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Seasonal Cycle And Population Built Up Of Hexamermis Viswakarma Dhiman (Nematoda – Mermithidae), A Parasitoid Of Kusum Pest, Leptocoris Augur (Fabr.) (Heteroptera – Coroidea – Rhapalidae)

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Abstract:

Hexamermis viswakarma Dhiman is an endoparsitoid of **Leptocoris augur** (Fabr.) which in turn is a pest of Kusum Plant, **S. oleosa**. Seasonal cycle and population built up study revealed that population of bug occur through out the year being on peak during summer and rainy month from April to September and the **H. viswakarma** only parasitizes during rainy months late June to October, with maximum parasitization in August and minimum during late June and October. No parasitization occurs in November to late June, though eggs, post parasitic and adults remain in soil upto 20-30cm depth under **S. oleosa** tree. Hibernation in these stages of this nematode occurs from November to February and then aestivation in continuation of it upto late June. There is a relationship between pest population built up and parasitization percentage, with regard to temp., R.H. and Rainfall as well as food of **L. augur**.

Key words: **Hexamermis vishwakarma**, parasitoid, **Leptocoris augur** seasonal cycle, temp., R.H.

Introduction:

Leptocoris augur (Fabr.) is a pest of "Kusum" tree **Schleichara oleosa** Lour (Sapindaceae) which is a forest tree on which best quality of lac is cultivated. The bug is a gregarious feeder and causes loss of viability of the seeds of its host plant (Dhiman and Gulati, 1986). **L. augur** is a polyphagous sap sucking bug. Dhiman and Gulati (1985) recorded four new host plants of this bug but **S. oleosa** is major host plant. Natural enemies of insect pest are naturally control insect pest outburst upto some extent and many of them are used as potential biocontrol agents. Jain et. al. (2019) recorded three natural enemies of this bug and among these **Hexamermis vishwakarma** is major one. It is an endoparasitoid of **L.**

augur and cause cent percent mortality of parasitized bug (Ghayyur, 1993). Various studies are carried out on this mermithid nematode time to time by Dhiman and Kumar (1996), Dhiman and Gujral (2000), Dhiman and Yadav (2004), Dhiman et.al. (2009) Jain and Dhiman (2011) and Tomar and Dhiman (2017) Further Dhiman (1994) described mermithid nematodes as potential biocontrol agent of insect pests. Looking to the biocontrol potential of **H. vishwakarma** present studies on it's seasonal cycle and population build up in relation to temp. and R.H. are taken up.

Material and Method

Kusum plants (**Schleichera oleasa**), the main host of **L. augur**, are planted in good number in H R I and training center, Saharanpur and the pest infests these plants in abundance. Hence, during present course of study, aforesaid place is selected as study site area. For the study of seasonal cycle and population built up of **H. vishwakarma** samples of soil and parasitzation of bug were analysed throughout the year, grouping the months like July, August, September and October under rainy, November, December, January and February under winter and March, April, May and June under summer season respectively. Soil sample was analysed from five meter square area up to 30 cm under host tree. 25 bugs were randomly selected and observed for parazitization of **H. vishwakarma** at an interval of one month during the three consecutive year 2020 to 2022. Temp. And R.H. data were noted from meteorology department of HRI and training center. Population count was made and corelated with these two ecological factors.

Results

Adults, post parasitic juveniles and late laid eggs (in October) of **H. vishwakarma** overwinter during November to February and aestivate upto 30cm deep in soil in continuation up to late June till the first rain. They remain in the soil in coiling state and as temp. rises and R.H. begins to increase on the commencement of rainy season in late June or first week of July, they become active begin egg laying. Aestivated post parasitic stages mounts into adults and overwintered eggs hatch into preparasitic stages. This occurs as average temp. rises to 25 to 30^{o}C and R.H. increase upto 75 to 85%.

Parasitzation begins during late June or first week of July after rain fall as said above and 18 to 25% parasitization was recorded during this month in three consecutive years 2020-2022. As temp. now becomes almost constant (average 28.5^{o}C) and R.H. increase to 86% due to rain fall in July, August, September months, parasitization precent increases to many fold (upto 90%) (Table-1). This resulted in the increase of post parasitic stage and finally adult population of **H. vishwakarma** goes on peak level, up to 120/25^{2} meter area. Not only this, the aforesaid climatic conditions stimubles active breeding in this mermithid nematode. Hence, eggs and preparasitic stages are available in maximum number during aforesaid period.

This high parasitazaton induces high mortality in the bug population due to which bug population begins to decline from September onwards and reaches to low level during October. Table -1 clearly depicts the relation between parasitization percentage, bug population, temp. and R.H. In November no parasitization was recorded. This is due to low temp. which prevails throughout winter in this region of U.P. (AV. 13.1 to 18.85^{o}C) and minimum goes to 3^{o}C at Saharanpur during January. In view of this, during throughout winter months (Nov. to Jan. or upto Feb.) number of post parasitic and hibernates in soil as well as late laid eggs of the last month of October also remain in dormant stage till late June or first week of July. During summer months (March to June), too, using to high temp. (39.1^{o}C) even upto 42^{o}C and low R.H. (37.5%), aforesaid stages of this nematode remain in aestivation in soil in continuation of hibernation. During these months adult **H. vishwakarma** population (upto 11/25^{2}m) as well as host bug population reached to low level (20/10^{2}m area), almost static after October months from late June. Both the host population and parasite population goes on peak level due to favourable climatic conditions and this causes maximum activity of adult **H. vishwakarma**. Moreover, the pulpy fruits of **S. oleosa** on which **L. augur** population feed gregariously fall down under the host tree during June to September months. Active breeding period of the bug also coincide with the breeding of nematode during these months.

The extremely low temp. (3 to 15^{o}C) that occurs in the field mainly during December to February and high temp. (more than 35^{o}C) during March to June, both effect the survivality and parasitization efficacy. Hence, low temp. includes the hibernation and high temp. and low R.H. to the aestivation in **H. vishwakarma**. In both the conditions, hibernating or aestivating stages survive through thick cuticle while eggs by cuticular sheath coverings around it.

Maximum population of all stages of **H. vishwakarma** occurs at Saharanpur during August and minimum during June and October. No preparasitic and parasitic stages occurs during November to mid June. As said above, thus, there is a great relationship between parasitization percentage, bug population, temp. and R.H. as well as fruiting of host plant of bug, **S. oleosa**.

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TABLE - 1

SEASONAL CYCLE AND POPULATION FLUCTUATIONS IN RELATION TO TEMPERATURE AND R.H. IN NATURE

Years	Particulars	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
	Average temperature (^{0}C)	13.1	16.6	21.1	25.8	31.0	30.1	30.55	28.65	27.85	23.25	15.5	14.6
2020	Average R.H. (%)	68.5	67.5	59.5	51.0	42.5	68.0	75.0	82.0	75.5	61.0	67.5	73.5
	Rainfall (mm)	000.4	030.9	034.8	029.0	005.6	103.6	134.6	227.8	070.7	000.0	009.6	054.4
	Bug Population in 10^2/m area	65	100	130	140	200	350	550	600	450	80	50	20
	Percentage of Parasitization	-	-	-	-	-	18%	75%	87.7%	78%	20%	-	-
	No. of parasiticjuvenile/ 25 host bug	-	-	-	-	-	72	75	102	84	66	-	-
	No. of adults in 25^2/m area	22	18	11	14	28	31	67	80	97	65	58	32
2021	Average temperature (^{0}C)	13.85	15.25	22.5	26.3	30	30.2	29.35	28.05	27.75	23.8	18.8	14.7
	Average R.H. (%)	74	59	54.5	50.5	37.5	53.5	75	84.5	74	62.5	66.5	68.5
	Rainfall (mm.)	063.4	048.6	003.0	000.6	029.4	018.7	125.2	836.5	074.4	000.0	004.2	000.0
	Bug population in 10^2/m area	50	90	110	150	230	300	500	580	400	100	40	30
	Percentage of parasitization	-	-	-	-	-	25%	79%	88%	80%	19%	-	-
	No. of parasitic juvenile/ 25 host bug	-	-	-	-	-	80	90	120	100	70	-	-
	No. of adults in 25^2/meter area	16	15	17	12	17	38	70	82	91	65	51	42
2022	Average temperature (^{0}C)	13.3	17.5	19.15	27.15	30.4	32.15	29.65	28.85	26.9	24.0	14.2	13.4
	Average R.H. (%)	67.5	68	54.5	43	46.5	58.5	79	76.5	82.5	64	58	61.2
	Rainfall (mm.)	011.4	036.2	047.8	000.0	025.6	069.8	180.1	067.6	549.6	012.0	14.0	15.3
	Bug population in 10^2/m area	30	60	90	120	150	250	580	620	500	160		
	Percentage of parasitization	-	-	-	-	-	20%	74%	90%	81%	18%	-	-
	No. of parasitic juvenile / 25 host bug	-	-	-	-	-	70	80	112	98	68	-	-
	No. of adults in 25/^{2}m area	18	16	15	11	20	35	76	90	120	70	48	31

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