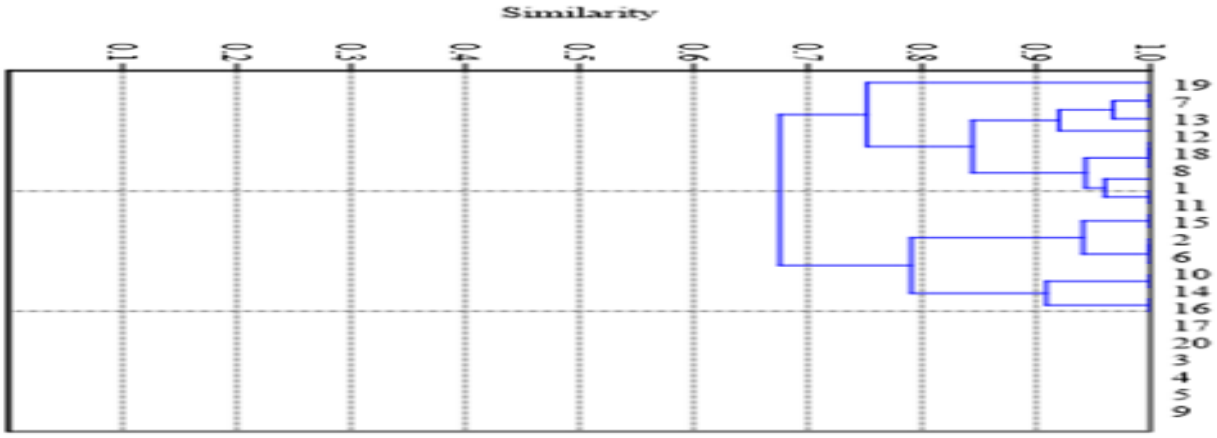


Figure 2:- Bray Curtis similarity index of the year 2019 from Savalghat (Sahyadri)

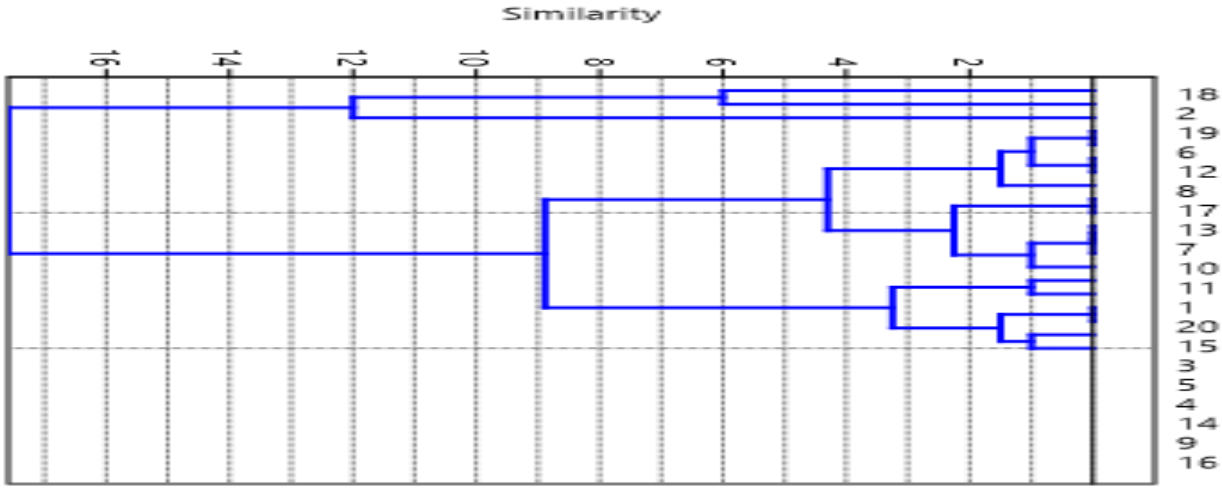


Figure 3:- Bray Curtis similarity index of the year 2020 from Savalghat (Sahyadri)

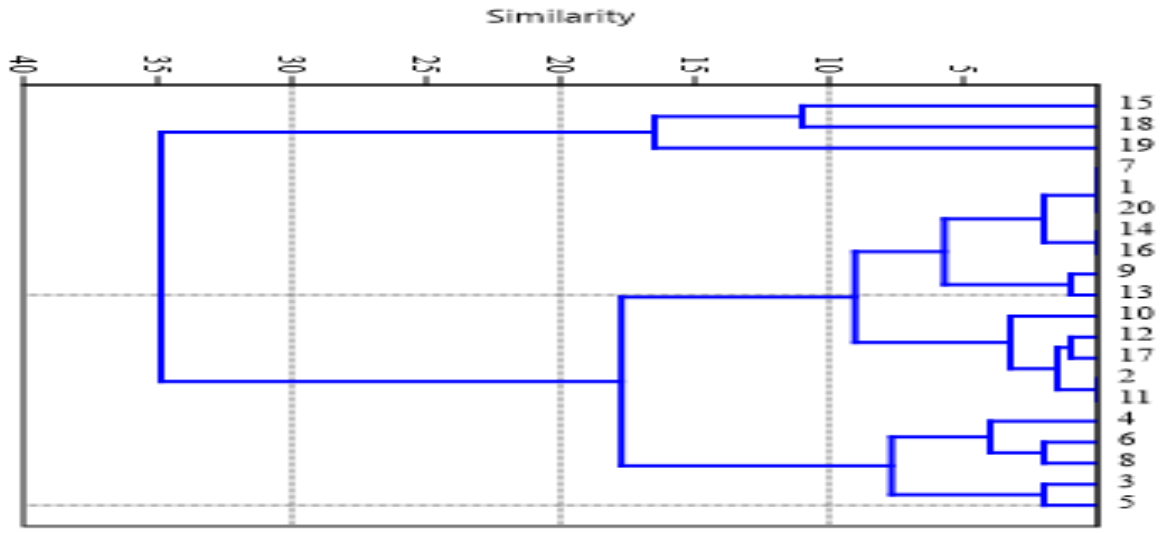


Figure 3:- Bray Curtis similarity index of the year 2021 from Savalghat (Sahyadri)

Discussion and Conclusion:-

The Sahyadri Hill Range of Maharashtra has expanded its landscape, containing diverse types of habitats for animals and plants to curl and endure. Differences in angles, wind velocity, angle of sunshine, altitudes, and water filtration affect the vegetation of a specific type to cultivate. It consists of xeric and scant flora having periodic variations in existence, evolution, and development. Climate and weather direct effect on the plenty and amount of moths. If all the climatic factors work in coordination, it will positively affect the plenty of moth species. Great species variety is riches in high rainfall areas in India, and squat species diversity is found in dry areas and in low rainfall areas too.

The great species abundance is owing to the high rainfall received and thus results in maximum flora. Moreover, forest types in Sahyadri are primarily of are steamy arid deciduous. In the present study, a record of moths is given data collected during the investigation survey tour conducted in this zone. The number of moth's wares exempted, collected, and identified under 20 species by belonging to five families and 12, and 13 subfamilies.

The maximum variety of species within the area is of family Thyrididae which accounts for about 10% of total collected species whereas family Geometridae, Lymantriinae, Erebidae, Arctiinae, and Crambidae are represented by single species and represents the least diversity from our study area (Table 1 the year 2021).

The major outcome of the report of 20 species: Spoladea recurvalis Crambidae, Spirama retorta Erebidae, Pygospila tyres Crambidae, Penicillaria sp. Euteliidae, Mocis frugalis Erebidae, Parapoynx sp.-Crambidae, Micronia aculeata Uraniidae, Chrysocraspeda sp. Geometridae, Hippotion rosetta Sphingidae Gramodes geometrica Erebidae, Micraloa lineola Erebidae Arctiinae, Brunia sp. Erebidae .Arctiinae, Bamra -mundata Erebidae, Asita fucys Erebidae, Arna sp. Erebidae, Lymantriinae, Trigonodes disjuncta Erebidae, Trabala vishnou Lasiocampidae, Thalassodes dissita Geometridae, Striglina sp. Thyrididae and Actias selene Saturniidae for the first time from the Peth and Dindori Tehsil. Out of the fifteen tehsils, only two were covered in this survey. More surveys are needed in the area so that a complete moth fauna from Nashik district can be compiled. The current information will run a standard to study the diversity of moths from the same district. This new information in addition to suggestion of other moth species will help to plan.

The current study is the first of its kind in the Sahyadri from Savalghat Landscape. It's impossible to say how abundance of the real local and regional species richness the survey caught because no previous species list for this area is available. The inventory was nearly complete at the regional scale, grounded on the estimated richness. Despite the study's relative success, it can't be called comprehensive because species were certainly overlooked at the local scale.

More species could be captured by sampling more sites or using various approaches. We also limited our sampling to the understorey layer because we did not have access to contemporary light-trapping equipment. As an outcome, species found mostly or solely underneath the canopy are under in research. Additionally, with dense forest foliage, collection effectiveness was reduced. As a consequence, in comparison to open zones, catching cryptic species in dense vegetation zones is likely less thorough. Using a specimen-independent diversity metric like Fisher's alpha (Hayek & Buzas 1997) [11], but on the other side, should minimize the biases of somewhere between assessments.

The study revealed the presence of 20 species belonging to five families and 12 genera from Peth and Dindori Tahsil during both sampling surveys (Tables.1). Shannon index of Peth and Dindori region are 2.93, 2.917, 2.921 & 2.903 in the year 2018, 2019, 2020 & 2021 respectively. With Evenness_e^H/S is 0.9366, 0.9245, 0.928 & 0.9111. Both the sites showed an evenness index above 0.7 which suggests less variation and constant spreading of moths in the whole area.

Fewer sites were selected from Peth and Dindori. Less species richness in the Peth zone in the year 2018 as compared to the next 2019, 2020, and 2021. Rich moth diversity in Peth and Dindori tehsil suggests that this zone had optimum climatic conditions which helped the moth to flourish. Observed Shannon diversity index for the year 2018 to 2021 was lower than expected (Tables I & 2). According to the Fisher_alpha index in the year 2018 to 2021 is 6.018, 5.346, 4.428, and 3.829 respectively this indicates the species diversity is increasing in the study zone.

PLATE I : Some of the Moths of Sahyadri (Savalghat) Landscape

Spoladea recurvalis Crambidae (Fabricius, 1775)

Spirama retorta Erebidae (Clerck, 1764)

Pygospila tyres Crambidae (Cramer, 1780

Mocis frugalis Erebidae Guenée, 1852

Parapoynx sp.Crambidae Snellen, 1880

Penicillaria sp. Euteliidae Walker, 1865

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