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Study the Population Dynamics of Major Insect Pest of Niger (*Guizotia abyssinica*) Crop

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

An experiment conducted at PC Unit, Sesame & Niger, JNKVV, Jabalpur, Madhya Pradesh during Pre-*rabi* season 2020-2021. Experiment was laid out in variety was JNC-6. The correlation studies between meteorological parameters and population of whitefly showed that mini. temp. (r= -0.681), relative humidity morning (r= -0.607) vapour pr. mor. (r= -0.642) and evening (r= -0.626) had

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significant negative impact on the incidence of whitefly. The other weather variables had non-significant (±) impact the incidence of whitefly. Correlation studies carried out between meteorological parameters and population of *Nezara* bug showed that maximum temperature (r= -0.756) and evaporation (r= -0.791) had significant negative impact on the incidence of *Nezara* bug. The other weather parameters had non-significant (±) impact on the incidence of stink bug. Correlation studies showed that the sunshine hours (r =-787) showed significant negative correlation while wind speed (r =0.826) had significant positive correlation with incidence of capsule fly. The other weather parameters had non-significant (±) impact on the incidence of capsule fly.

Keywords: Population dynamics; Niger; capsule fly; Nezara bug; whitefly; leafhopper; stink bug.

1. INTRODUCTION

Niger (*Guizotia abyssinica* L. f. Cass) is an essential minor oilseed crop of India and grown mainly in hilly and tribal areas, it is nutritious in terms of its 38 to 42% of quality oil with 18 to 20% protein in the seed. It is the lifeline of tribal agriculture and Indian economy [1]. Though it is a native of Tropical Africa, is widely spread and extensively cultivated in India since long and commonly known as Ramtil in India and Noog in Ethopia. In India, niger crop is cultivated mainly in the states of MP, Orissa, MT, Hilly area of JH, BR, Chhattisgarh, KT, AP and to some extent in the hilly areas of RJ, GJ and TN. India ranks first in area, production and export of Niger in the world. Niger is produced on an area of 112.8 thousand hectares in India, with a production of 40.3 thousand tonnes and an average productivity of 357.2 kg per hectare. Madhya Pradesh supplies roughly 16.0 thousand hectares of land, with an annual yield of 4.9 thousand tonnes and a seed productivity of 308.8 kg per hectare [2]. Insect pests, diseases and weeds impose a serious threat to niger crop production [3]. One of the constraints in the production of niger is the colossal damage caused by various insect pests under certain agro production situations. The crop affected by following prominent insects pests like *Condica conducta*, *Spilosoma oblique*, *U. carthami, Dioxyna sororcula, B. tabaci*, *Taylorilygus pallidulus* and leaf hopper.

2. MATERIALS AND METHODS

The experiment was laid out in 20×10m² area with 10cm plant to plant and 40cm row to row spacing, variety used was JNC-6. For population dynamic studies of major insect pests, observations were recorded in each meteorological week on five plants from ten randomly selected spot, start from first week after germination and continued till maturity of the crop. The observations of whitefly (adult) and leaf hopper (nymph and adult) were recorded on six leaves per plant *viz.,* each from top, middle and bottom (lower leaves). The population of niger caterpillar was recorded by counting the number of larvae per plant while the population of capsule fly was recorded by counting the number of adult per plant. The population of green stink bug was recorded by counting the number of nymph and adults per plant.

3. RESULTS AND DISCUSSION

The incidence of whitefly (0.26 whitefly/three leaves) was recorded from 40th standard week (vegetative stage) and continued till 50th standard week (maturity of the crop). The population of whitefly was gradually increased from 40th standard week, (0.26 whitefly/three leaves) and reached on peak (2.23 whitefly/three leaves) during 47th standard week, when the maximum and minimum temperatures were 28 and 10.7˚C, respectively, with 82 percent morning and 37 percent evening relative humidity and 1.4 mm of rainfall. The population of whitefly showed significant negative correlation with minimum temperature (r= -0.681), relative humidity morning (r= -0.607) vapour pressure morning (r= -0.642) and evening (r= -0.626). The population of whitefly showed non-significant negative correlations with maximum temperature (r= -0.4499), relative humidity evening (r= -0.567), evaporation (r= -0.249) while its population showed non-significant positive correlation with sunshine hours (r= 0.326), rainfall (r= 0.111), wind speed (r= 0.395) and rainy days (r= 0.056). The incidence of leafhopper was observed from 40th standard week with 0.24 leafhopper/three leaves and continued till 49th standard week with 0.14 leafhopper/three leaves. The peak period for the incidence of leafhopper (r= 1.36 leafhopper/three leaves) was observed during 46th standard week of when the maximum and minimum temperatures were 31.2˚C and 15.5˚C, respectively, with 86% and 41% morning and evening relative humidity and 5.2mm rainfall. The

incidence of *Nezara viridula* was noticed from 43th standard week with 0.20 bug/plant and continued till 49th standard week with 0.54 bug/plant. The peak period (1.02 bug/plant) for the activity of *Nezara* bug was recorded in 48th standard week when the maximum and minimum temperatures were 27.6˚C and 9.1˚C, respectively, with 83% morning and 33% evening relative humidity and there were no rainfall was recorded during that period.

The incidence of capsule fly was reported from (43rd standard week) flower bud initiation stage with 0.96 fly/plant and continued till (49th standard week) maturity stage of the plant growth. The population of capsule fly (0.96 fly/plant) was gradually increased from 43rd standard week and reached on peak (2.32 fly/plant) during 47th standard week when the maximum and minimum temperatures were 28˚C and 10.7˚C respectively, with 82% morning and 37% evening relative humidity and 1.4mm rainfall. The larvae of this insect pest were observed to defoliate the plants. The incidence of these insect pests was noticed from 44th standard week (4th week of Oct.) with 0.26 larvae/plant and continued till 49th standard week (1st week of Dec.) with 0.16 larvae /plant. The population of niger caterpillar was gradually increased from 44th standard week and reached at peak (0.55 larvae/plan) during 46th standard week (2nd week of Nov.) when the maximum and minimum temperatures were 31.2˚C and 15.5˚C, respectively, with 86% morning and 41% evening relative humidity and 5.2mm rainfall were recorded. Present findings are also supported by the findings of Chaukikar et al. [4] they studied that population dynamics of insect pests of niger and reported that the population of *Bemisia tabaci* showed non-significant positive correlations with maximum temperature, sunshine, morning relative humidity and evaporation. Present findings are supported by the findings of Prasad et al. [5] they reported that the incidence of leaf hopper was observed in the months of August-September. Findings of Darandale [6] are partially supported the present findings they reported that the incidence of leaf hopper was started from the fourth week of sowing i.e. second week of Dec. (0.27 jassid/leaf). Present findings are in agreement with the findings of Panday et al. [7] they reported that niger caterpillar was at peak during 43rd standard week. Incidence of niger caterpillar showed significant positive correlation with minimum temperature (r= 0.80) and sunshine hours (r= 0.75).

Path analysis revealed that morning relative humidity and rainfall had high direct negative effect on the incidence of niger caterpillar. The incidence of this insect pest was noticed from 44th standard week (0.26 larvae/plant) and continued till 49th standard week (0.16 larvae /plant). The peak period for the incidence of niger caterpillar (0.55 larvae/plan) was recorded during 46th standard week (2nd week of Nov.) when the maximum and minimum temperatures were 31.2˚C and 15.5˚C, respectively, with 86% morning and 41% evening relative humidity and 5.2 mm rainfall were recorded. Present findings are supported by the findings of Basappa et al. [8] they reported that the niger caterpillar was found feeding on the crop from seedling stage to till harvest with peak population of 4.6,3.5,12.03 and 2.13, larvae/plant respectively during vegetative stage (Sept. 3rd week to October 1st week).

4. CONCLUSION

It is concluded that minimum temperature (-0.681), relative humidity morning (-0.607) vapour pressure morning (-0.642) and evening (-0.626) had significant negative impact on the incidence of whitefly. The other weather variables had non-significant (±) impact the incidence of whitefly. In case of population of Nezara bug showed that maximum temperature (-0.756) and evaporation (-0.791) had significant negative impact on the incidence of Nezara bug. The other weather had non-significant (±) impact on the incidence of stink bug. While correlation studies showed that the sunshine hours (-0.787) showed significant negative correlation while wind speed (0.826) had significant positive correlation with incidence of capsule fly. The other weather had non-significant (±) impact on the incidence of capsule fly

CONFERENCE DISCLAIMER

Some part of this manuscript was previously presented in the conference: 6th International Conference on Strategies and Challenges in Agricultural and Life Science for Food Security and Sustainable Environment (SCALFE-2023) on April 28-30, 2023 in Himachal Pradesh University, Summer Hill, Shimla, HP, India. Web Link of the proceeding: https://www.shobhituniversity.ac.in/pdf/Souvenir-Abstract%20Book-Shimla-HPU-SCALFE-2023.pdf

COMPETING INTERESTS

Authors have declared that they have no known competing financial interests or non-financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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