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SEASONAL INCIDENCE OF CASTOR CAPSULE BORER (*CONOGETHES PUNCTIFERALIS* GUÈNEE)

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ABSTRACT

Study on seasonal incidence of castor capsule borer, *Conogethes punctiferalis* Guènee was carried out during *kharif-rabi*, 2023-24 at Agricultural Research Station, Anand Agricultural University, Sansoli. The study revealed that *C. punctiferalis* incidence on castor begins at the reproductive stage, starting in the first week of November (45th SMW) with 3.82 per cent capsule damage. The infestation reached its peak (18.76% capsule damage) in the third week of December (51st SMW). Relatively higher capsule damage (10.53% to 18.76%) observed from first week of December (50th SMW) to first week of January (1st SMW). Afterwards, pest incidence declined from the second week of January (2nd SMW) until termination of the crop. Correlation analysis revealed that maximum temperature (r = - 0.542*) and bright sunshine (r = -0.615*) were significantly negatively correlated with capsule borer damage indicating higher temperature and more sunshine reduces pest incidence. Minimum temperature (r = -0.190) had a non-significant negative correlation with pest incidence. Whereas, morning (r = 0.167) and evening relative humidity (r = 0.325), rainfall (r = 0.122), wind speed (r = 0.398) and evening vapor pressure (r = 0.138) showed positive but non-significant correlation with capsule damage. Morning vapor pressure (r = -0.243) and evaporation (r = -0.444) shown negative but non-significant correlation with pest incidence.

Key words: Castor, capsule borer, *Conogethes punctiferalis*, seasonal incidence, weather parameters, correlation

Introduction

Castor (*Ricinus communis* Linnaeus), belongs to the Euphorbiaceae family, is an important non-edible oilseed crop grown predominantly in arid and semi-arid regions. It is primarily a rainfed crop. Castor seeds are notable for their high oil content, with up to 42 per cent extractable oil which finds diverse applications in industrial, agricultural, domestic and medical fields (Agyenim-Boateng *et al.*, 2018). India holds the top position in global castor seed production, accounting for 70 per cent of the world's castor seed producing area and 87 per cent of its production (Anonymous, 2022). Brazil and China are the leading producers of castor after India (Agyenim Boateng *et al.*, 2018). In India, castor crop was grown on 1.05 million hectares, yielded approximately 1.84 million tonnes during 2019-20 with a productivity of 1.76 tonnes per hectare. Castor cultivation significantly contributes to the Indian economy, generating Rs. 6802 crores in foreign exchange through the export of around 0.73 million tonnes of castor oil in 2020-21 (Anonymous, 2022). In castor, number of insect pests are responsible for 17.20 to 63.30 per cent seed production losses (Lakshminarayana and Duraimurugan 2014). The castor capsule borer, *Conogethes* (=*Dichocrocis*) *punctiferalis* Guènee, is considered the most significant pest of castor due to its direct negative impact on seed yield and quality. This insect feeds on the castor capsules, destroying the internal seeds. In severe infestations, it can decimate the entire castor inflorescence, including the developing seeds. The pest attacks the castor crop from the flowering stage and persists until maturity (Patel *et al.*, 1970). The larvae are polyphagous and have been reported to attack over 120 wild and cultivated plants, including castor, guava, cotton, cocoa, mango, pomegranate, jackfruit, avocado, mulberry, loquat, peach, plum, pear, sorghum, sunflower, turmeric, ginger, tamarind, amaranths, soapnut, hollyhocks, custard apple, and other Zingiberaceous plants (Sekiguchi, 1974; Thyagaraj *et al*., 2003). Infestation of *C. punctiferalis* begins at the flowering stage, and recent years have seen yield losses of up to 50 per cent due to this pest (Anonymous, 2006; Rao *et al*., 2012). Insects are poikilothermic species, the environment has a significant impact on the growth, development, life cycle, population dynamics and other characteristics of their life histories. To effectively control these insect pests, an integrated approach is necessary. Integrated Pest Management (IPM) relies on understanding pest ecology and knowing when pests are likely to appear at different stages of the crop. This information, along with weather data, is crucial for managing these pests. By identifying the right weather conditions that trigger pest outbreaks, farmers can be warned in advance and take preventive measures. Collecting long-term data on pest population and weather conditions helps in developing forecasting models for better pest control. Considering above points in view, study on "seasonal incidence of castor capsule borer, *C. punctiferalis*" was conducted at Agricultural Research Station, Anand Agricultural University, Sansoli during *kharif-rabi*, 2023-24.

Materials and Methods

The study on seasonal incidence of capsule borer, *C. punctiferalis* infesting castor was carried out at Agricultural Research Station, Anand Agricultural University, Sansoli during

kharif-rabi, 2023-24. The seasonal incidence study was carried out on the variety GAC 11 (Gujarat Anand Castor 11), sown on 18th August 2023 at the spacing of 120 × 60 cm and experimental plot was kept free from any insecticidal application during the course of investigation. The experimental plot was divided into four

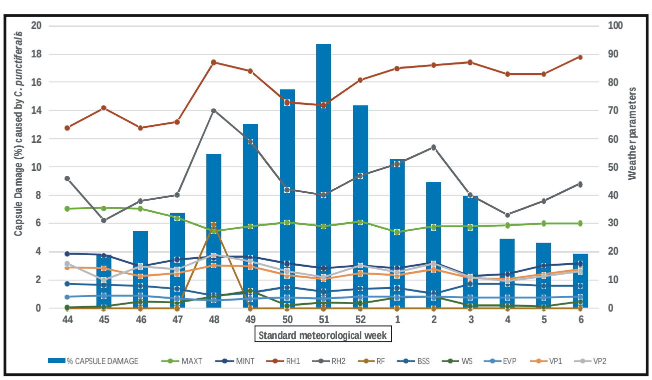

Fig. 1: Seasonal incidence of castor capsule borer, *C. punctiferalis* and its correlation with weather parameters.

Table 1: Seasonal incidence of castor capsule borer *C. punctiferalis* (*Kharif-Rabi*, 2023-24).

Month	Week	Standard Meteorological Week	Capsule damage (%) caused by *C. punctiferalis*
October	IV	44	0.00
November	I	45	3.82
	II	46	5.48
	III	47	6.73
	IV	48	10.93
December	I	49	13.08
	II	50	15.46
	III	51	18.76
	IV	52	14.40
January	I	1	10.53
	II	2	8.92
	III	3	7.92
	IV	4	4.91
	V	5	4.61
February	I	6	3.89

equal sectors (6 × 9 m). For recording observations, five plants were selected randomly from each sector. The number of healthy and infested capsules from three spikes per plant was recorded at weekly interval starting from the initiation of capsule formation till termination of the crop. Capsule damage was worked out as per below mentioned formula:

$$\text{Capsule Damage (\%)} = \frac{\text{Number of damaged capsules/spike}}{\text{Total number of capsules/spike}} \times 100$$

Correlation analysis

In order to study the instantaneous effect of weather parameters on incidence of *C. punctiferalis,* the data of physical factors of environment *viz.*, bright sunshine (BSS), rainfall (RF), wind speed (WS), maximum (MaxT) and minimum (MinT) temperature, morning (RH1) and evening (RH2) relative humidity, morning vapor pressure (MoVP), evening vapor pressure (EvVP) and evaporation (EP) prevailed during the period of study were obtained from the meteorological observatory, Main Rice Research Station, AAU, Nawagam and correlated with the damage caused by *C. punctiferalis* by calculating the values of correlation co-efficient (r) as described by Panse and Sukhatme (1985), Steel and Torrie (1980).

Results and Discussion

Seasonal incidence of castor capsule borer, *C. punctiferalis*

The data presented in Table 1 indicated that the capsule borer incidence started when the castor crop entered in its reproductive stage. The incidence of *C. punctiferalis* began in the first week of November (45th

Table 2: Weekly metrological data recorded at the observatory of Main Rice Research Station, AAU, Nawagam.

Standard Meteoro-logical Week	Maximum Temp. °C [MaxT]	Minimum Temp. °C [MinT]	Morning Relative Humidity (%) [RH1]	Evening Relative Humidity (%) [RH2]	Rain Fall (mm) [RF]	Bright Sunshine hr/day [BSS]	Wind Speed during 24 hrs Km/hr. [WS]	Evapo-transpo ration (mm) (EP)	Morning Vapour Pressure (mm to Hg) [VP1]	Evening Vapour Pressure (mm to Hg) [VP2]
44	35.1	19.2	64	46	0	8.6	0.3	4.0	14.6	15.7
45	35.4	18.8	71	31	0	8.2	0.5	4.5	14.2	10.0
46	35.1	14.7	64	38	0	8	2.2	4.4	11.5	14.8
47	32	17.3	66	40	0	6.8	2.1	3.5	12.4	13.9
48	27.1	18.1	87	70	29.5	4.5	4	2.7	15.0	18.8
49	29	18.1	84	59	0	5.4	6.2	3.5	14.7	16.7
50	30.4	15.7	73	42	0	7.4	0.9	3.8	11.8	13.2
51	29	14.1	72	40	0	5.9	2.1	3.4	10.4	11.1
52	30.6	15.3	81	47	0	7	1.7	4.0	12.4	15.0
1	27.0	14.1	85	51	0	7.2	3.60	3.9	11.7	12.7
2	28.8	16.1	86	57	0	5.2	4.0	3.9	13.8	15.8
3	28.8	11.5	87	40	0	8.5	0.8	3.7	10.7	11.1
4	29.2	12.2	83	33	0	8.7	0.8	3.8	10.2	9.7
5	30.0	15.0	83	38	0	8.0	0.5	3.7	11.9	11.5
6	30.1	15.7	89	44	0	8.0	2.5	4.1	13.7	13.2

Standard Meteorological Week - SMW) with initial capsule damage of 3.82 per cent. Pest incidence then increased and reached at peak (18.76%) in the third week of December (51st SMW). Relatively higher capsule damage (10.53 to 18.76%) was observed from the first week of December (50th SMW) to the first week of January (1st SMW). Capsule damage caused by *C. punctiferalis* ranged from 3.82 per cent to 18.76 per cent. From the second week of January (2nd SMW) until the crop termination, pest incidence was declined.

Deepak *et al.*, (2022) reported an initial infestation of the castor capsule borer, *C. punctiferalis* during the 42nd SMW, with initial capsule damage of 3.20%. The damage increased and reached its peak (12.20%) during the 50th SMW, after which the incidence began to decline. Umbarkar and Patel (2017) observed the incidence of *C. punctiferalis* from the 47th SMW to the third week of November, with a peak in the 51st SMW (third week of December). Patel *et al.*, (2015) noted capsule borer population from early November to mid- January in Anand (Gujarat) with significant pest activity starting in the third week of November with its peak (20.04%) capsule damage during 47th SMW. Basavaraj and Naik (2013) studied the population dynamics of the castor capsule borer from September to February. They found that the higher pest activity was recorded in December, while the lowest activity occurred in the first week of February. The results of present investigation are more or less closely aligned with previous studies.

Correlation between weather parameters and incidence of castor capsule borer, C. punctiferalis

The correlation analysis between the incidence of *C. punctiferalis* and various weather parameters (Table 3) indicated that maximum temperature (r = -0.542*) and bright sunshine (r = -0.615*) were found to have a significant negative correlation with castor capsule borer, indicating that higher temperature and more sunshine led to a decrease in pest incidence. Conversely, minimum temperature (r = -0.190) showed a negative but non-significant correlation. Humidity factors shown varied influences on pest activity. Morning relative humidity (r

Table 3: Correlation coefficient (r) between weather parameters and capsule damage caused by, *C. punctiferalis* on castor during *kharif-rabi*, 2023-24.

Weather parameters	Correlation co-efficient (r) Capsule damage
Maximum Temperature, °C (MaxT)	-0.542*
Minimum Temperature, °C (MinT)	-0.190
Morning Relative Humidity, % (RH1)	0.167
Evening Relative Humidity, %(RH2)	0.325
Rainfall, mm (RF)	0.122
Bright Sunshine Hours, hrday^{1} (BSS)	-0.615*
Wind Speed, kmhr^{-1} (WS)	0.398
Morning Vapour Pressure, mm of Hg (VP1)	-0.243
Evening Vapour Pressure, mm of Hg (VP2)	0.138
Evaporation, mm day^{-1} (EP)	-0.444

Note: * Significant at 0.05 % level, n = 15.

= 0.167) and evening relative humidity (r = 0.325) exhibited positive but non- significant correlation with capsule damage. Similarly, rainfall (r = 0.122) shown a positive but non-significant correlation, suggesting that increased humidity levels might slightly enhance pest activity. Wind speed (r = 0.398) and evening vapor pressure (r = 0.138) also shown positive but non-significant correlation with capsule damage. In contrast, morning vapor pressure (r = -0.243) and evaporation (r = -0.444) shown negative but non-significant correlation with the pest incidence.

Deepak *et al.*, (2022) found capsule damage caused by *C. punctiferalis* negatively correlated with both maximum temperature (r = -0.698) and minimum temperature (r = -0.828). Manjunatha *et al.*, (2018) observed negative relationship, indicating significant correlation of castor capsule borer with minimum temperature (r = -0.907*) and maximum temperature (r = -0.726*). Lakshmi Narayanamma and Reddy (2015), indicated a negative correlation between castor capsule borer incidence and minimum temperature (-0.396). The results of present investigation are more or less closely aligned with previous studies.

These findings emphasize the complexity of interactions between weather parameters and pest activity. The negative correlation with maximum temperature and bright sunshine suggests that these factors could be crucial in managing C. *punctiferalis* populations.

Conversely, the positive correlations with humidity parameters indicate that pest activity might increase under more humid conditions, necessitating targeted pest management strategies during such periods.

Conclusion

In nutshell, initial infestation was observed in the first week of November (45th SMW) and reached its peak in the third week of December (51st SMW). The highest damage was recorded from the first week of December (50th SMW) to the first week of January (1st SMW), after which pest incidence declined until the crop termination. Correlation analysis revealed significant negative association of capsule borer incidence with MaxT and BSS. Conversely, RH1 and RH2 showed positive but non-significant correlation with pest activity. This information can be used in developing region-specific crop simulation dynamic models. Such models can predict and forecast insect pest populations, enabling farmers to implement control measures in advance and thus protect their crops from potential losses.

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