POPULATION TREND OF RICE LEAF FOLDER, *Cnaphalocrocis medinalis* G. (LEPIDOPTERA: CRAMBIDAE)

Khwaja Junaid[1] and Shah Alam Khan[1]

Corresponding author: kjppr@aup.edu.pk

1. Department of Plant Protection, The University of Agriculture, Peshawar, Peshawar-25120, Pakistan

ABSTRACT

The population trend of *C. medinalis* larval and adult/moth were observed on the commercial rice cultivar 'Kashmir Basmati-100'. The Larvae infestation was recorded as average number of larvae per 10 hills at weekly interval from its initial appearance at vegetative stage till the maturity of the crop in paddy field. During the month of August noticeable larval infestation was observed on plants. The number of larvae increases gradually and reached to its peak during the third and fourth week of September (last two weeks of September). After that the larval population started to decrease and disappeared in the beginning of November. The moth's appearance was observed during the last week of July onward. The population of moths increases and reached to its peak during September (17-23). After that the moth's population gradually started decreasing till and disappeared in the beginning of November.

Keywords: Rice Leaf Folder, Population trend, paddy field.

INTRODUCTION

Rice leaf folders are found in humid tropical and temperate regions in Asia, Africa, Australia and Oceania, located between 0° East to 172° West and 48° North and 24° South on the globe. Among the leaf folder complex, only three species, *Cnaphalocrocis medinalis*, *Marasmia exigua* and *Marasmia patnalis* have attain the status of pest in rice crop. Among these, *Cnaphalocrocis medinalis* is the major leaf folder pest in the rice fields of Asia (Murthy et al., 2015). The Rice Leaf Folder has four developmetal stages eggs, Larvae, pupa and adult (Moth).

There are eight insects' species within family Pyralidae which fold or roll the leaves of plants belonging to family graminaceae and they are called the leaf folder complex. They are *Cnaphalocrocis medinalis* (Guenée), *Marasmia venilialis* (Guenée). *Marasmia trapezalis* (Guenée), *Marasmia suspicalis* (Walker), *Marasmia ruralis* (Walker), *Marasmia patnalis*

(Bradley), *Marasmia bilinealis* (Hampson) and *Marasmia (Susumia) exigua* (Butler) (Rani et al., 2007).

Temperature and humidity plays a vital role in the Rice Leaf Folder abundance in an area where in warm tropical areas they are usually most abundant in the rainy seasons however, its population can be observed year around in these areas. The insect Rice Leaf Folder is active from May to October in areas with cool winters, and complete four to five generations. The leaf folders distribution is seasonal and long distance dispersal is not-known in other leaf folders except *Cnaphalocrocis medinalis*, which may not overwinter in temperate regions. As the moth is a long distance migrant, every year the initial population moves to these temperate regions from tropical areas. The pest goes through reproductive diapause at the start of sessional migratory periods and migrates towards north in spring and south in fall. In irrigated multi cropped rice areas of Philippines, *Cnaphalocrocis medinalis* remains active throughout the year and moves long distances to colonize the rain fed rice fields in the rainy season (Ahmed, et al., 2010).

The second instar larva is the most destructive as it starts leaf folding and feeding on soft mesophyll tissues in this stage which can cause the loss of 20%-30% (Shepard et al., 1995). The loss is resulted by feeding of larvae inside the folded leaves, leaving behind the dry leaves affecting the rate of photosynthesis (Javvaji et al, 2021). A single larval can cause damage to more than one leaves during its development by moving from leaf to leaf while folding and feeding on them. The leaf folder infestation also makes the plant susceptible to bacterial and fungal infections. Heavy infestation can completely destroy the rice crop (Javvaji et al., 2021).

Rice Leaf Folder has become an important pest in areas where modern varieties are extensively grown in both lowland and upland rice fields. This problem has become more severe with the application of high level nitrogen based fertilizers, increase in rice cultivated areas due to modern irrigation systems and multiple rice cropping systems. The introduction of high yielding varieties reduced the genetic variability and excessive use of insecticides which results in the pest resurgence makes the pest problem more complex (Laskar et al., 2008

MATERIALS AND METHODS

Field preparation

The experiment was conducted at New Developmental farm, Malakander, Peshawar during 2018 and 2019. To record the population trend of *C. medinalis*, at larvae and moth stages. The larval stage is the only destructive stage of this pest while moth is free living reproductive stage of the insect. For this purpose the selected rice commercial cultivar 'Kashmir Basmati-100' was grown in a field measuring 30m x 75m. All the agronomic practices were kept constant. The seeds were sown in seed beds on 2nd May 2018-19 and transplanted to the main field on 10th July 2018-19.

Larval Population trend of RLF (*Cnaphalocrocis medinalis)*

For study the population trend a sample unit of Muhammad et al., (2003) was followed where larvae infestation was recorded at weekly interval from initial appearance/early vegetative stage till the maturity of the crop in paddy field (second week of July to second week of November). The sampling unit was used as the number of insect larvae on 10 randomly selected plants at three different selected points in the field and calculated average number of larvae per 10 hills at each fixed point with three replications. A randomized zigzag pattern was used for plants selection in the field by following the procedure of Harbitz, (2019). The number of lavae per 10 hills were collected and counted on daily basis and converted in to average number of larvae per week basis for further analysis.

Adult (moths) Population trend of RLF (*Cnaphalocrocis medinalis*)

The adult (moth) population trend was determined by following the procedure of Bilal et al., (2019). In this study Light traps were used for attracting and killing moths. The light trap consist of light source (electric tourch) for attracting the moths at night and 5% kerosene oil dissolved in water for killing the moths, data were recorded on daily basis and light source were recharged. Moth's population recorded on daily basis were converted into average number of moths traped per week from early vegetative stage till the maturity of the crop (second week of July to second week of November) in the monoculture paddy field. To record the population of moths three light traps were installed 6 meter above the ground level, at equal distance with a single trap area of 750m^2/trap in total area of 2,250 m^2. All the traps were operated from 18:00 hours (06:00pm) to 06:00 hours (06:00am).

Statical analysis

Recorded data were analyzed (ANOVA) by using STATISTIX 8.1 software and the means were compared by least significant difference (LSD) at P≤5% (probability level) (Steel and Torrie et al., 1997).

Fig: 1. Field preparation

Fig: 2. Rice field

Fig: 3. Larval Infestation

Fig: 4. Light trap

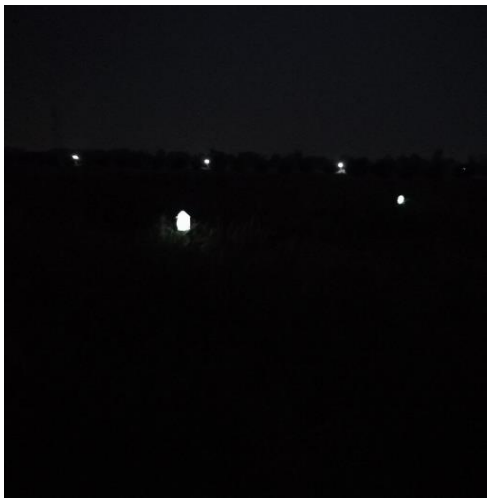

Fig: 5. Light traps/Adults monitoring

RESULTS

Population trend of Rice Leaf Folder (RLF) has been recorded at adult and larval stages on the selected cultivar 'Kashmir Basmati-100' under field condition during 2018-19 at New Developmental Farm, Malakander, The University of Agriculture Peshawar (Figure. 6 & 7).

The population trend of Rice Leaf Folder at larval stage was recorded during 2018 and 2019 (Table. No. 1). It was recorded that till 32 Standared Materiological Week (SMW) during 2018 and 31 Standared Materiological Week (SMW) in 2019, the rice field remained un-infested. However, noticeable larval infestation of RLF was observed in the form of rolled leaves during 33 SMW (0.17 larvae hill^{-1}) in 2018 and 32 SMW (0.03 larvae hill^{-1}) in 2019. The number of larvae continued to increase gradually till 38 SMW (4.07 larvae hill^{-1}) in 2018 and 39 SMW (4.17 larvae hill^{-1}) in 2019. The larval population of RLF reached to its peak during September 17-23 during 2018 and September 24-30 during 2019. Then after the peak infestations the larval population started to declined gradually till 44 SMW (0.03 larvae hill^{-1}) in 2018 and 43 SMW (0.03 larvae hill^{-1}) in 2019. In 2018 during 41 SMW an increase in larval infestation was recorded (3.00 larvae hill^{-1}) compared to the previous week (2.83 larvae hill^{-1}), beside that no unusual increase or decrease in the population trend was observed during both years.

The moth's population of RLF was recorded by using light traps from 28 SMW till the moths fully declined at 45 SMW during 2018 and 2019. The moth's appeared in the paddy field during 31 SMW (Jul-Aug 03-05) in 2018, and in 32 SMW (August 06-12) during 2019. After the appearance of RLF moths, its infestation gradually increase till 38 SMW where maximum adults were trapped during 2018 (42.66) and 2019 (45.66). From 39 SMW the moth's population gradually started decreasing till 45 SMW. Less number of adult's was trapped during 44 SMW (2019) and 45 SMW (2018). After that the moth's population decline/disappeared in the field.

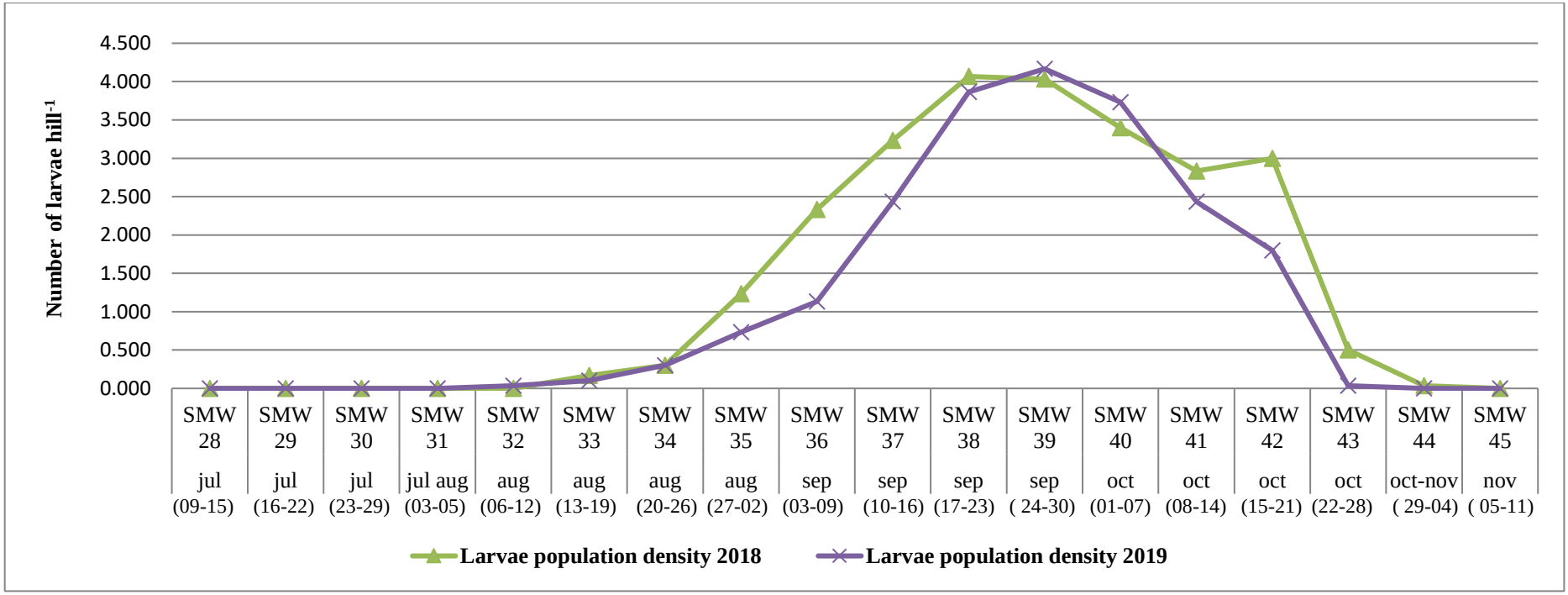

Figure: 6. Population trends of Rice Leaf Folder, *Cnaphalocrocis medinalis* G. (Lepidoptera: Crambidae) larvae in paddy crop during 2018 and 2019.

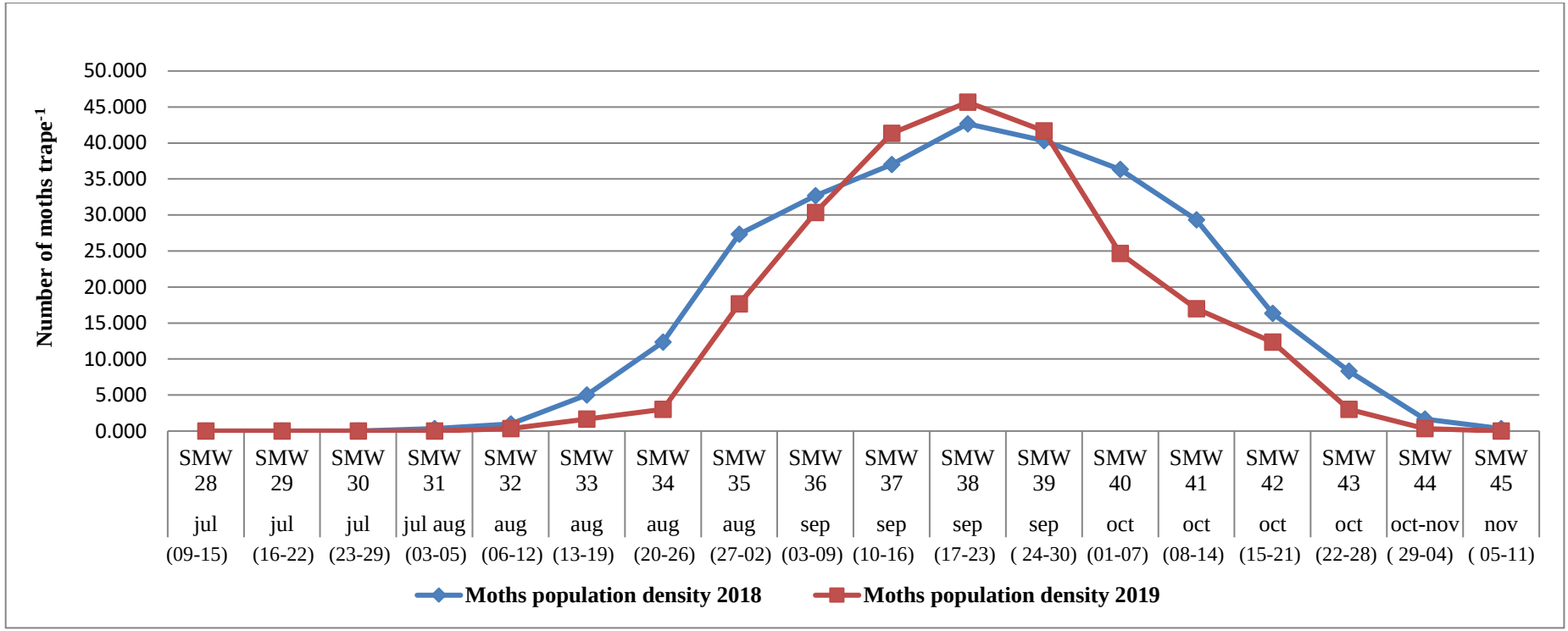

Figure: 7. Population trends of Rice Leaf Folder, *Cnaphalocrocis medinalis* G. (Lepidoptera: Crambidae) moths in paddy crop during 2018 and 2019.

DISCUSSION

The population trend of Rice Leaf Folder at larval stage have been studied by different researchers and indicated their initial infestation, peak population period and finally either the RLF declined or disappeared in the field. Based on their findings; Alvi et al., (2003); Garg, (1984); Khan et al., (1989); Rashid, (1994) and Kraker et al., (1999) recorded similar pattern of RLF larval population with peak infestation in the month of September. Our results are in line with these findings, but different from those of Anuj et al., (1999) who recorded highest larval infestation in the final week of October with the first three months of cropping season having low larval infestation which may be due to the local weather or varietal differences.

Furthermore the population trend of Rice Leaf Folder moths, our study are in line with the findings of Bilal et al., (2019); Ram et al., (2014); Chakraborty and Deb, (2011); Khan et al., (1996) and Kraker et al., (1999). Almost similar population trend was observed by them with maximum number of moths collected during 38 SMW (second last week of September). Contrary to our experiment Khan et al., (2004); Khan and Ramamurthy, (2004) and Patnaik, (2001) have collected maximum RLF moths from the light traps in the month of October. While Ahmad et al., (2010) has reported maximum moth's collection during 33 SMW (3rd week of August) furthermore, Kaul et al., (1999) reported the peak adult collection in the light traps from mid of August till end of September.

Thus, the difference in the peaks observed in the moth's and larval population by different researchers was at different time and space. Among other factors climate change, difference in transplantation dates and use of synthetic insecticides in the agro ecosystem have strong influence over the pattern of infestation of the Rice leaf folder

CONCLUSIONS AND RECOMENDATIONS

CONCLUSION

- The RFL larvae appeared in the paddy field during Aug 13-19 in 2018 and Aug 06-12 in 2019. The RLF larvae infestation increases gradually and reached to its peak period during Sep 17-23 in 2018 and Sep 24-30 in 2019. Onward the larvae infestation decreases and disppaered during Oct-Nov 29-04 in 2018 and Oct 22-28 in 2019.

- The RFL moths appeared in the paddy field during Jul-Aug 30-05 in 2018 and Aug 06-12 in 2019. Aftrerward the infestation gradually increases and reached to its peak during Sep 17-23 in both years and finally decline in the field during Nov 05-11.

RECOMENTATIONS

- After first week of August, close attention should be paid to Rice Leaf Folder appearance in the rice field and control measures should be initiated accordigly.

- Careful observations should be made during '38 SMW' and '39 SMW' (Last two weeks of September) as the pest reaches to its peak population during this time and control measures should be initiated on or before the ETL.

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