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IMPACT OF ELEVATED CO_2 ON RICE BROWN PLANTHOPPER *NILAPARVATA LUGENS* (STAL.)

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ABSTRACT

Influence of elevated CO_2 (570±25 ppm) on the rice brown plant hopper (BPH), *Nilaparvata lugens* (Stal.) was studied in the Free Air Carbon Enrichment (FACE) facility during rainy season 2013. The BPH appeared on the crop during last week of August (35th Standard Meteorological Week- SMW) that corresponded to 44 days after transplanting (DAT). From 35th to 38th SMW, total BPH population under both elevated and ambient conditions did not differ significantly; however, significantly higher BPH population was recorded from 39th to 44th SMW under elevated CO_2. The peak incidence was recorded in the second week of October (42nd SMW) under both the conditions. Significantly higher canopy circumference under elevated condition provided better environmental condition for the BPH multiplication.

Key words: climate change, elevated CO_2, *Nilaparvata lugens*, incidence, weather, population dynamics, multiplication

Rice productivity in India remains on the lower side due to many abiotic and biotic constraints (Behura *et al*., 2011). Among the biotic factors, the brown plant hopper (BPH), *Nilaparvata lugens* (Stal.) is one of the most important sucking pests, causing huge crop losses (Krishnaiah *et al*., 2008) and crop failure (Srivastava *et al*., 2009). Global climate change poses multitude of threats to biodiversity, human life and livelihood. A 15% decrease in irrigated rice yields in developing countries and a 12% increase in rice price is anticipated as a result of climate change by 2050 (CRRI, 2011). Besides climate change is projected to have both direct and indirect effects on pest population which will further affect crop productivity. In this context, the present study was aimed to understand the effect of elevated CO_2 and other physical factors on BPH population dynamics.

MATERIALS AND METHODS

The present investigation was carried out in the Free Air Carbon Enrichment (FACE) facility with 570±25 ppm CO_2 compared to the ambient CO_2 (400±25 ppm) during the rainy season (July-November) of 2013 at the Division of Plant physiology, Indian Agricultural Research Institute, New Delhi (28°38' N, 77°09' E and 228.61 msl). Twenty five days old seedlings of Pusa Basmati 1401 were transplanted into ten plastic pots (22.5 × 15 cm) at two seedlings per pot on 16th July under each of FACE and ambient CO_2 condition. Weekly observations on number of nymphs, wingless females and males were recorded. Canopy circumference was measured at 55 DAT. Meteorological data were collected from the Agrometeorological Observatory, Division of Agricultural Physics, Indian Agricultural Research Institute and correlated with BPH population. Pearson correlation coefficient values were computed for pest population with weather data of same week as well as weather of preceding week. Statistical analyses were performed using SAS Software, Version 9.2 (SAS, 1990). Repeated measure ANOVA was undertaken to assess the effect of elevated CO_2 (570±25 ppm) on BPH population compared to ambient CO_2.

RESULTS AND DISCUSSION

The study revealed that BPH incidence in rice under elevated as well as ambient CO_2 conditions commenced during 35th Standard Meteorological Week (SMW) that corresponded to August last week (Table 1). This attained its peak during 42nd SMW (October second week), and declined during first week of November as the crop reached its harvesting stage.

From 35th to 38th SMW, total population of BPH under the two conditions did not differ significantly; however, significantly higher BPH population was