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SEASONAL INCIDENCE OF PINK BOLLWORM *Pectinophora gossypiella* (Saunders) IN COTTON

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ABSTRACT

The field experiment was carried out during *Kharif* 2020-21 at Regional Agricultural Research Station, Lam, Guntur. The research revealed that the peak activity of moth was observed during the third week of December (51 SMW) with a trap catch of 441 moths/trap/week. The incidence of larvae in green bolls was noticed from first fortnight of November (46 SMW) and increased gradually during the first fortnight of December (51 SMW). The Green boll damage caused by pink bollworm ranged between 20 percent and 90 percent with a mean of 26.52 percent. The Green locule damage caused by pink bollworm ranged between 12.5 percent and 68.5 percent with a mean of 17.65 percent. The population of pink bollworm larvae per 10 Green bolls ranged between 2 to 14 with a mean of 3.13 Larvae per 10 green bolls. It first appeared during second week of November (46 SMW). The highest population of Larvae per 10 green bolls (14 Larvae per 10 green bolls) was observed at the time of third week of December (51 SMW). The Pink bollworm Larvae per 10 green bolls have showed significant negative correlation with minimum temperature (r= -0.661) and morning relative humidity (r= -0.524).

Key Words: Boll damage, Cotton, Pheromone trap catch, Pink bollworm

INTRODUCTION

Cotton is a fibre crop that produces natural fibre and is grown as an annual crop in both tropical and warm temperate regions (Rahman *et al.,* 2012). It has been commercially grown for domestic consumption and export purposes of 111 countries around the world (Srinivas *et al.*, 2018). It supplies seeds with a potential multi-product base such as hulls, oil, lint, and animal fodder, in addition to textile manufacture (Ozyigit *et al*., 2007).

Gossypium hirsutum, *G. herbaceum, G. arboreum*, *G. barbadense* are four spinnable fibre producing *Gossypium* species that are commercially grown. It provides up to 75 percent of the textile industry‘s entire raw material demands and employs around 60 million people (Sandhya rani *et al*., 2010). After China, India is

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the world's second-largest producer of cotton, accounting for 36 percent (118.72 lakh hectare) of total area and 25 percent (352 lakh bales) of seed cotton. Cotton productivity in India is 504 kg/ha, which is poor when compared to the global average of 786 kg $ha^{-1.}$

As per the USDA Foreign Agricultural Service in Mumbai cotton acreage of 12.35 million hectares and production of 28.35 million bales of 480 lbs of cotton for the marketing year 2018-19. Cotton is grown in India's nine major cotton growing states: Punjab, Haryana and Rajasthan in Northern zone, Gujarat, Maharashtra and Madhya Pradesh in Central zone and Andhra Pradesh, Karnataka, and Tamil Nadu in Southern zone. The different cotton growing districts in Andhra Pradesh are Guntur, Krishna, Chittoor, Nellore, Kadapa, Prakasam, Anantapur, Kurnool, with an area of 6.17 lakh ha and with production of 1.05 million bales and productivity of 1713 kg ha^{-1}. Cotton productivity in India was lower than the world average (786 kg $ha^{-1)}$ due to the variety of insect pests that attack cotton. Around 162 bug species infest crops at various phases of development, with 15 of them being major pests (Kannan *et al.,* 2004).

The bollworms (Dhruva and Gujar, 2011) namely Pink bollworm, *Pectinophora gossypiella (*Saunders), Cotton leaf worm, *Spodoptera litura* (Fabricius), Spiny bollworm, *Earias insulana* (Boiusduval), Spotted bollworm, *Earias vittella* (Fabricius) and American bollworm, *Helicoverpa armigera* (Hubner) normally referred as bollworm complex, pose greater threat to cotton production (Ghosh, 2001; Kranthi, 2015).

The use of synthetic insecticides to control insect pests in cotton has been used for many years and was hailed as a blessing during the green revolution. The sole dependence on synthetic insecticides, notably pyrethroids (Ramasubramanyam, 2004), created an imbalance in the agro-system, resulting in resistance and resurgence issues that necessitated the employment of other control methods. Insecticide application in cotton varies from 6-8 rounds in a rainfed scenario to 12-18 rounds in an irrigated situation on average (Kulkarni *et al.,* 2003). Bollworm control alone accounts for roughly 80% of the insecticide market, valued around 12 billion rupees, and about one-third of current pesticide sales (Gupta, 2001).

MATERIALS AND METHODS

The field experiments were conducted at Regional Agricultural Research Station, Acharya N.G. Ranga Agricultural University, Lam, Guntur (Andhra Pradesh), during *kharif 2020*-21.

Experimental details

The experiment was designed as observational trial with cotton hydrid DCH-32 was sown in *kharif* 2020 with a planting distance of 105 cm × 60 cm in a plot size of 378 m^2 with 40 plants per row and 600 plants per plot. The fertilizer dose of N:P:K 48 kg, 24 kg and 24 kg was given respectively during the cropping season.

Pheromone trap catch

At Regional Agricultural Research Station, Lam, Guntur, two pheromone baited sleeve traps were constructed at 1-2 m height in bulk plots depending on the crop stage to monitor the pink bollworm adult emergence from the first week of September 2020 to the end of March 2021. Pheromone lures were procured from Pheremone Chemicals Private Ltd., Hyd and

lures were changed every 15 days. Catches of adult moths were recoreded on a daily basis.

Field incidence

Cotton fruiting bodies were sampled at weekly intervals to investigate the association between pheromone trap catches and field incidence of pink bollworm. Ten green bolls were randomly selected from the experimental plot for this purpose. By destructive sampling of green bolls, boll damage % and larvae of PBW were recorded.

Percent Green Boll Damage

The number of healthy and damaged bolls by pink bollworm were counted on randomly selected five plants and the following formula was used to calculate the % green boll damage

$$\text{Green boll damage(\%)} = \frac{\text{No. of green bolls damaged}}{\text{Total no. of green bolls}} \times 100$$

Number of larvae / 10 green bolls

10 green bolls were chosen at random from the plot and dissected them and counted the number of larvae per 10 bolls

$$\text{Larval population (\%)} = \frac{\text{No. of larvae in green bolls}}{\text{Total no. of green bolls}} \times 100$$

Open boll damage

At the time of each picking, number of healthy and damaged bolls were recorded from five randomly selected plants from the plot. Percent open boll damage was worked out by the formula

$$\text{open boll damage (\%)} = \frac{\text{Total no. of good open bolls /plant}}{\text{Total no. of open bolls/plant}} \times 100$$

Open locule damage

At the time of each picking, number of healthy and damaged locules were counted from five randomly selected plants from the plot. Percent locule damage was worked out by the following formula

$$\text{Open Locule damage} = \frac{\text{Total no. of damaged locules}}{\text{Total no. of locules}} \times 100$$

Influence of weather factors on the buildup of pink bollworm

The data on percent green boll locule damage and larval occurrence were pooled by standard week wise and correlated with significant meteorological parameters for the corresponding standard week. Counts of male moths collected in the traps were pooled standard week wise and statistically correlated with weather parameters *viz*.,maximum temperature, minimum temperature, rainfall, number of rainy days, morning and evening relative humidity. Regression studies were also worked between trap catch Vs weather parameters, percent green boll locule damage vs weather parameters and larval incidence Vs weather parameters using OPSTAT statistical package.

RESULTS AND DISCUSSION

Larvae/ 10 green bolls

Pink bollworm larvae per ten green bolls ranged between 2 to 14 with a seasonal mean of 3.13 larvae per 10 green bolls (Fig.1). It first appeared during second week of November (46

SMW). The highest population of larvae per 10 green bolls (14 larvae per 10 green bolls) was observed at the time of third week of December (51 SMW).

The pink bollworm larvae per 10 green bolls showed substantial significant and negative correlation with minimum temperature (r=-0.661) and morning relative humidity (r= -0.524).

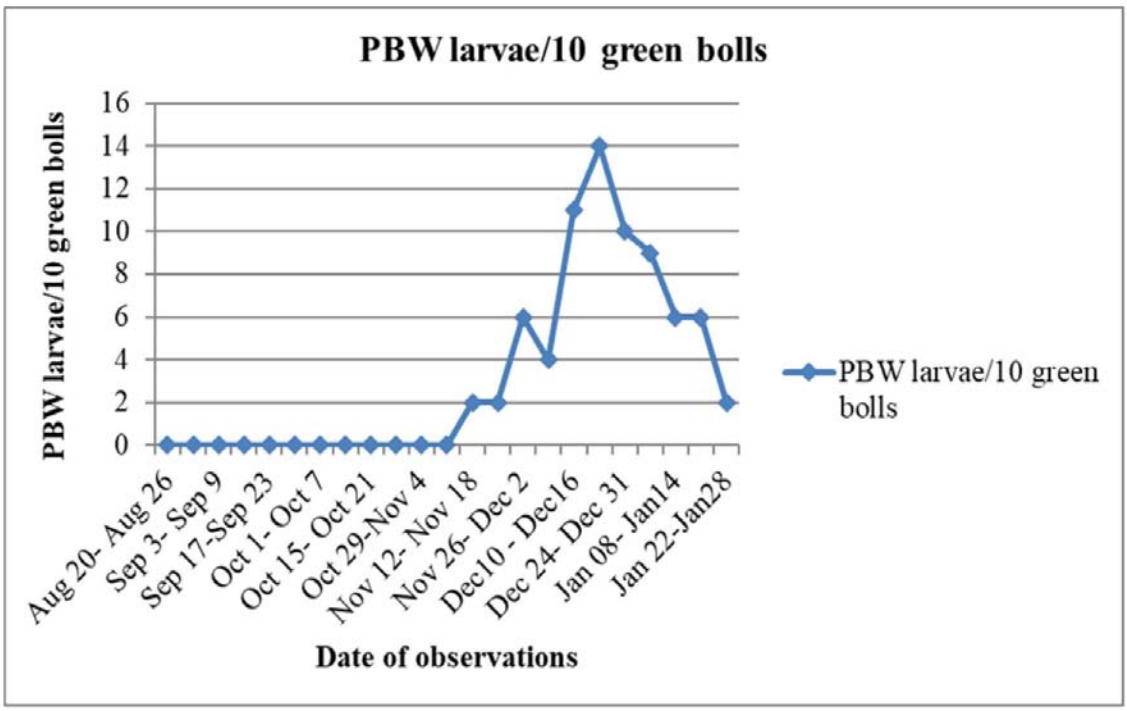

Fig.1. Mean population of Pink bollworm, *Pectinophora gossypiella* on cotton crop during *kharif* season of 2020

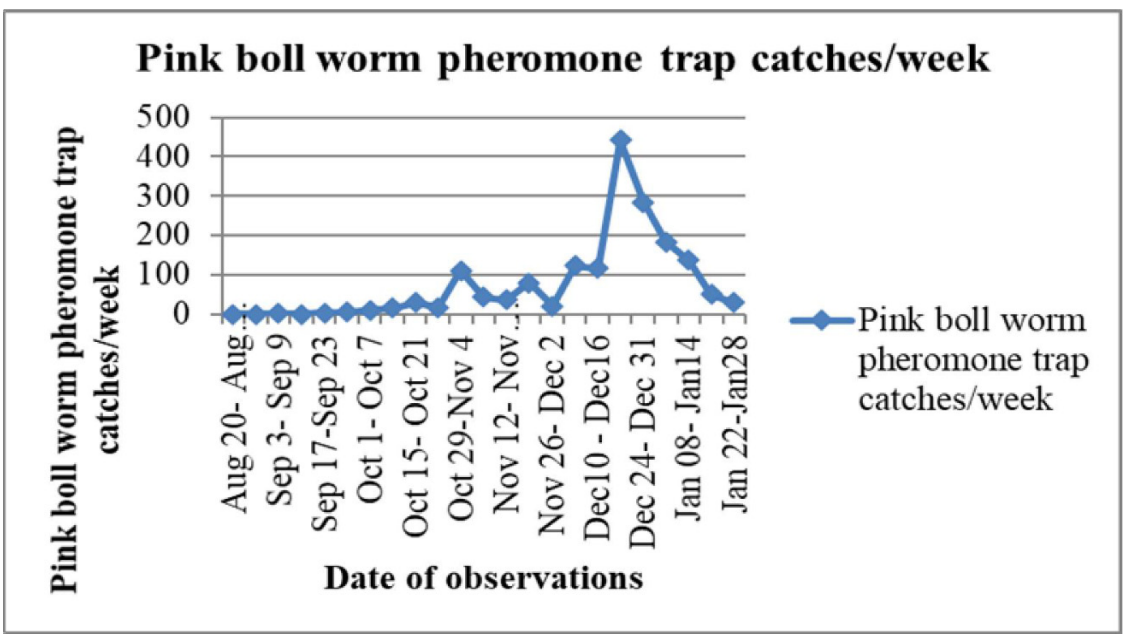

Fig. 2. Contd...

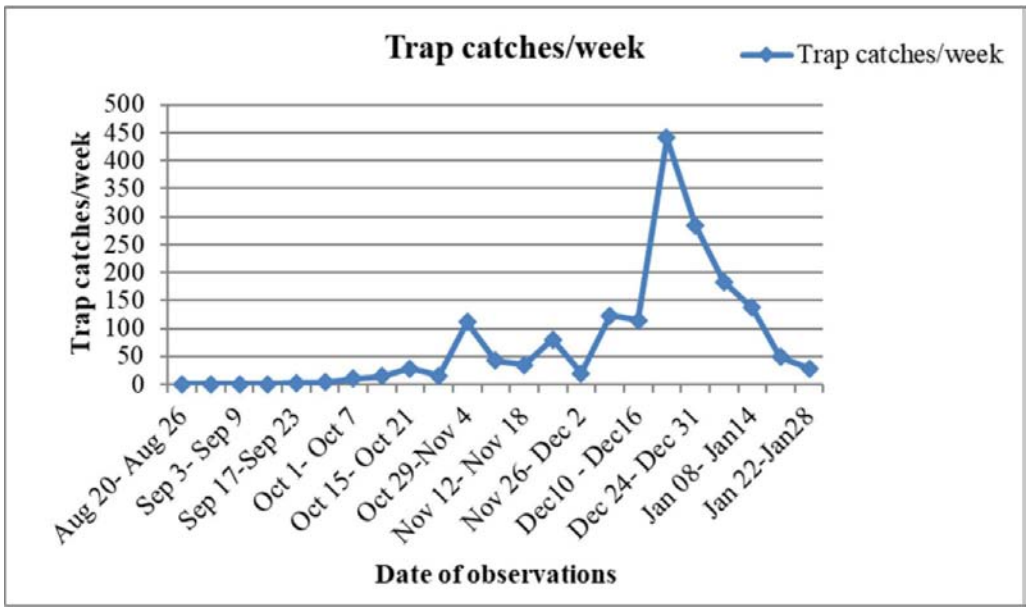

Fig. 2. Mean population of pheromone trap catches/week on cotton crop during *Kharif* season of 2020-21

Pink bollworm pheromone trap catches (moths/trap/week)

The pink bollworm moth catches ranged between 1 to 441 moths/trap/week with a seasonal mean of 75.17 moths/trap/week (Fig. 2). It was first appeared during first week of September (36 SMW). The highest moth catches (441 moths/trap/week) was observed at the time of third week of December (51 SMW).

The pink bollworm moth catches/week showed significant and negative correlation with minimum temperature (r= -0.454), morning

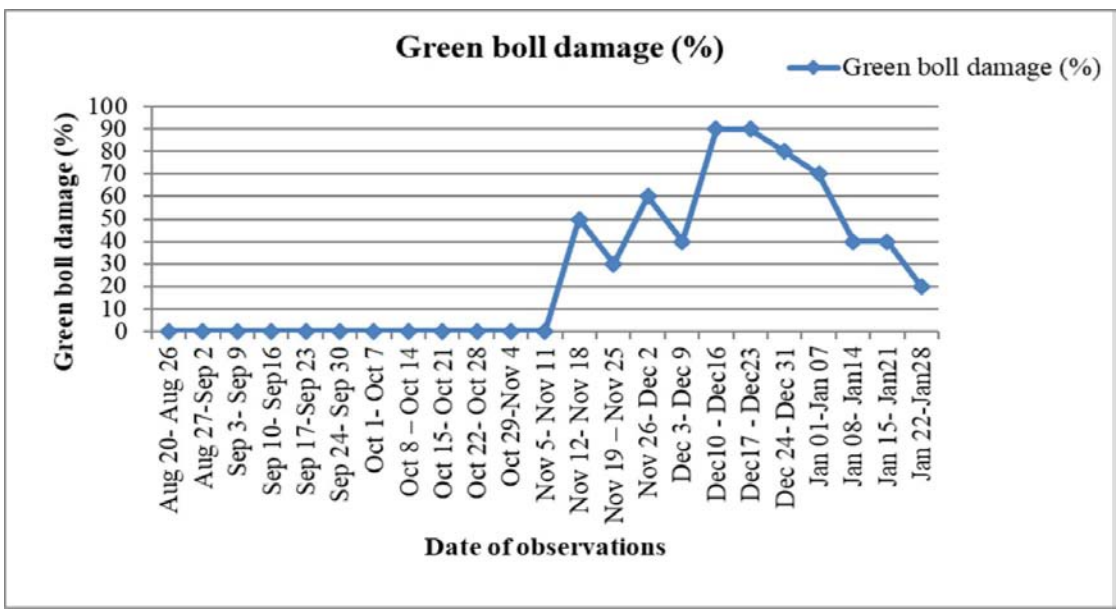

Fig. 3. Mean population of Green Boll damage (%) on cotton crop during *kharif* season of 2020-21

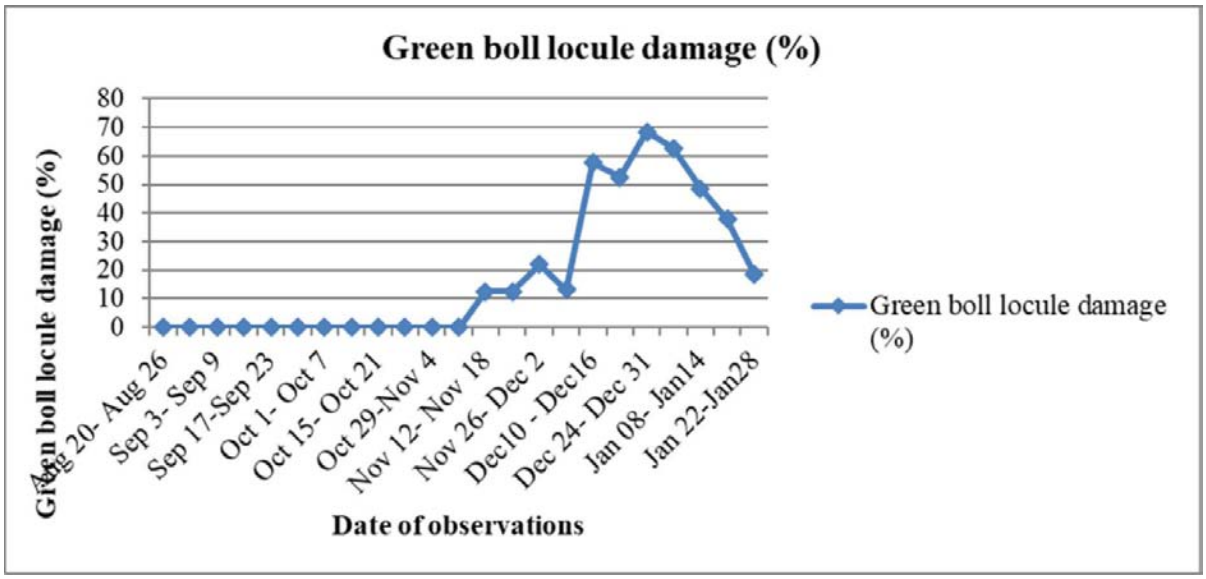

Fig. 4. Mean population of Green boll locule damage (%) on cotton crop during *kharif* season of 2020-21

relative humidity (r= -0.699) and rainfall (r= -0.459).

Green Boll damage (%)

The Green Boll damage caused by pink bollworm ranged between 20 % and 90 % with a seasonal mean of 26.52 percent (Fig. 3). It was first appeared during second week of November (46 SMW). The highest Green Boll damage (90 percent) was observed at the time of second week of December (50 SMW).

The Green boll damage showed significant and negative correlation with minimum temperature (r= -0.729) and morning relative humidity (r= -0.505).

Green boll locule damage (%)

Pink bollworm damage to Green boll locules ranged from 12 percent to 68.5 percent with a seasonal mean of 17.6 percent (Fig. 4). It was first surfaced in the second week of November (46 SMW). The highest green locule damage (68.5 percent) was recorded at the time of fourth week of December (52 SMW).

The percent Green boll locule damage caused by pink boll worm was significantly correlated with minimum temperature (r= -0.413) and morning relative humidity (r= -0.564).

The larval population of pink bollworm per 10 green bolls ranged between 2 to 14 with a seasonal mean of 3.13 larvae per 10 green bolls and showed showed significant and negative correlation with minimum temperature (r= -0.661) and morning relative humidity(r=-0.524). It was first surfaced in the second week of November (46 SMW). The highest population of Larvae per 10 green bolls (14 Larvae/10 green bolls) was observed at the time of third week of December (51 SMW).

The Green Boll damage caused by pink bollworm ranged between 20 to 90 percent with a seasonal mean of 26.52 percent. It was first surfaced in the second week of November (46

Table 1. Seasonal incidence of pink bollworm on cotton crop during *kharif* 2020-21 at RARS, Lam

SMW No.	Duration	PBW larvae/10 green bolls	PBW moth catches/ trap/week	Green boll damage (%)	Green locule damage (%)
34	Aug 20- Aug 26	0	0	0	0
35	Aug 27-Sep 2	0	0	0	0
36	Sep 3- Sep 9	0	1	0	0
37	Sep 10- Sep16	0	0	0	0
38	Sep 17-Sep 23	0	3	0	0
39	Sep 24- Sep 30	0	4	0	0
40	Oct 1- Oct 7	0	10	0	0
41	Oct 8 – Oct 14	0	15	0	0
42	Oct 15- Oct 21	0	29	0	0
43	Oct 22- Oct 28	0	16	0	0
44	Oct 29-Nov 4	0	111	0	0
45	Nov 5- Nov 11	0	43	0	0
46	Nov 12- Nov 18	2	35	50	12.5
47	Nov 19 – Nov 25	2	80	30	12.5
48	Nov 26- Dec 2	6	20	60	21.95
49	Dec 3- Dec 9	4	123	40	13.15
50	Dec10 - Dec16	11	115	90	57.57
51	Dec17 - Dec23	14	441	90	52.5
52	Dec 24- Dec 31	10	284	80	68.5
1	Jan 01-Jan 07	9	184	70	62.8
2	Jan 08- Jan14	6	137	40	48.6
3	Jan 15- Jan21	6	49	40	37.7
4	Jan 22-Jan28	2	29	20	18.35

Table 2. Correlation between pink bollworm (*Pectinophora gossypiella*) and weather parameters

Particulars	Weather parameters				
	Max Temp (°C)	Temp Min (°C)	Morning RH (%)	Evening RH (%)	Rainfall (mm)
Pink bollworm larvae/10 green bolls	-0.363	-0.661**	-0.524*	-0.408	-0.351
Green boll locule damage (%)	-0.407	-0.413*	-0.564**	-0.355	-0.403
Pink bollworm pheromone trap catches/week	-0.345	-0.454*	-0.699**	-0.338	-0.459*
Green Boll damage (%)	-0.379	-0.729**	-0.505*	-0.445	-0.349

SMW). The highest Green Boll damage (90 percent) was observed at the time of second week of December (50 SMW). The Green Boll damage showed significant and negative correlation with minimum temperature (r= -0.729) and morning relative humidity (r= -0.505).

The Green locule damage caused by pink bollworm ranged between 12.5 to 68.5 percentwith a seasonal mean of 17.65%. It was first surfaced in the second week of November (46 SMW). The highest Green locule damage (68.5 percent) was observed at the time of fourth week of December (52 SMW) and showed significant and negative correlation with minimum temperature (r= -0.413) and morning relative humidity (r= -0.564).

The Pink bollworm moth catches/week ranged between 1 to 441 moths/trap/week with a seasonal mean of 75.17 moths/trap/week. It first surfaced in the first week of September (36 SMW). The highest pink bollworm moth catches/ week (441 moths/trap/week) was observed at the time of third week of December (51 SMW).

CONCLUSION

The pink bollworm larvae per 10 green bolls, percent green boll damage with an average seasonal mean of 26.52, percent green boll locule damage with a mean of 17.65 and pheromone trap catches per week with a seasonal mean of 75.17 showed significant negative correlation with minimum temperature and morning relative humidity.

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