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INFLUENCE OF BIOTIC AND ABIOTIC FACTORS ON SEASONAL ABUNDANCE OF LEPIDOPTERAN INSECT PESTS ON CASHEW IN CHHATTISGARH, INDIA

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Cashew (*Anacardium occidantale* L.) is dollar earning crop of India. But, production of raw nut is not fulfilling the requirement of the processing industries. There are various factors responsible for low yield in cashew, in which the insect pest problem is major one. Rai (1984) has listed 21 species of lepidopterans as leaf feeders of cashew. To study the seasonal occurrence of leaf feeding lepidopteran insect pests a survey was conducted at S.G. College of Agriculture & Research Station, IGKV, Jagdalpur (C.G.) during 2007 and 2008 in randomly selected trees in cashew plantation in the surrounding areas of District Bastar (Chhattisgarh) and their intensities in forest plantation were recorded at weekly intervals by placing a frame of 1.0 sq. m area on the tree canopy on all the four sides. The leaf caterpillar damage (33.14% mean damage) was noticed throughout the year with relatively higher damage during November-December. The leaf folder was observed (17.14% mean damage) round the year with maximum in November to January. The leaf miner mean damage was observed (9.20%) almost throughout with the peak in November. The leaf and blossom webber appeared (1.54% mean damage) as minor pest but its damage was seen almost round year, while, some insect pests present in cashew plantation as minor pests which were: inflorescence caterpillar (0.28% mean damage) observed during reproductive stage, semilooper appeared intermittently with peak (0.06 numbers) in November-December, slug caterpillar appeared in spring and cooler season. In natural enemies, spiders were prevalent (0.59 mean population) throughout the year feeding upon thrips and lepidopteran larvae. The maximum temperature and evaporation influenced negatively the leaf caterpillar damages; while, relative humidity and vapour pressure (II) had positively correlated. Leaf folder damage was negatively influenced with maximum temperature, minimum temperature, wind velocity and evaporation; whereas, relative humidity correlated positively. The maximum temperature and evaporation negatively correlated with leaf miner; while, relative humidity and vapour pressure (I) influenced positively. Leaf & Blossom Webber damage was correlated negatively with maximum temperature, evaporation and bright sunshine (hours); while, relative humidity influenced positively. The activity of Inflorescence caterpillar was positively influenced with maximum temperature and evaporation; whereas, relative humidity (morning and evening) were negatively correlated. The maximum temperature had significant negative contribution and the vapour pressure (I) had highly significant positive contribution of 31% towards percentage damage of leaf caterpillar. The 33% variation in leaf folder damage was contributed significantly negatively by maximum temperature and significantly positively by evaporation; while, 27% variation contributed positively by rainy days.

Key words : Abiotic, Biotic factors, Lepidopteran insect pests, Cashew, Chhattisgarh, India.

INTRODUCTION

Cashew (*Anacardium occidantale* L.) is the poor man's crop and the rich man's food and it is an important cash crop in India. Chhattisgarh is a tribal state and Bastar is one of

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the biggest tribal districts to have around 40,000 hectares suitable for cashew plantation (Geographical Information Survey & Survey of Government of India, 2002-2003). This crop was considered as most appropriate for soil conservation, afforestation and wasteland development and has now become an important horticultural crop. The cashew (*A. coccidental*) is an important commercial plantation crop with tremendous potential foreign currencies. Cashew cultivation in India during 2005-2006 concerned on area of 837 thousand hectares of land and produced 573 thousand tones of raw nuts (Directorate of Cashew & Cocoa Develpoment Reports, 2006-2007). There are various factors responsible for low yield in cashew, in which the insect pest problem is major one.

Rai (1984) has listed 21 species of lepidopterans as leaf feeders of which only two species as *Metanastria hyrtica* (Lasiocampidae) and *Lymnatria obfuscata* (Lymantridae) cause severe sporadic defoliation in cashew.The early instars of *M. hyrtica* are gregarious on tender leaves, while full grown caterpillars feed voraciously on mature leaves.

Misra & Basu Chaoudhary (1974) recorded leaf caterpillar *L.obfuscata* as new defoliator of cashew from South India. The caterpillars congregate in large number on the ground under dry leaves near the base of the tree in cervices of bark or as lower parts of well shaded branches during day time and are active during night only. The caterpillars defoliate the cashew trees completely leaving only bare branches.

Ambethgar & Lakshmanan (1999) reported that leaf caterpillar *Metanastria hyrtaca* infecting cashew in an epidemic observed during December 1997-Febraury 1998 in Vridhachalam Jayakondam Taluk, Tamil Nadu. In Baster (Chhattisgarh) leaf feeding caterpillars occurrence was found throughout the year. Therefore, present investigation was carried out.

MATERIALS AND METHODS

To study the seasonal occurrence and intensity of leaf feeding caterpillars, a survey was conducted at S.G. College of Agriculture and Research Station, Jagdalpur (Chhattisgarh) during 2007 and 2008 in randomly selected trees in cashew plantation in the surrounding areas of Bastar (Chhattisgarh) and intensities of insects in forest plantation were recorded at weekly intervals by placing a frame of 1.0 sq. m area on the tree canopy on all the four sides. Data was recorded on the following parameters: number of leaves damaged by leaf feeding insect pests. Based on the data generated on the above parameters, per cent infestation or damage was calculated for the different insect pests. The data was also analyzed statistically by simple correlation and multiple regression analysis to know the influence of abiotic components on the infestation levels.

RESULTS AND DISCUSSION

The finding of present investigation revealed based on a survey of pest complex were taken in cashew plantation in the study area comprises Bakawand, Tokapal, Bastar and Lohandiguda blocks of Districts Jagdalpur. The various insect pests as well as natural enemies occurring and their intensities in forest area were recorded and the data is presented in Table I to IV. The prevailing weather factors observed during the course of study are given in Table I and II.

The extent of insect pest infestation and their seasonal incidence was recorded at weekly interval from twelve randomly selected cashew trees under unsprayed condition throughout the year during the study period (January 2007 to December 2008) to observe the incidence of pest complex of cashew. During the course of study several species of insect pests were noticed causing damage to different parts of cashew tree at various stages.

Leaf Caterpillars, *Metanastria hyrtica* Cramer

The leaf damage by leaf caterpillars was noticed throughout the year during both the years 2007 and 2008. The relatively higher leaf damage was recorded during month of November-December with maximum (48.57%) leaf damage in second week of November and minimum infestation (6.77% leaf damage) was observed in fourth week of May during 2007. Whereas in 2008, the leaf damage by this insect ranged minimum (14.60% leaf damage) in second week of March to maximum (57.69% leaf damage) in last week of June. Its average infestation was recorded 28.30 and 33.14% in 2007 and 2008, respectively. Similarly, Abraham (1958) reported the leaf caterpillars are the more important and major ones. While, Misra & Basu Chaoudhary (1974) recorded in South India that leaf caterpillar, *Lymnatria obfuscata* (Lymantridae) as new defoliator of cashew. Ambethgar & Lakshmanan (1999) reported that leaf caterpillar *Metanastria hyrtaca* infecting cashew and its epidemic infestation observed during December 1997-

Table I : Seasonal occurrence of Lepidopteran insect pests on cashew during the 2007 and 2008.

S. No.	Common Name	Scientific Name	2007			2008		
			Month of occurr-ence	Range	Mean	Month of occurrr-ence	Range	Mean
1.	Leaf caterpillars (%)	*Metanastria hyrtica* Cramer	Through out the year	6.77 - 48.57	28.30	Through out the year	14.60 - 57.69	33.14
2.	Leaf Folder (%)	*Caloptilea tiselea* M.	Through out the year	0.67 - 24.44	11.67	Through out the year	1.81 - 31.07	17.14
3.	Leaf Miner (%)	*Acrocercops syngramma* M.	Through out the year	0.23 - 42.37	9.20	Through out the year	0.65 - 35.03	6.56
4.	Leaf & Blossom Webber (%damage)	*Lamida moncusalis*	Through out the year	0.11 - 8.69 %	1.54	Through out the year	0.15 - 11.59	1.05
5.	Slug caterpillar (numbers)	*Latoia lepida* Cramer	Intermi ttently through out the year	0.02 - 0.13	0.01	Jan- Feb & June to December	0.02 - 0.75	0.05
6.	Inflorescence caterpillars (%)	*Euproctis scintillans* Walker	Last Feb. to May	0.02 - 3.65	0.37	February to May & December	0.14 - 3.68	0.22
7.	Semilooper (numbers)	*Thallasodes* spp.	Nov- Jan	0.02 - 0.06	0.00	January, April, May & November	0.02 - 0.04	0.00

Febraury 1998 in Vridhachalam and Jayakondam Taluk, Tamil Nadu. The leaf caterpillar damage was noticed through out the year and its peak activity was recorded during October-November month with infestation ranged from 0.6 to 44% leaf damage in earlier finding by Anonymous (2004).

Leaf Folder, *Caloptilea tiselea* M.

In the year 2007 and 2008, the activity of leaf folder was observed round the year. The intensity of this insect pest ranged from 0.0 to 24.44% and 1.81-31.07% folded leaves with maximum in first week of November and second week of January during 2007 and 2008, respectively.

Similar result was observed with peak incidence during April where intensity ranged from 1.13 to 20.39% leaf folds in earlier reports (Anon., 2005). In agreement with present finding Rao *et al.* (2006) reported that leaf folder (*Caloptilia tiselaea*) incidence was highest during the second week of November coinciding with new flush and blooming stage and the pest was absent during parts of May, June and July. Whereas, the incidence of leaf folder was observed round the year with a maximum of 23.78% damage in earlier findings (Anon., 2007).

Leaf Miner, *Acrocercops syngramma* M.

The incidence of leaf miner damage during 2007 was observed almost throughout the year except second week of January, last week of March, third and fourth week of December with the peak infestation (42.37% mined leaf) in second week of November. While in 2008, the leaf miner infestation ranged 0.00 to 25.03% with peak in third week of November. In contrary, Pillai *et al.* (1976) reported that leaf miner *Acrocercops syngramma* Meyr., causing the most damage and found abundantly during post-harvest and post-monsoon flushes, whereas, Rai (1984) considered *A. syngramma* as major pests with high intensity in September-October, moderate in November and low incidence in December-January. In agreement with present findings Athalye & Patil (1998) reported the incidence of the cashew leaf miner throughout the year in Maharashtra with peaked (18.21%) during September on post monsoon vegetative flush. In accordance with present investigation, Sundararaju (1984), Jena *et al.* (1985), Chatterjee (1989), Sundararaju *et al.* (1999) and Bhatnagar & Sharma (2004) were included *A. syngramma* as main pest with a maximum damage of 18-20%. In contrary, Godse (2002) considered leaf miner (*A. syngramma*) as secondary important pests. Whereas, Rao *et al.* (2006) reported that the leaf miner (*A. syngrammma*) incidence was at its peak. during the second week of December with no infestation during May-June and lowest incidence was observed in July in Andra Pradesh.

Leaf and Blossom Webber, *Lamida moncusalis* Walk

The leaf and blossom webber appeared as minor pest but its damage was seen almost round year in 2007 and 2008 with maximum infestation (8.69 and 11.59%) during second week of October and in third week of July, during 2007 and 2008, respectively. Similarly, Pillai *et al.* (1976), Babu *et al.* (1983) and Bhatnagar & Sharma (2004) reported the damage of this pest in cashew and its larvae web the terminal portions of new shoots and blossom, causing the shoots to dry up. While, this insect active from end

of February to end of May with a maximum incidence during second fortnight of April, damaging 4.82% of shoots and its activity was drastically reduced after onset of monsoons reported in earlier findings (Anonymous, 1994). Whereas, Abraham (1958) and Godse (2002) reported that leaf and blossom webber was secondary important pests.

Slug Caterpillar, *Latoia lepida* Cramer

The slug caterpillar appeared in spring and cooler season in both the years 2007 and 2008. The population of this insect was ranged 0.02-0.13 numbers and mean of 0.01 numbers per 52 leader shoot with its peak in second week of November in 2007; while in 2008, population varied from 0.02 to 0.75 numbers per 52 leader shoot with mean of 0.05 numbers and its maximum population was observed in last week of July. Abraham (1958) and Rai (1984) also reported this pest in spring season and isolated plants.

Inflorescence Caterpillar, *Euproctis scintillans* Walker

The result revealed that the inflorescence caterpillar observed during reproductive stage of cashew with maximum 3.65% panicle damage in second week of March in 2007 and mean infestation of 0.37%. Its activity was ranged from 0.08 to 3.68% panicle damage with maximum infestation in second week of April in 2008, respectively, and mean infestation of 0.22%. Similarly, this pest was also observed in flowering stage of cashew as minor pest by Rai (1984). Similar result was also reported by Abraham (1958) and Godse (2002) who found this pest occasionally in the inflorescence, tender nuts and apples.

Semilooper, *Thallasodes* sp.

It appeared intermittently and the population ranged from 0.0 to 0.06 numbers per 52 leader shoot in 2007 with maximum infestation in third week of December. In 2008, semilooper population varied from 0.0 to 0.04 numbers per 52 leader shoot with peak in first and third week of November. Its average population of 0.01 numbers was observed in both the years. Similarly, Rai (1984) also observed this insect as minor pest.

Natural Enemies of Lepidopteran Insect Pests on Cashew

Survey was conducted to know the natural enemies of lepidopteran insect pests in the different cashew orchards including old plantations of Forest Departments. The natural enemies were observed on the same plants at the time of recording insect pest infestation at weekly interval. List of natural enemies associated with different insect-pests is presented in Table II. The detailed descriptions of natural enemies are as follows:

Spiders : Different species of spiders (*Argeopes sp., Oxypes sp.* and *Plexippus paykulli*) were active and feed upon lepidopteran larvae (like leaf and shoot webber, leaf caterpillar and leaf folder). The number of spiders in cashew varied from 0.0 to 2.96 spiders with mean population of 0.41 numbers and its peak population was recorded in third week of November during 2007. While, the spider activity was found throughout the year in 2008 with minimum (0.10 spiders per 52 leader shoot) in last week of June first week of November. Its average population was 0.59 spiders per 52 leader shoot.

incontrary, Sundararaju (1984) reported that *Helopeltis antonii* was preyed on by a spider. While, Anon. (1994) reported that the population of spiders was highest during the flowering period. Similarly, the spider population ranged from 0.29 to 12.50 with maximum number in month of October reported in earlier finding (Anon., 2004).

Rove beetle *Paederus forceps* : The activity of rove beetle *Paederus furceps* ranged from 0.0-0.25 beetles with peak incidence was observed in last week of June in both the observing years 2007 and 2008. This predator was first time recorded in cashew.

Preying Mantis, *Mantisa religiosa* : The praying of this predator was observed throughout the year, intermittently in both the observing year 2007 and 2008. Its population ranged from 0.0 to 0.17 and 0.0 to 0.04 numbers with peak in fourth week of July and third week of April during the 2007 and 2008, respectively. The mean population of this predator was observed 0.01 in both the years. Similarly, praying mantis present in cashew ecosystem reported in earlier finding (Anon., 1994).

Braconids (*Bracon brevicornis* and *Apantales* sp.) : The braconid parasites were found to parasitized upon leaf and blossom webber and leaf miner and its population was recorded about 0.06 and 0.08 average number per 52 leader shoot with peak population in second week of January in 2007 and 2008, respectively. The braconid parasite were found and recorded about 8.6% and 5.8% of the population of shoot and blossom webber and leaf miner were parasitized by the braconid parasite at Jhargram (W.B.) (Anon., 1994). Similar to present finding the leaf and blossom webber was parasitized by *Bracon brevicornes* (Braconidae : Hymenoptera) to an extent of 10% during April observed in NRCC, Puttur (Karnataka) (Anon., 1994).

Ichneumonid wasp (Unidentified) **:** This predator was observed in field as well as in nursery. The incidence was low and ranged from 0.0 to 0.02 during both the observing year 2007 and 2008.

Effect of Abiotic Factors

The different abiotic factors influenced the incidence of lepidopteran insect pests of cashew spatially and temporarily. The coefficient of correlation was calculated to study the correlation of different insect pests of cashew with different weather factors. The values of coefficient of correlation for the years 2007 and 2008 were given in Table III. The abiotic factors maximum temperature and evaporation was significantly negatively correlated (r = -0.444 and -0.422) with per cent leaf damaged by leaf caterpillar; while, relative humidity (morning) was significantly positively correlated (r = 0.401) during 2007. In 2008, only relative humidity (evening) and vapour pressure (I) significantly positively influenced (r = 0.386 and 0.461) the leaf caterpillar damage. Similarly, the rainy days were positively correlated with leaf caterpillar damage reported in earlier findings (Anon., 2005).

Per cent leaf folded by leaf folder in 2007 was significantly negatively influenced with maximum temperature, minimum temperature, wind velocity and evaporation with correlation coefficient values of -0.585, -0.401, -0.464 and -0.604, respectively; whereas, relative humidity (morning and evening) significantly positively correlated (r = 0.514 and 0.310), respectively. In 2008, same trend observed that maximum temperature,

Table II : Seasonal occurrence of Lepidopteran insect pests on cashew during the 2007 and 2008.

S. No.	Common Name	Scientific Name	2007			2008		
			Month of occurrence	Range (No.)	Mean (No.)	Month of occurrence	Range (No.)	Mean (No.)
	Spider	*Argeopes* sp., *Oxypes* sp. & *Plexippus paykulli*	Through out the year	0.02-2.96	0.41	Through out the year	0.10-3.19	0.59
2.	Rove beetle	*Paederus* species	Intermittently Through out the year	0.02-0.25	0.02	Intermittently Through out the year		0.01
3	Praying Mantis	*Mantisa religiosa*	Intermittently Through out the year	0.02-0.17	0.01	Intermittently Through out the year		0.00
4	Ichneumonid wasp	Unidentified	January & Sept.-October	0.02-0.02	0.00	April to May		0.00

minimum temperature and evaporation significantly negatively correlated (r = -0.474, -0.453 and -0.401, respectively); while only relative humidity (evening) was significantly positively correlated (r = 0.460) with leaf folder damage. Similarly, Rao *et al.* (2006) reported a negative and significant correlation with maximum and minimum temperatures, while a significant positive correlation was observed with morning and evening relative humidity. While, Chakraborti & Majumder (2007) reported that cool temperature conditions were favourable for the build-up of the population densities of leaf folder.

The environmental factors, maximum temperature and evaporation during 2007 significantly negatively influenced (r = -0.432 and -0.524) the per cent leaf mined by leaf miner; while, relative humidity (morning and evening) and vapour pressure (I) were significantly positively correlated with correlation coefficient values of 0.494, 0.471 and 0.288, respectively. In 2008, all the abiotic factors were found non-significant on the activity of leaf miner. In contrary, Senguttuvan & Shah (1990) reported that as the total rainfall and number of rainy days increased, the incidence of leaf miner was reduced. Similarly, leaf miner infestation increased with decline in relative humidity, rainfall and temperature reported in earlier findings (Anon., 1994). Similarly, Rao *et al.* (2006) reported that the negative and significant correlation of leaf miner with maximum and minimum temperatures, while a significant positive correlation was observed with morning and evening relative humidity. While, Chakraborti & Majumder (2007) reported that cool temperature conditions were favourable for the build-up of the population densities of leaf miner which was in agreement with present findings.

Table III : Correlation of Lepidopteran insect pest on cashew with corresponding weather parameters during 2007 and 2008.

Insect Pests	Years	Value of Correlation Coefficient										
		Max. Temp ^{0}C	Min. Temp ^{0}C	Rainfall (mm)	Relative Humidity		Vapour Pressure		Wind Vel. (Kmph)	Evap. (mms)	Bright Sunshine (hrs)	Rainy Days
					I	II	I	II				
LC (%)	2007	-0.444**	-0.189	0.028	0.401**	0.244	0.006	-0.140	-0.189	-0.422**	-0.118	0.067
	2008	-0.139	0.031	0.033	0.220	0.386**	0.134	0.461**	-0.105	-0.197	-0.176	0.098
LF (%)	2007	-0.585**	-0.401**	-0.060	0.514**	0.310*	-0.167	-0.036	-0.464**	-0.604**	-0.003	-0.114
	2008	-0.474**	-0.453**	0.118	0.460**	0.203	-0.268	0.073	-0.093	-0.401**	-0.102	-0.127
LM (%)	2007	-0.432**	0.066	0.214	0.494**	0.471**	0.288*	0.002	-0.234	-0.524**	-0.179	0.229
	2008	-0.138	-0.213	-0.135	0.105	0.082	-0.186	0.047	-0.197	-0.093	0.052	-0.142
Shoot LBW (%)	2007	-0.305*	-0.014	0.243	0.394**	0.336*	0.156	0.086	-0.156	-0.399**	-0.140	0.081
	2008	-0.195	0.132	0.493**	0.183	0.328*	0.215	-0.013	0.619**	-0.274*	-0.385**	0.265
Slug caterpillars	2007	-0.272	-0.159	-0.114	0.297*	0.112	-0.065	-0.128	-0.337*	-0.329*	0.135	-0.079
	2008	-0.246	0.008	0.065	0.228	-0.078	0.105	0.184	0.083	-0.306*	-0.182	0.085
IC	2007	0.530**	0.260	-0.160	-0.524**	-0.415**	0.023	-0.117	0.198	0.607**	0.252	-0.091
	2008	0.220	-0.030	-0.086	-0.127	-0.360**	-0.090	-0.263	-0.125	0.068	0.228	0.067

* : Significant at 5% level of significance; ** : Significant at 1% level of significance.

Table IV : Multiple Regression Equation of Lepidopteran Insect Pest on cashew with their corresponding weather parameters in 2007.

Insect Pest		Intercept	Value of Regression Coefficient											R^2
			Max. Temp ^0C	Min. Temp ^0C	Rain-fall (mm)	Relative Humidity		Vapour Pressure		Wind Vel. (Kmph)	Evap. (mms)	Bright Sun-shine (hrs)	Rainy Days	
						I	II	I	II					
			X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	
Y1	LC (%)	133.56	-5.120*	2.399	-0.120	0.114	-0.177	-1.870	1.538**	-2.333	6.276	0.156	0.833	0.31
Y2	LF (%)	92.30	-3.127*	0.919	-0.023	-0.065	0.007	-0.526	0.588	-1.786	4.359*	-0.583	-1.267	0.33
Y3	LM (%)	1.12	-2.912	2.519	0.026	0.689	0.145	-2.587	0.106	-0.239	5.629	0.662	-2.860	0.36
Y4	Shoot LBW (%)	0.72	-0.316	0.115	0.014	0.060	0.002	-0.008	0.012	0.047	0.426	0.232	-0.662	0.16
Y5	IC (%)	-8.65	0.326*	0.006	0.010	0.018	0.010	-0.101	-0.050	0.145	-0.427	0.005	0.055	0.33

* - Significant at 5% level of significance; ** - Significant at 1% level of significance.

Table V : Multiple Regression Equation of Lepidopteran Insect Pest on cashew with their corresponding weather parameters in 2008.

Insect Pest		Intercept	Value of Regression Coefficient											R^2
			Max. Temp ^0C	Min. Temp ^0C	Rain-fall (mm)	Relative Humidity		Vapour Pressure		Wind Vel. (Kmph)	Evap. (mm)	Bright Sun-shine (hrs)	RainyDays	
						I	II	I	II					
			X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	
Y6	LC (%)	12.84	0.022	-0.049	0.001	0.348	-0.088	-0.668	0.374	-0.084	1.700	-1.249	0.116	0.10
Y7	LF (%)	7.26	-0.600	0.125	-0.029	0.103	-0.009	-0.320	0.044	0.414	2.065	1.202	2.715**	0.27
Y8	LM (%)	-14.51	-0.241	1.738	-0.004	0.340	0.028	-2.120	0.042	-0.045	0.040	0.177	0.458	0.10
Y9	Shoot LBW (%)	9.91	0.017	-0.375	0.015	-0.097	0.002	0.322	0.079	0.173	-0.062	-0.219	-0.513	0.36
Y10	IC (%)	1.15	0.063	-0.190	0.003	-0.034	0.007	0.219	-0.037	-0.029	-0.023	0.019	0.026	0.26

* - Significant at 5% level of significance; ** - Significant at 1% level of significance.

In 2007, the Leaf & Blossom Webber damage was significantly negatively correlated (r = -0.305 and -0.399) with maximum temperature and evaporation, respectively; while, relative humidity (morning and evening) was significantly positively correlated (r = 0.394 and 0.336, respectively). In 2008, rainfall, relative humidity (evening) and wind velocity were positively correlated (r = 0.493, 0.328 and 0.619, respectively), whereas, evaporation and bright sunshine hours negatively influenced this insect with correlation coefficient values of -0.274 and -0.385, respectively. In contrary, infestation of leaf and blossom webber on leaves was negatively correlated with relative humidity reported in earlier finding (Anon., 1994). While, Chakraborti & Majumder (2007) reported that the moderate temperature favoured the growth and development of leaf and blossom webber.

The incidence of slug caterpillar was postively influenced (r = 0.297) by relative humidity (morning) and negatively influenced (r = -0.337 and -0.329) by wind velocity and evaporation during 2007, respectively; whereas in 2008, only evaporation was correlated negatively (r = -0.306). Maximum temperature and evaporation during 2007 was significantly positively correlated (r = 0.530 and 0.607) with activity of Inflorescence caterpillar; whereas, relative humidity (morning and evening) were significantly negatively influenced this insect with correlation coefficient values of -0.504 and -0.415, respectively. In 2008, only relative humidity (evening) was significantly negatively correlated with correlation coefficient value of -0.360. Senguttuvan & Shah (1990) reported that increase in maximum and minimum temperatures was observed to be unfavorable for multiplication of inflorescence caterpillar.

Multiple Regression Analysis of Different Insect Pest with their corresponding weather parameters

The multiple regression analysis of different insect pests with their corresponding weather parameters were worked out during the observing years 2007 and 2008 and multiple regression equations calculated were presented in Table IV and Table V. The maximum temperature had significant negative contribution and the vapour pressure (I) had highly significant positive contribution of 31% towards per cent damage of leaf caterpillar in the year 2007; whereas in 2008, the contribution of all the weather parameters were observed non-significant. In case of per cent leaf folder damage, the 33% variation was contributed significantly negatively by maximum temperature and significantly positively by evaporation in the year 2007; while in 2008, only rainy days were significantly positively contributed 27% towards per cent leaf folder damage.

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