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SeasonalIncidenceofmajorinsectpestsofrice(*Oryzasativa*L.)anditscorrelationwithweatherparameters

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SeasonalIncidenceofmajorinsectpestsofrice(*Oryzasativa*L.)anditscorrelationwithweatherparameters

Abstract

Thepresentinvestigationwascarriedouttostudytheseasonalincidenceofmajorinsectpestsof rice (*Oryza sativa* L.) at Agricultural Research Station (ANGRAU, Guntur), Nellore. Forrecordingseasonalincidenceofyellowstemborer,leaffolderandwhorlmaggottheseedlings

of 27 days old were transplanted in the experimental plot (900 m^2) with spacing 20 cm betweenrows and 15 cm between plants. A susceptible rice variety Taichung Native 1 (TN1) and apopularly grown rice variety, NLR 34449 were used as test varieties for the experiment. Noplant protection measures were taken throughoutthe crop periodto get natural pest incidenceon the crop. Observations on stem borer, leaf folder, gall midge and whorl maggot infestationwas recorded on 50 randomly selected hills at weekly intervals starting from 15 days aftertransplantation.Deadheartincidence(Stemborer)wascommencedduringfirstweekofOctober i.e 40th standard week. Dead heart incidence was reached to its peak level (32.56 %)during 42nd standard week on TN1 and 23.3 % on NLR 34449. The leaf folder incidence wascommencedfrom42ndstandardweekbothonNLR34449andTN1(1.8and0.4%,respectively). Then the per cent leaf folder damage wasgradually increased and reached itspeak during 46th standard weeknNLR 34449(21.41 %)and during 45thstandard weekonTN1 (17.8 %). The gall midge incidence in terms of silver shoot was initiated during 41ststandard week both on NLR 34449 and TN1 (2.10 and 0.5 %, respectively). Then the per centsilver shoot incidence was gradually increased and reached its peak during 45th standard weekboth onNLR 34449(15.46 %)andTN1 (18.3%).The whorl maggotincidencewas firstnoticedduring40thstandardweekonbothNLR34449andTN1(1.12and0.98%,respectively). Then the per cent damage was gradually increased and reached its peak during44thstandardweek.

Introduction

Rice, *Oryza sativa* (L.) is one of the important cereal crops, being the staple food for more than65 per cent of the world population (Mathur et al., 1999).It is cultivated in almost all thetropical, sub-tropical and temperate countries of the world. India is the largest rice growingcountry,whileChinaisthelargestproduceroftherice.Oneofthemajorconstraintsofrice

production and low productivity in Indiaisthe occurrence ofinsect pestsat various stages ofthecropgrowth.Thericecropissubjecttoattackbymorethan100speciesofinsectsand20ofthemcanc auseeconomicdamage(PathakandKhan,1994).Worldwideupto37%ricecropisdamagedbymanyins ectspecies.Andaveragelossof25-30%inpaddyproductionduetothedamageofinsectpestswasrecordedinIndia(DhaliwalandArora,201 0).

The rice crop is subjected to damage by many number of insect pests, among them the yellowstem borer, *Scirpophaga incertulas* (Walker) is the major insect pest causing dead hearts andwhiteearsleadingtomajoreconomicdamage(Satpathietal.,2012).Theleaffolder,*Cnaphalocrocis medinalis* (Guenee), which was become major pest during recent years. Thelarvaefold the leaves and scrape the green tissues showing scorchinganddryingsymptoms.The yield loss caused by leaf folder reported to the extent of 5-25 % (Kulgagod et al., 2011).The rice gall midge attacks rice from nursery to the end of tillering stage. The larvae of the gallmidge fly cause heavy damage to the rice crop. Early infestation results in gall formation fromthetillerswhichconsequentlydo nothear panicles.

The rice whorl maggot *Hydrellia philippina* Ferino was first reported in India on rice crop andseven other graminaceous weeds growing in rice fields as host of *H. philippina* (Ferino, 1968).Whorl maggot damagesrice plnat s primaril during the vegetative phase, althrough minordamage can be seen in later growth stages. Its damge not only reduceds phhotosymthetic areaandalso causes necrosisof leaf margins whichis a unique damage symptom and reported upto a significant yield loss of 41 per cent from untreated plot (Ferino, 1968). In recent years dueto conductive environment whorl maggot is cusing severe damage in all rice growing areas ofAndhraPradesh.

Recently, emphasis is being given on ecological based pest management strategies. The maincomponentsofanypestmanagementprogrammeistostudytheincidenceperiodofthepest,

population distribution on crop and regular monitoring or survey of field.The seasonal effectsof weather and ongoing changes in climatic conditions will directly lead to modifications indispersal and development of insect species. The changes in surrounding temperature regimescertainlycausealterationsindevelopmentalrates,voltinismandsurvivalofinsectsandsubsequently act upon size, density and genetic compositionof populations (Kennedy andstorer,2000;Bale*etal*.,2002).Seasonalincidencestudieshelpsinplanningneedbasedapplication of insecticides as it clearly reveals the insect's peak activity as well as insect freeperiods during crop growth. In the current experiment an attempt was made to know the effectofabioticfactorsonthepestpopulationtrendonricecropduring Kharif,2022-23.

Materials and MethodsExperimentallayout

For recordingseasonal incidence ofyellowstemborer,leaffolder, gallmidgeandwhorlmaggotthestudywasconductedatAgriculturalResearchStation(ANGRAU),Nellore,Andhra Pradesh, India during kharif, 2022-23. The total experimental plot size measured 30x30m (900 m^2). The seedlings of 27 days old were transplanted in the experimental plot withspacing 20 cm between rows and 15 cm between plants. A susceptible rice variety TaichungNative 1 (TN1) and a popularly grown rice variety, NLR 34449 were used as test varieties forthe experiment. All other cultural practices were followed as per the recommendations exceptplant protection measures against insect pest and diseases. No plant protection measures weretakenthroughoutthecropperiodtogetnaturalpestincidenceonthecrop. Thedailyobservationsofmeteorologicalvariablesviz.,temperature(maximumandminimum),rainfall andrelativehumiditywerecollectedfromAgro-meterorologicalobservatory,DepartmentofagronomyatAgriculturalResearchStation,Nellore.The observationswerecompiledand averagedtoweekly.

Observationsandanalysis

Observationson stemborerinfestationwas recordedintermsof deadheartcountson 50random hills by counting the total number of tillers and number of dead hearts at weeklyintervals starting from 15 days after transplantation. The per cent dead heart incidence wascomputedasfollows.

$$\text{Percentstemborerincidence} = \frac{\text{Numberofdeadhearts/hill}}{\text{Totalnumberoftillers/hill}} \times 100$$

Observation on the leaf folder incidence in terms of number of damaged leaves by leaf folderwas recorded on 50 randomly selected hills by counting the total number of leaves and numberof leaf folder damaged leavesat weekly intervalsstarting from 15 days after transplantation.The percentleaf folderincidencewascalculatedasfollows.

$$\text{Percentleaffolderdamage} = \frac{\text{Numberofdamagedleaves}}{\text{Totalnumberofleaves}} \times 100$$

Observations on the incidence of gall midge in terms of silver shoots were recorded at on 50randomlyselected hills by counting the totalnumber of tillers and number of gall midgeeffected tillers atweekly intervals starting from 15 days after transplantation. The per cent gallmidge incidence was calculated asfollows.

$$\text{Percentgallmidgeincidence} = \frac{\text{Numberofsilvershoots}}{\text{Totalnumberoftillers}} \times 100$$

Observation on the whorl maggot incidence in terms of number of damaged leaves by whorlmaggot was recorded on 50 randomly selected hills by counting the total number of leaves andnumber ofwhorlmaggotdamagedleavesatweeklyintervalsstartingfrom15daysaftertransplantation.Theperc entwhorlmaggotincidencewascalculatedasfollows.

$$\text{Percentwhorlmaggotdamage} = \frac{\text{Numberofdamagedleaves}}{\text{Totalnumberofleaves}} \times 100$$

ResultsanddiscussionStem
borer

Inthepresentstudystemborerincidencewasinitiatedonricecropduring39th standardweek i.e last week of September on TN1(0.82 %) and on NLR 34449 dead heart incidence wascommenced during first week of October i.e 40th standard week. Dead heart incidence wasreached to its peak level (32.56 %) during 42nd standard week (15th– 21st October) on TN1and23.3%onNLR34449.Deadheartincidencewasstartsdeclinefrom43rdstandardweekto 46th standard week on NLR 34449 and TN1 from 14.59 to 1.75 and from 15.7 to 5.1 % deadhearts,respectively.

Present study also matches to the findings of Kumar and Sudhakar, 2001 reported that peakincidence of YSBat 2nd fortnightof Octoberduring kharifseason. Rai*et al*., 2002 alsorevealedthatpeakoccurrenceofYSBduringfirstfortnightofOctober,whichmaybeduetothedifferenceinclimaticconditions.Ontheotherhandpresentobservationwascontradictedby Justin and preetha, 2013, who reported *S. Incertulas* incidence in two spells during August-September and December-February at Thirupathsaram (Kanyakumari) whereas Gole (2012)stated that the incidence of YSB initiated from second week of August (32nd SMW) andcontinuedup totheharvestof thecrop.

Correlation co-efficient analysis between weather parameters and field incidence of dead heartsrevealed, significant positive correlation was recorded with correlation co-efficient r= 0.6863($p \leq 0.01$)betweendeadheartincidenceandmaximumtemperatureandminimumtemperature (r=0.8145). Whereas morning and evening relative humidity had a non-significantnegativecorrelation (r= 0.3327 and 0.3263), while rainfall had significant positive correlation with deadheart incidence. Similar observations were recorded by Israel and Rao (1961) and Singh, et al.(2013).AyyannaandHamidali(1970)alsoreported*S.incertulas*emergencestartedfromsecond week of September, with a peak activity during the first week of October betweentemperatures of 30.60 ℃ and 21.60 ℃. The damage was negatively correlated with minimumtemperature.

Leaffolder

The first observation of leaf folder damage was recorded during 42nd standard week both onNLR 34449 and TN1 (1.8 and 0.4 %, respectively). Then the per cent leaf folder damage wasgradually increased and reached its peak during 46thstandard week on NLR 34449 (21.41 %)and during 45th standard week on TN1 (17.8 %). Afterwards from 47th standard week on wardsleaf folder damage starts decline from 14.4 % to 2.54 % leaf folder damage on NLR 34449. OnTN 1 also leaf folder incidence starts decline from 46th standard week from 12.4 % to 1.85 %.Kumaretal.(1996)recordedtheinfestationofriceleaffolder,*C.medinalis*variedfrom1.4to 33.2 per cent in rice from July to October. Kumar et al. (2003) found that the peak activity leaffolder in the October during the kharif, season. Alvi et al. (2003) found that the activity of *C.medinalis* lasted from the second week of august to the second week of October during 2000,while it lasted from the last week of august to the second week of October during kharif, 2001.Theleaffolderinfestationonleaveswasnoticedthatpeakleafinfestationwasmaximum(61.9 %)atsecondweekofOctober(Chavietal.,2015).Kumaretal.(2013)andKhanandRamamurthy (2004) revealed in his study leaf folder population were higher in the month ofOctober,exhibitingpeakactivityinthefirstweek,followedbySeptember.

Correlation studies revealed that per cent leaf damage by leaf folder showed non-significantnegative correlation with maximum and minimum temperatures (r= 0.4795 and 0.3714) andnon-significant positive correlation was recorded with morning and evening relative humidity(0.1223and 0.0930).Rainfallshowed non-significant negativecorrelationwithleaffolderdamage (r= 0.2840). Khan et al., 2004 also reported that leaf folder infestation had negativecorrelationwithminimumtemperature,eveningrelativehumidityandrainfall(r=0.1665,0.00 67 &0.0888) and had positive correlation with maximum temperature (r=0.0442) andmorningrelativehumidity(r=0.2062).

Gallmidge

The gall midge incidence in terms of silver shoots was initiated during 41st standard week bothon NLR 34449 and TN1 (2.10 and 0.5 %, respectively). Then the per cent silver shoot incidencewas gradually increased and reached its peak during 45th standard week both on NLR 34449(15.46 %) and TN1(18.3%). Afterwards from46th standardweekonwards silver shootincidence starts decline from 10.25 % to 0.89 % on NLR 34449. On TN 1 also silver shootincidencestartsdeclinefrom46thstandardweekfrom5.9%to1.4%.

Correlationstudiesrevealedthatpercentsilvershootincidenceshowednon-significantnegative correlation with maximum and minimum temperatures (r= 3042 and 0.1934) and non-significantpositivecorrelationwasrecordedwithmorningandeveningrelativehumidity(0.0343 and 0.1320). Rainfall showed non-significant negative correlation with silver shootincidence(r=0.1690).

Whorlmaggot

Thewhorlmaggotincidenceonthericecropwasfirstnoticedduring40thstandardweek(1stto 7th October) on both NLR 34449 and TN1 (1.12 and 0.98 %, respectively). Then the per centdamagewasgraduallyincreasedandreacheditspeakduring44thstandardweek(29thOctoberto 4th November) on TN1 and on NLR 34449 reached to its peak during 43rd standard week(8.29 %), from 45th standard week the whorl maggot incidence was followed decreasing trend.Correlation co-efficient analysis between weather parameters and field incidence of whorlmaggot revealed, non-significant negative correlation was recorded with correlation co-efficient r= 0.3224 between Whorl maggot incidence and maximum temperature and minimumtemperature (r=0.4856). Whereas morning and evening relative humidity had a non-significantpositivecorrelation(r=0.2879and0.3896).Rainfallhadsignificantpositivecorrelation withwhorlmaggotincidence(r=0.0985).

Conclusion

Thepresentstudyconcludesthatduringkharifseasonthemajorinsectpestactivityviz.,stemborer,leaffolder,gallmidgeandwhorlmaggotonricecropwasinitiatedfrom40th standardweek (1st to 7th Oct) to 42nd standard week (15th to 21st Oct) i.e during first fortnight of October.And reached to their peak levels during 45th (5th to 11th Nov) to 46th (12th to 18th Nov) standardweeksi.eduringfirstfortnightofNovember.From47thstandardweekonwardspestactivityshowed a declining trend. With regard to correlation co-efficient analysis between weatherparameters and field incidence of major pest of rice, stem borer incidence (dead hearts) showedsignificant positive correlation with maximum temperature with correlation co-efficient r=0.6863($p \leq 0.01$)andminimumtemperature(r=0.8145).

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Table2:Correlationcoefficient(r)ofinsectpestincidenceonricewithprevailingweatherpara metersduringkharif,2022-23.

Factor	Correlation(r)					
	Maximumt emperature	Minimumt emperature	Relative humidity (Morng.)	Relativehumi dity(Even.)	Sunshi nehou rs	Rainfall(mm)
Deadheart	0.6863*	0.8145**	-0.3327	-0.3263	-0.1408	0.7298*
Leaffolder	-0.4795	-0.3714	0.1223	0.0930	0.4655	-0.2840
Gallmidge	-0.3042	-0.1934	0.0343	0.1320	0.4824	-0.1690
Whorlma ggot	-0.3224	-0.4856	0.2879	0.3896	-0.1582	0.09855

*Significantat5%level **significantat1%level

Table1:Influenceofabioticfactorsonseasonalincidenceofvariousinsectpestonriceduringkharif,2022-23.

SMW	Period	Stem borer (% Dead heart)		%Leaffolder		Gallmidge(%Silvershoots		% Whorl maggot		Temperature(°C)		Relativehumidity(%)		Rainfall(mm)
		NLR 34449	TN1	NLR 34449	TN1	NLR 34449	TN1	NLR 34449	TN1	Max.	Min.	Morng.	Even.	
39	24th-30thSep	0.00	0.82	0.00	0.00	0.00	0.00	0.00	0.00	33.6	24.6	72.9	58.9	43.5
40	1st–7thOct	0.00	2.12	0.00	0.00	0.00	0.00	0.00	0.00	30.5	24.1	82.6	75.7	7.4
41	8th-14thOct	4.5	9.4	0.00	0.00	2.10	0.5	5.89	2.25	30.2	24.1	81.1	77.9	30.7
42	15th-21stOct	23.3	32.56	1.8	0.00	8.5	0.00	7.81	4.26	30.7	24.8	81.4	70.4	61.9
43	22nd-28thOct	14.59	15.7	8.4	4.4	8.5	0.00	8.29	10.21	31.2	23.1	61.1	52.3	58.9
44	29th4thNov	4.5	11.3	14.6	8.9	11.4	15.25	7.90	11.35	27.5	22.1	83.7	79.4	20.5
45	5th–11thNov	4.0	9.8	17.25	17.8	15.46	18.3	1.34	8.46	28.7	22.4	80.4	71.6	43.5
46	12th-18thNov	1.75	5.1	21.41	12.4	10.25	5.9	1.56	1.76	28.1	22.3	90.6	74.0	18.6
47	19th-25thNov	006	5.1	14.4	10.8	3.54	3.4	0.00	1.1	26.9	21.1	79.6	75.6	28.9
48	26th-2ndDec	0.00	0.9	12.1	1.3	4.23	1.4	0.00	0.00	28.0	21.0	86.9	76.0	37.4
49	3rd-9thDec	0.00	3.9	8.7	2.5	0.89	0.00	0.00	0.00	28.4	21.7	83.0	70.7	25.8
50	10th–16thDec	0.12	1.25	2.54	1.85	0.00	0.00	0.00	0.00	27.1	24.0	82.4	83.7	50.1
51	17th–23rd Dec	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.3	20.0	93.1	85.0	34.2