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Seasonal incidence of rice caseworm, *Nymphula depunctalis* Guenee in different rice ecosystem

Yaspal Singh Nirala and Gajendra Chandrakar

Abstract
Field experiment was conducted at research farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur during *kharif* season 2013-14 under different rice ecosystems. The results of field experiments revealed that the maximum population was found in August-September month. Among the ecosystem highest caseworm, *N. depunctalis* adult population was recorded in LLC (0.44 adults/25 sweeps), followed by LLO (0.31 adults/25 sweeps), MNT (0.25 adults/25 sweeps), MSR (0.15 adults/25 sweeps) and UTP (0.11 adults/25 sweeps). The incidence of caseworm, *N. depunctalis* revealed that the per cent leaf infestation was noticed from 31 to 32 SMW of July to August with 0.08 to 0.20 and disappears after 37 to 38 SMW of September in among the rice ecosystem. There was an increase in population in subsequent weeks and the maximum per cent of leaf infestation was recorded during 34 to 37 SMW of August-September with (0.00%), (0.19%), (0.46%), (0.31%), (0.69%), and (0.46%) leaf infestation/hill in upland direct seeded rice ecosystem (UDS), upland transplanted rice ecosystem (UTP), midland normal transplanted rice ecosystem, midland SRI rice ecosystem (MSR), lowland organic rice ecosystem (LLO), lowland conventional rice ecosystem (LLO), respectively. On the basis of seasonal mean it is crystal clear that the maximum per cent of leaf damage/hill was recorded in LLC (0.20 % leaf damage/hill), followed by LLO with (0.13 % leaf damage/hill), MNT (0.10 % leaf damage/hill), MSR (0.0.07 % leaf damage /hill), UPT (0.0.05 % leaf damage/hill) and UDS (0.00% leaf damage/hill).

Keywords: rice, rice case worm, rice ecosystems, seasonal incidence.

Introduction
Rice is life'! This has become a worldwide mantra since the International Year of Rice in 2004 (Uphoff, 2011). Rice is the most important staple food grain in the global food grain production. India has the largest acreage under rice, about 44.6 m ha of land with a production of about 90 MT (Roy *et al.,* 2013). Even though, there are many constraints in rice production, insects' pests remain a constant problem in all the rice growing regions. In rice pests management strategies mainly aim at prevention of outbreak or epidemics through the use of host plant resistance and chemical pesticides. The persistent, injudicious use of chemicals has toxic effects on non-target organisms and can cause undesirable changes in the environment. Most of these chemicals are too expensive for the resource poor farmers whose main cultivable crop is rice (Mina *et al.,* 2013; Gade, 2013; Ramteke *et al.,* 2011 and Balai *et al.,* 2013). In Chhattisgarh there are 5 agro-ecosystems in which rice is cultivated with different practices. These ecosystems are: upland ecosystem, midland ecosystem, lowland ecosystem, submergence prone and irrigated ecosystem. Chhattisgarh state is known as the rice (*Oryza sativa* L.) bowl of India because nearly 74-76 per cent area during rainy season is under rice cultivation. Chhattisgarh has a tremendous agricultural potential with a diversity of soil and climate, mountains, plateau, rivers, natural vegetation and forest. It is unique in sense in many ways. In Chhattisgarh, rice, *Oryza sativa* Linnaeus occupies average of 3.6 million ha with the productivity of the state ranging between 1.2 to 1.6 t/ha depending upon the rainfall. Technological innovations are also required for production of high quality seed for hybrids, development of appropriate varieties and agronomic practices for specific ecosystems, new management practices for control of diseases, insects and pests including weeds (Anonymous, 2009). Rice caseworm, *Nymphula depunctalis* Guenee (Lepidoptera: Pyralidae) is a serious pest of paddy that attacks young rice plants theirs moths are nocturnal in habit and are attracted to light. They are delicate, white with luscous markings and black specks on wings. Usually eggs are laid during night. Larvae are transparent green in color with light brownish orange heads. The damaging stage is the larvae that live in sections of leaves cut from young rice plants and rolled into tubes called cases. The leaf cases floats to carry the larvae from one plant to another during the day and at night the larvae climb plants to cut off leaves to make new cases, or feed on severed leaves on the water surface. Rice at seedling and tillering stages are

the preferred host but does not occur after maximum tillering (Singh and Singh 2010). The caseworm is widely distributed in rice growing counties of Asia, Australia, America and Africa (Dale, 1994). The present study was undertaken to find out the active period may be ascertained for controlling them in the field condition to avoid the loss to the rice crop caused by them.

Materials and Methods

Mean population of rice case worm by Net Sampling

The populations of Rice caseworm, *N. depunctalis* Guenee, were recorded through sweeping net in different rice ecosystems. A specification of sweep net is 30 cm diameter and 65cm depth. Sampling was done randomly four places by 25 sweep of rice field in morning at weekly interval. The observations on occurrence of plant and leaf hopper were recorded by taking total 4 samples from 4 locations in MSR. All samples were collected near the center of the ecosystem at least 5 meter from the edge in order to reduce edge effects modified according to Singh and Singh (2010) and Claver and Jaiswal, (2012) Garg, (2012), Zhang *et al,* (2013).

Per cent leaf damage

The damaged leaves and total number of leaves from 10 randomly selected hills at three spots were observed in each ecosystem. The percentage of leaf damage was calculated as follows.

$$\text{Per cent incidence} = \frac{\text{Number of damaged leaves}}{\text{Total number of leaves}} \times 100$$

Result and Discussion

Mean population of caseworm, *N. depunctalis* Guenee

From the data presented in (Table 1) on mean population of caseworm in different rice ecosystems at Raipur during *kharif* season 2013-14 revealed that in upland direct seeded rice ecosystem caseworm population was negligible during kharif season while, first appearance of caseworm, *N. depunctalis* larvae/adult was observed from 32 SMW in month of August with 0.25 larvae/adult/25 sweeps and disappears after 37 SMW in month of September in upland transplanted rice ecosystem (UTP). The larvae/adult population of *N. depunctalis* was highest in 35 SMW of August with 0.50 larvae/adult/25 sweeps. The average population varied from 0.00 to 0.50 larvae/adult/25 sweeps during the rice cropping season. During course of study the caseworm, *N. depunctalis* larvae/adult was noticed during 31 SMW of July with 0.25 larvae/adult/25 sweeps and disappears after 37 SMW in month of September in midland normal transplanted rice ecosystem (MNT). The adult population of *N. depunctalis* was reached peak in 35 SMW of August with a population of 1.25 larvae/adult/25 sweeps. The average population varied from 0.00 to 1.25 larvae/adult/25 sweeps during the rice cropping season whereas in midland SRI rice ecosystem (MSR) the larvae/adult caseworm population was initiated from 32 SMW in month of August with 0.50 larvae/adult/25 sweeps and disappear after 38 SMW in month of September in midland SRI rice ecosystem (MSR). The maximum population of caseworm found in 35 SMW of August with 1.00 larvae/adult/25 sweeps. The average population varied from 0.00 to 1.00 larvae/adult/25 sweeps during the rice *kharif* season 2013-14.

Periodical observations of caseworm revealed that the larvae/adult population was initiated in the lowland conventional rice ecosystem (LLC) during last week (31 SMW) of July with 0.50 larvae/adult/25 sweep and disappear after 39 SMW in month of October. The peak population of caseworm was recorded in 1st week (36 SMW) of September with 2.00 larvae/adult/25 sweeps. The average population varied from 0.00 to 2.00 adult/25 sweeps during the rice *kharif* season despite the fact that, in the lowland organic rice ecosystem (LLO) pest appear during last week (31 SMW) of July with 0.75 larvae/adult/25 sweeps and disappear after 37 SMW in month of September. There was an increase in population in subsequent weeks and the peak caseworm population was observed in last week (35 SMW) of August with a population of 3.00 adult/25 sweeps. The average population varied from 0.00 to 1.25 adult/25 sweeps during the rice cropping season.

It may be stated that on the basis of seasonal mean the status of caseworm, *Nymphula depunctalis* in different rice ecosystems of Raipur during 2013-14 revealed that the maximum population was found in August-September month. Among the ecosystem highest caseworm, *N. depunctalis* adult population was recorded in LLC (0.44 adults/25 sweeps), followed by LLO (0.31 adults/25 sweeps), MNT (0.25 adults/25 sweeps), MSR (0.15 adults/25 sweeps) and UTP (0.11 adults/25 sweeps) (Table 4.1.1.2).

These finding are in conformity with Wahed (1959) reported the incidence of insect in the rice field from July to September. Pulin and Khound (1998) reported that the caseworm incidence was greatest during the vegetative stage of the crop, infestation started two weeks after transplanting and peak infestations in terms of cut leaves and larvae were recorded 4-5 weeks after transplanting. Devid *at al.,* (2005) reported that the caseworm SRI had low pest incidence than normal transplanting (NTP). Karthikeyan *et al*., (2010) reported that the caseworm lower in SRI method than standard system of cultivation in rice ecosystem. Zhimomi and Ao (2011) reported that the major insect pests of rice highest in lowland as compared to upland paddy ecosystem.

Per cent leaf damage of caseworm, *N. depunctalis* Guenee

Perusal of data presented (Table 2) on the incidence of caseworm, *N. depunctalis* revealed that the per cent leaf infestation was noticed from 31 to 32 SMW of July to August with 0.08 to 0.20 and disappears after 37 to 38 SMW of September in among the rice ecosystem. There was an increase in population in subsequent weeks and the maximum percent of leaf infestation was recorded during 34 to 37 SMW of August-September with (0.00%), (0.19%), (0.46%), (0.31%), (0.69%), and (0.46%) leaf infestation/hill in upland direct seeded rice ecosystem (UDS), upland transplanted rice ecosystem (UTP), midland normal transplanted rice ecosystem, midland SRI rice ecosystem (MSR), lowland organic rice ecosystem (LLO), lowland conventional rice ecosystem (LLO), respectively. It is crystal clear from the (Table 2) that the maximum percent of leaf damage/hill was recorded in LLC (0.20 % leaf damage/hill), followed by LLO with (0.13 % leaf damage/hill), MNT (0.10 % leaf damage/hill), MSR (0.0.07 % leaf damage /hill), UPT (0.0.05 % leaf damage/hill) and UDS (0.00% leaf damage/hill).

These finding are in conformity with Hazarika, (1952) and Janjua (1957) who reported that the rice caseworm normally occur during September to October in Bangladesh. Wahed (1959) reported the incidence of insect in the rice field from July to September. Pulin and Khound (1998) reported that the caseworm incidence was much more during the vegetative stage of the crop and peak infestations in terms of cut leaves and larvae were recorded 4-5 weeks after transplanting. Kumar and Patil (2004) reported that the caseworm as minor

pests. Devid *at al.*, (2005), Ngo (2007) and Karthikeyan *et al*., (2010) reported that the caseworm lower in SRI than normal transplanting method of cultivation. Zhimomi and Ao (2011) reported that the major insect pests of rice highest in lowland as compared to upland paddy ecosystem.

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Table: 1: Mean population of caseworm in different rice ecosystems at Raipur during *kharif* season 2013-14

Month	SMW	Mean population of caseworm						Weather parameters							
		UDS	UTP	MNT	MSR	LLC	LLO	Temperature (^{0}C)			Rainfall (mm)	Relative humidity (%)			Sun shine (hours)
								Maxi.	Mini.	Avg.		Morn.	Even.	Avg.	
July	31	0.00	0.00	0.25	0.00	0.50	0.75	28.30	23.90	26.10	255.80	95.10	83.90	89.50	1.30
August	32	0.00	0.25	0.00	0.25	0.50	0.25	31.10	24.70	27.90	87.40	93.10	76.00	84.55	3.30
	33	0.00	0.00	0.50	0.25	0.75	0.75	31.30	24.40	27.85	177.00	94.70	79.60	87.15	3.30
	34	0.00	0.25	0.75	0.25	1.00	1.00	27.80	23.80	25.80	60.50	92.00	83.60	87.80	1.50
	35	0.00	0.50	1.25	1.00	1.25	1.25	29.30	24.50	26.90	120.80	94.90	78.10	86.50	3.10
September	36	0.00	0.25	0.75	0.25	2.00	0.75	31.10	24.80	27.95	54.80	92.60	75.70	84.15	4.20
	37	0.00	0.25	0.25	0.00	0.50	0.25	31.90	25.20	28.55	11.60	91.70	73.30	82.50	6.20
	38	0.00	0.00	0.00	0.25	0.25	0.00	29.90	24.10	27.00	92.60	93.40	76.90	85.15	2.50
	39	0.00	0.00	0.00	0.00	0.25	0.00	32.00	24.90	28.45	28.60	93.00	68.00	80.50	6.30
October	40	0.00	0.00	0.00	0.00	0.00	0.00	30.10	24.20	27.15	45.20	95.00	75.30	85.15	4.20
	41	0.00	0.00	0.00	0.00	0.00	0.00	30.20	23.30	26.75	8.60	83.70	71.10	77.40	3.50
	42	0.00	0.00	0.00	0.00	0.00	0.00	30.70	21.40	26.05	0.00	91.40	56.30	73.85	8.60
	43	0.00	0.00	0.00	0.00	0.00	0.00	28.80	22.60	25.70	32.60	95.90	73.10	84.50	2.10
	44	0.00	0.00	0.00	0.00	0.00	0.00	30.50	17.30	23.90	0.00	92.30	38.40	65.35	8.90
November	45	-	-	0.00	0.00	0.00	0.00	30.00	16.70	23.35	0.00	90.90	37.30	64.10	8.20
	46	-	-	-	-	0.00	0.00	27.50	13.20	20.35	0.00	90.60	36.00	63.30	7.60
	**S.M.	0.00	0.11	0.25	0.15	0.44	0.31								

*SMW = Standard meteorological week, **S.M. = Seasonal mean, UDS = Upland Direct seeded (Aerobic) rice ecosystem, UTP = Upland transplanted rice ecosystem, MNT = Midland normal transplanted rice ecosystem, MSR = Midland SRI (System of rice intensification) rice ecosystem, LLC = Lowland conventional rice ecosystem, LLO = Lowland organic rice ecosystem, - = Crop harvested.

Table 2: Per cent leaf damage /hill of rice caseworm in different rice ecosystem at Raipur during *kharif* season 2013-14

Month	SMW	UDS	Caseworm (per cent leaf damage /hill)					Weather parameters							
			UTP	MNT	MSR	LLC	LLO	Temperature (^{0}C)			Rainfall (mm)	Relative humidity (%)			Sun shine (hours)
								Maxi.	Mini.	Avg.		Morn.	Even.	Avg.	
July	31	0.00	0.00	0.11	0.00	0.20	0.17	28.30	23.90	26.10	255.80	95.10	83.90	89.50	1.30
August	32	0.00	0.08	0.14	0.09	0.35	0.21	31.10	24.70	27.90	87.40	93.10	76.00	84.55	3.30
	33	0.00	0.09	0.16	0.12	0.38	0.27	31.30	24.40	27.85	177.00	94.70	79.60	87.15	3.30
	34	0.00	0.18	0.24	0.14	0.47	0.39	27.80	23.80	25.80	60.50	92.00	83.60	87.80	1.50
	35	0.00	0.19	0.46	0.26	0.41	0.45	29.30	24.50	26.90	120.80	94.90	78.10	86.50	3.10
September	36	0.00	0.14	0.26	0.31	0.48	0.46	31.10	24.80	27.95	54.80	92.60	75.70	84.15	4.20
	37	0.00	0.04	0.13	0.06	0.69	0.12	31.90	25.20	28.55	11.60	91.70	73.30	82.50	6.20
	38	0.00	0.00	0.00	0.00	0.17	0.00	29.90	24.10	27.00	92.60	93.40	76.90	85.15	2.50
	39	0.00	0.00	0.00	0.00	0.00	0.00	32.00	24.90	28.45	28.60	93.00	68.00	80.50	6.30
October	40	0.00	0.00	0.00	0.00	0.00	0.00	30.10	24.20	27.15	45.20	95.00	75.30	85.15	4.20
	41	0.00	0.00	0.00	0.00	0.00	0.00	30.20	23.30	26.75	8.60	83.70	71.10	77.40	3.50
	42	0.00	0.00	0.00	0.00	0.00	0.00	30.70	21.40	26.05	0.00	91.40	56.30	73.85	8.60
	43	0.00	0.00	0.00	0.00	0.00	0.00	28.80	22.60	25.70	32.60	95.90	73.10	84.50	2.10
	44	0.00	0.00	0.00	0.00	0.00	0.00	30.50	17.30	23.90	0.00	92.30	38.40	65.35	8.90
November	45	-	-	0.00	0.00	0.00	0.00	30.00	16.70	23.35	0.00	90.90	37.30	64.10	8.20
	46	-	-	-	-	0.00	0.00	27.50	13.20	20.35	0.00	90.60	36.00	63.30	7.60
	**S.M.	0.00	0.05	0.10	0.07	0.20	0.13								

*SMW = Standard meteorological week, **S.M. = Seasonal mean, UDS = Upland Direct seeded (Aerobic) rice ecosystem, UTP = Upland transplanted rice ecosystem, MNT = Midland normal transplanted rice ecosystem, MSR = Midland SRI (System of rice intensification) rice ecosystem, LLC = Lowland conventional rice ecosystem, LLO = Lowland organic rice ecosystem, - = Crop harvested.

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