Incidence of stem borer (*Chilo partellus* Swinhoe) and cob borer (*Stenachroia elongella* Hampson) on maize in relation to dates of sowing and weather parameters under mid altitude hills of Meghalaya

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ABSTRACT

To study the effect of date of sowing on incidence of stem borer and cob borer in maize, the field experiments were conducted at ICAR Research Complex for North Eastern Hill Region, Umiam, Meghalaya for two consecutive seasons. Total five dates of sowing were evaluated at fortnightly interval starting from second week of April (Sowing I) to second week of June (Sowing V) for both the seasons. Maize (Var: Vijay composite) was sown in randomized block design with four replications. Results revealed that maximum dead heart was found in sowing I (10.67 & 13.45%) followed by sowing II (10.18 & 11.33%) during season I and II, respectively. The highest cob borer damage was recorded in sowing V (13.92 & 7.50%) followed by sowing IV (12.89 & 7.32%) during season I & II, respectively. Among the abiotic factors, maximum temperature had positive influence on stem borer incidence while minimum relative humidity and rainfall had positive effect on cob borer incidence in maize. The highest grain yield of maize was recorded in sowing I (22.98 & 23.65 q/ha) followed by sowing II (22.67 & 23.44 q/ha) and sowing III (22.15 & 22.82 q/ha) for season I & II, respectively.

1. Introduction

Maize (*Zea mays* L.) is commonly known as queen of cereals for its huge genotypic diversity and highest genetic yield potential (Singh et al., 2020). It is third most important cereal crops in India after rice and wheat and second most important cereal in Meghalaya only after rice. It is grown throughout the country under wide agro-climatic condition (Kumar et al., 2014; Singh and Jaglan, 2018). In India, maize occupied 9.2 mha area with a production of 28.75 mt (Rakshit et al., 2019) whereas in Meghalaya it covered about 18000 ha area with productivity of 2150 kg/ha (Babu et al., 2019). In spite of increased cultivation area under maize, still the productivity of maize is lower as compared to other countries. Though, many biotic and abiotic factors are associated with low productivity of maize but insect pest problem is assumed one of the major limiting factors for reducing yield (Ngoko et al., 2002). It is infested by different insect pests at various growth stage of maize. It is

reported that around 250 species of insect and mite pests (Mathur, 1991) and about 139 species of insect pests attack on maize, out of that few are detrimental (Sarup et al., 1987; Siddiqui and Marwaha, 1993). Out of these, stem borer (*Chilo partellus* Swinhoe) is the deadest insect pests of maize in India as well as other Asian countries (Singh et al., 2018) and it contribute about 90-95% of the total damage (Jalali and Singh, 2002) in *kharif* season. Plant infestation and dead heart is reported up to 33.33 and 18.88%, respectively in *kharif* maize under Meghalaya condition (Patra et al., 2013a). Bhanukiran and Panwar (2000) also reported the yield loss due to this pest between 24.3-36.3 % from varied agro-climatic areas of India. Another lepidopteran insect, cob borer (*Stenachroia elongella* Hampson) also cause considerable damage to the maize cob starting from silking stage of the crop in Meghalaya. It is reported that 6.5 to 11.95% (Patra et al., 2013b) and 5 to 39% (Shylesha, 1996) damage on maize

cob from Meghalaya. For implementation of appropriate management practices, incidence pattern of any insect pest is a prerequisite parameter for getting successful results. Pest incidences and their severity on a particular crop varies from province to province depending upon the prevailing weather condition. Therefore, the present experiment was carried out to study the incidence of stem borer and cob borer on maize in relation to planting dates and effect of weather parameters on pest incidence under mid altitude hills of Meghalaya.

2. Materials and methods

To study the effect of date of sowing on incidence of stem borer and cob borer in maize, the field experiments were conducted at ICAR Research Complex for North Eastern Hill Region, Umiam, Meghalaya for two consecutive seasons (season I: 2010 and season II: 2011). Total five dates of sowing were done at fortnightly interval starting from second week of April (Sowing I) to second week of June (Sowing V) for both the seasons. Maize (Var: Vijay composite) was sown in 3m X 5m plots with 60cm X 25cm spacing. The experiment was laid out in randomized block design with four replications. Proper agronomic management practices except plant protection were followed for growing of the crop. Dead heart due to stem borer infestation were observed on 30 and 45 days after each sowing date while cob borer damage was recorded at harvest for each sowing date. Weather data from April to September (Figure 1 & 2) for both the seasons were collected from Agro-meteorological observatory of ICAR Research Complex for NEH Region, Umiam, Meghalaya for correlation study. Incidence of pests was correlated with weather parameters prevailed during two preceding weeks of one-month old crop. Mean data of stem borer and cob borer infestation were subjected to angular transformation for calculation of critical differences at 5% level of significance.

3. Results and discussion
3.1 Incidence of stem borer and cob borer with different dates of sowing of maize

Dead hearts due to stem borer infestation in maize with different dates of sowing are presented in Figure 3 for both the seasons. It is clear that during season I the highest dead heart was recorded in sowing I (10.67%) which was closely at par with sowing II (10.18%). Third and fourth sowing were at par each other with 7.87 and 6.25% dead heart, respectively whereas sowing V showed minimum dead heart (2.19%). During season II, pattern of stem borer infestation was slightly different with significant differences among the sowing dates. The maximum dead heart was observed in sowing I (13.45%) followed by sowing II (11.33%), sowing IV (9.30%) and sowing V (6.25%) whereas minimum dead heart was found in sowing III (3.50%).

Cob borer infestation in different dates of sowing are illustrated in Figure 4 for season I & II. Results revealed that season I, minimum cob borer damage was recorded in sowing I (1.35%) which was highly significantly different from other dates of sowing. Next best sowing dates in term of cob borer infestation were sowing II and III with 7.32 and 7.27%, respectively. The highest cob borer damage was recorded in sowing V (13.92%) followed by sowing IV (12.89%). In the season II, cob borer infestation was less as compared to season I. The minimum cob borer infestation was again found in sowing I (1.67%) which was statistically different with rest of sowing dates. Second date of sowing recorded 5.24% cob damage which was at par with sowing III (6.25%). Though, the highest cob borer infestation was recorded in sowing V (7.5%) but it was statistically at par with sowing IV (7.32) and sowing III (6.25%).

Results of the present experiments showed that dead heart ranged from 2.67 to 13.45% and cob borer damage ranged from 1.35 to 13.92% irrespective of dates of sowing and years. The present findings may be comparable with Khan and Amjad (2000) who reported 7.71 to 10.34% dead hearts due to stem borer infestation on different maize varieties while Ahad et al. (2008) observed mean stem borer infestation (dead heart + leaf infestation) from 0 to 23.16% during kharif season. The average of two years study showed that dead heart and cob borer damage on different varieties of maize were recorded 3.25 to 9.94% and 4.11 to 10.86%, respectively when the crop was sown during the second week of April under Meghalaya condition (Patra et al., 2013a). The present findings are again in line of Patra et al. (2013b) who reported 13.45 to 15.67% stem borer and 6.5 to 11.95 % cob borer damage on Vijay composite maize when it was sown during April under mid altitude hills of Meghalaya. Shylesha (1996) also reported 5-39% cob borer damage on seven maize varieties under Meghalaya condition. Results of present experiments revealed that early sown maize recorded highest stem borer infestation whereas late sown maize showed maximum cob borer infestation. The findings are in line with Anonymous (2008) and Anonymous (2011) who stated that stem borer infestation was more on early sown crops whereas cob borer infestation was found maximum on late sown crop.

3.2 Effect of weather parameters on incidence of stem borer and cob borer in maize

Correlation study between pest incidence and weather parameters is depicted in Table 1 for both the seasons. Results revealed that maximum temperature showed non-significant positive influence (r=0.403 and r=0.153) on stem borer incidence for both the seasons, respectively whereas all others parameters (minimum temperature, maximum and minimum relative humidity and rainfall) had non-significant

negative influence on population build-up of stem borer in maize. In case of cob borer, minimum temperature and maximum relative humidity revealed non-significant negative effect on cob borer incidence whereas effects of maximum temperature were not cleared. Minimum relative humidity (r=0.203 and r=0.367) and rainfall (r=0.208 and r=0.216) had non-significant positive effect on population build-up of cob borer in maize. The present results are in analogous with Patel et al. (2016) who reported the negative correlation of *C. partellus* infestation with minimum temperature. The present findings are in comparable with the results of Kurly et al. (2021) who reported highly significant and positive correlation of maximum temperature with leaf infestation and dead heart while significant and negative correlation of maximum relative humidity leaf infestation and dead heart. Sharma et al. (2017) reported significant negative correlation of larval population of *Sesamia inferens* with maximum temperature, minimum temperature and rainfall in maize. The results of present findings are in line of Anonymous (2009) who reported that high rainfall and relative humidity favoured multiplication of the cob borer in maize.

3.3 Grain yield of maize with different dates of sowing

Grain yield of maize with different dates of sowing during season I and II is presented in Figure 5. The significant variation was observed in grain yield among the different dates of sowing during both the seasons. The highest grain yield of maize was recorded in sowing I (22.98 q/ha) which was closely at par with sowing II (22.67 q/ha) and sowing III (22.15 q/ha) whereas lowest grain yield was recorded in sowing V (14.33 q/ha) followed by sowing IV (18.20 q/ha). Similar results were observed in term of grain yield during season II. The maximum grain yield was found in sowing I (23.65 q/ha) which was statistically at par with sowing II (23.44 q/ha) and sowing III (22.82 q/ha) whereas yield was minimum in sowing V (16.35 q/ha).Yield of present experiments ranged from 14.33 to 23.67 q/ha. The average productivity of maize is reported as 21.50 q/ha under Meghalaya condition (Babu et al., 2019).

4. Conclusion

From the present study, it was observed that stem borer infestation was more on early sown maize as compared to late sown maize while cob borer damage was maximum in late sown maize as compared to early sown maize. Among the abiotic factors, maximum temperature had positive influence on stem borer incidence and minimum relative humidity and rainfall had positive effect on cob borer incidence in maize. As the higher grain yield of maize was observed in sowing I to III, therefore, optimum sowing time of maize may be considered from April to mid-May for higher grain yield under Meghalaya condition.

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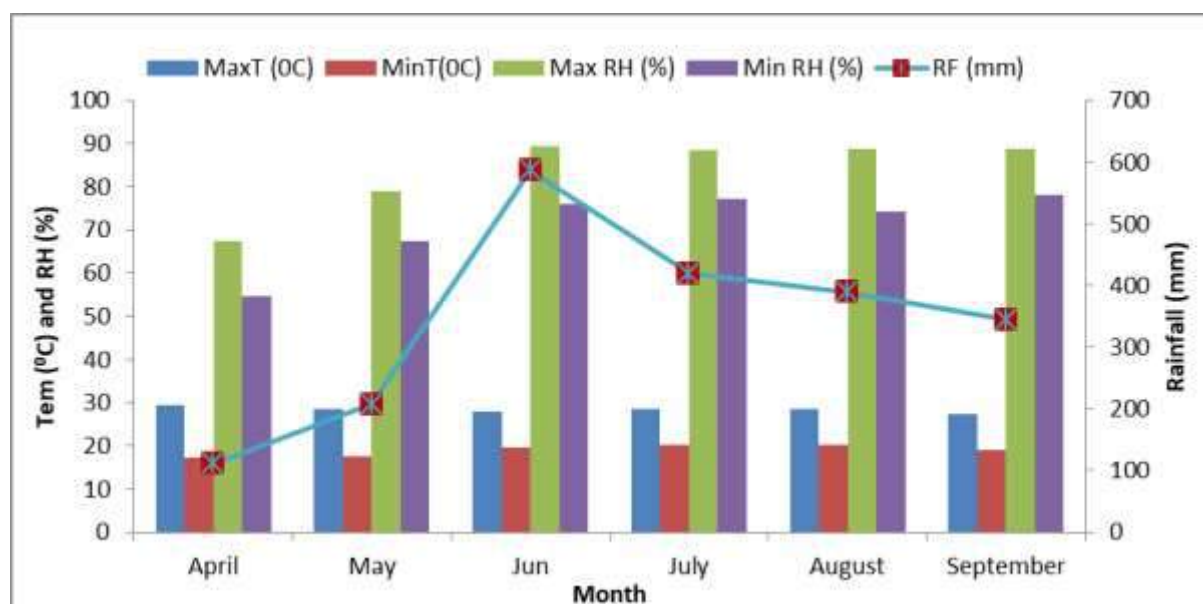
Figure 1. Weather condition prevailed during experimental period of season I
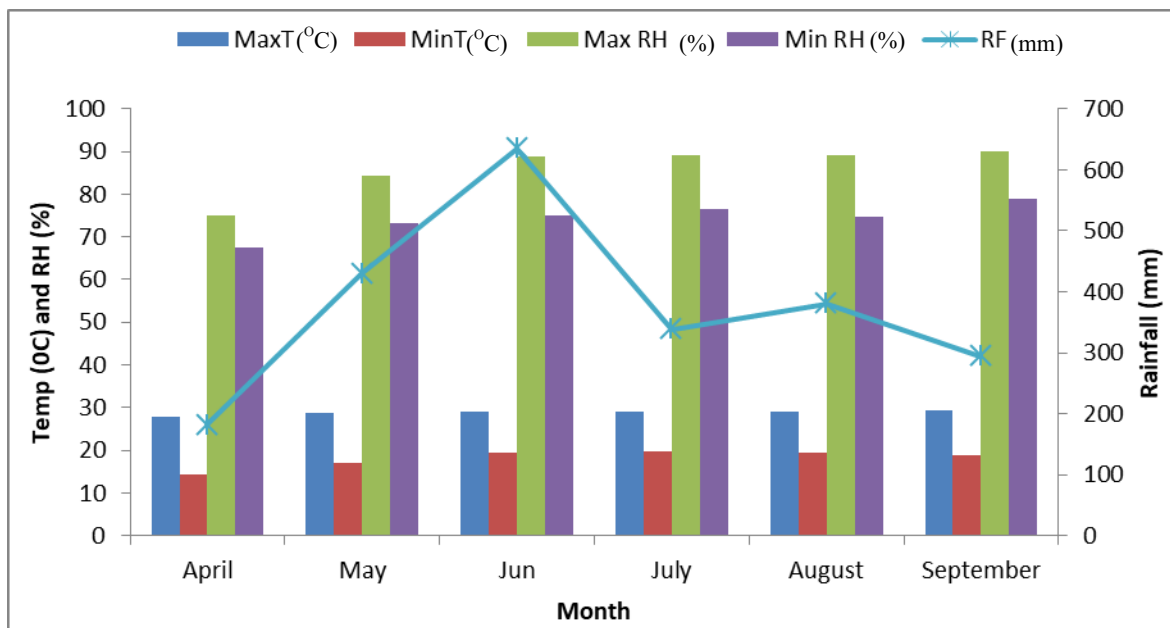
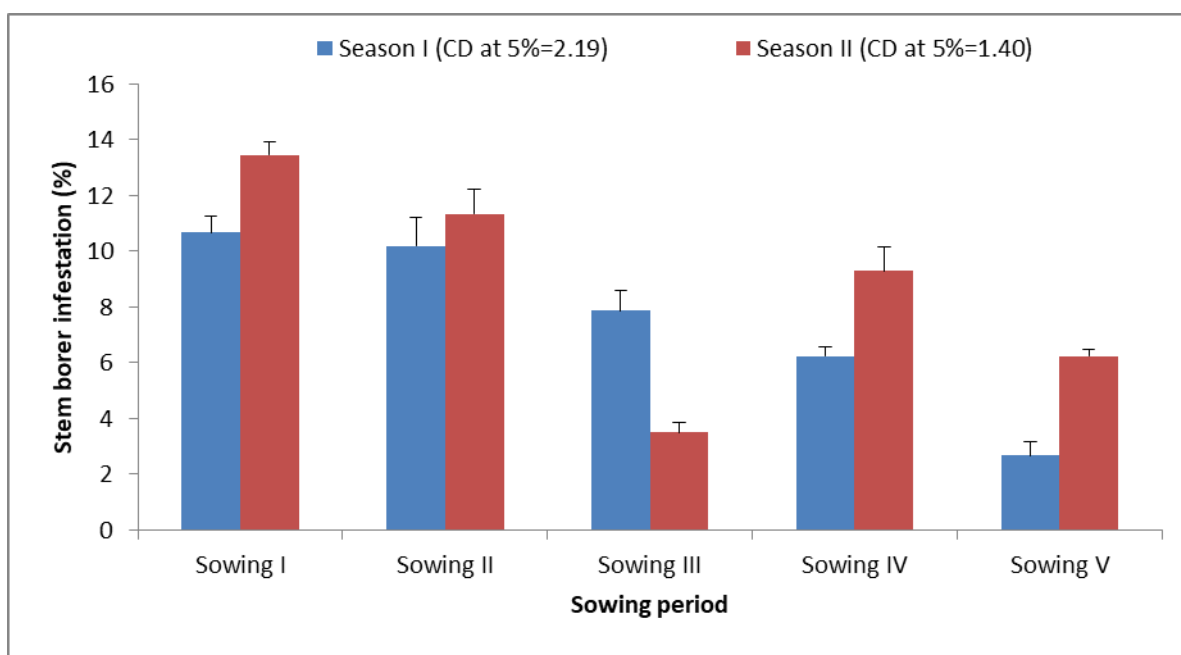**Figure 2.** Weather condition prevailed during experimental period of season II

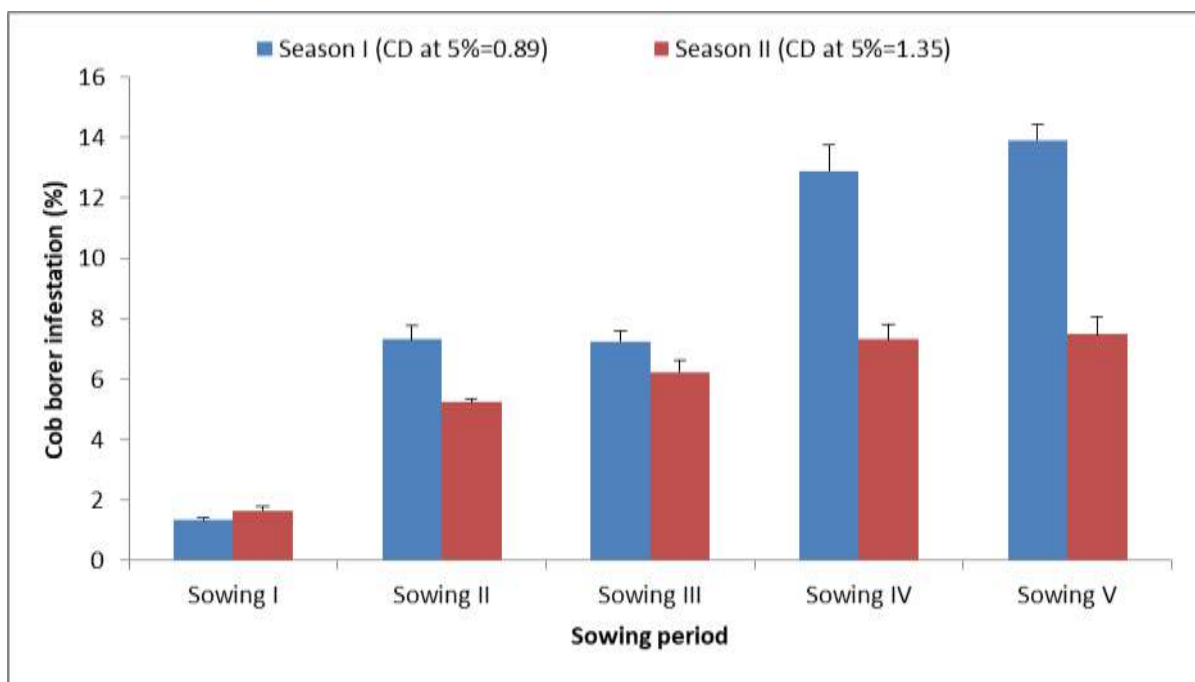**Figure 3.** Incidence of stem borer under different sowing dates of maize

Figure 4. Incidence of cob borer under different sowing dates of maize
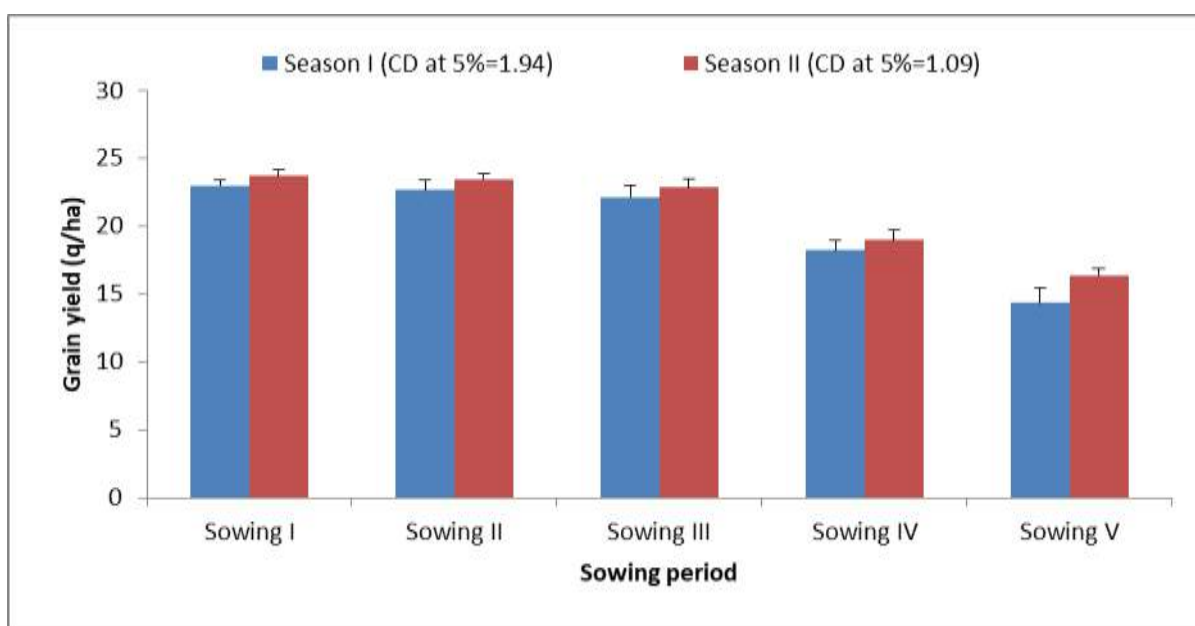

Figure 5. Effect of date of sowing on yield of maize

Table 1. Correlation coefficient (r) between weather parameters and borer incidence in maize

Weather parameters	Correlation coefficient (r)			
	Stem borer		Cob borer	
	Season I	Season II	Season I	Season II
Maximum temperature (^{0}C)	0.403	0.153	-0.586	0.416
Minimum temperature (^{0}C)	-0.866	-0.566	-0.870	-0.785
Maximum RH (%)	-0.566	-0.790	-0.098	-0.463
Minimum RH (%)	-0.646	-0.486	0.203	0.366
Rainfall (mm)	-0.536	-0.343	0.208	0.216