

Population Dynamics of Key Pests and Natural Enemies on Quinoa

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ABSTRACT

A field experiment was conducted to investigate the population dynamics of major insect pests and associated natural enemies in quinoa crop under field conditions. Observations on pest incidence and natural enemy populations were recorded weekly from germination to harvest on 10 randomly selected plants. The study revealed the occurrence of several key pests including jassids, aphids, thrips, leaf miners, epilachna beetles, and spodoptera larvae throughout the crop growth period. The average population recorded during the 11-week observation period was 0.25 jassids, 0.15 aphids, and 0.09 thrips per leaf, whereas 0.28 leaf miners, 0.34 epilachna beetles, and 0.65 spodoptera larvae per plant were observed. Among the natural enemies, earwigs, chrysopa eggs, and adult ladybird beetles were found to be associated with the quinoa ecosystem, with average populations of 0.17, 0.15, and 0.55 per plant, respectively. The findings indicated that spodoptera larvae and epilachna beetles were the predominant pests, while ladybird beetles constituted the major natural enemy population during the crop season. The study provides useful baseline information on pest succession and the abundance of beneficial insects in quinoa, which can aid in developing eco-friendly and integrated pest management strategies for sustainable quinoa cultivation.

Keywords: Quinoa; Population Dynamics; Insect Pests; Natural Enemies; Integrated Pest Management.

INTRODUCTION

Quinoa or quinua (*Chenopodium quinoa* Willd.) is native to the Andes Mountains of Bolivia, Chile, and Peru. This crop (pronounced KEEN-WAH), has been called "41 vegetable caviar" or Inca rice, and has been eaten continuously for 5,000 years by people who live on the mountain plateaus and in the valleys of Peru, Bolivia, Ecuador, and Chile. Quinoa means "mother grain" in the Inca language. This crop was a staple food of the

Inca people and remains an important food crop for their descendants, the Quechua and Aymara peoples who live in rural regions.

This annual species is in the goosefoot family and is related to the weed, common lambsquarters (*Chenopodium album* L.), canahua (*C. pallidicaule* Aellen), and wormseed (*C. ambrosiodes* L. *anthelminticum*). Possible hybrids between quinoa and common lambsquarters have been observed in Colorado.

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Quinoa is also in the same botanical family as sugarbeet, table beet, and spinach, and it is susceptible to many of the same insect and disease problems as these crops. Quinoa is sometimes referred to as a "pseudocereal" because it is a broadleaf non-legume that is grown for grain unlike most cereal grains which are grassy plants. It is similar in this respect to the pseudocereals buckwheat and amaranth.

Quinoa (*Chenopodium quinoa* Willd., Caryophyllales, Amaranthaceae) is considered as a very important grain crop for the Andean region of Latin America. It was domesticated 3000 – 4000 years ago for human consumption (Shukla and Ohri, 2006). Quinoa has a high nutritive value because its grains contain high protein quality and quantity as well, all essential amino acids and trace elements and vitamins. Quinoa has the ability to adapt to different ecological environments and climates (Rasmussen et al., 2003; El-Assiuty et al., 2014). Plants can be grown under poor, saline soils conditions. For all these advantages quinoa can be considered as the most promising crop especially in poor new reclaimed rural area. According to (Danielsen et al., 2003) quinoa is more susceptible to soil borne pathogens in comparison with other species belong to the same family. Quinoa is attacked by several pests and diseases in many south American countries (from Colombia in the north through Ecuador, Peru and Bolivia to Chile in the south). These pests and diseases attack all plant parts during all stages of growth (Drimalkova and Veverka, 2004).

The aim of the present study is to find out pest that may attack quinoa as a new crop in the region. These studies will offer a map and data regarding distribution of pest attacking quinoa. High authority and decision maker can use these data to build up their decision or plans on scientific base and also prepare the suitable mean to control each pest.

MATERIALS AND METHODS

The field experiment was conducted at National Agricultural Research Project, Chh. Sambhajinagar to study the population

dynamics of key pests and natural enemies on quinoa. The plot size was 27m X 15m and quinoa variety, S-7 was raised with standard agronomical practices during *Rabi* season of 2018-19 under normal field conditions. Quinoa sowing was done on 29th November, 2018 and harvested on 14th March, 2019. The plant to plant and row to row distance was maintained at 45 cm and 30 cm, respectively. None of the insecticide was applied to protect the crop from the infestation of pests.

The population of pests and natural enemies was recorded on randomly selected 10 plants at weekly intervals commencing from the germination till harvest, for sucking pests, observations were recorded from three leaves per plant each one from bottom, middle and top canopy of plant, respectively, and rest of the observations were recorded on whole plant basis. As such observations were recorded and the data thus generated was processed properly for obtaining results.

RESULTS AND DISCUSSION

The data on seasonal incidence of major pests along with natural enemies was recorded in the untreated plot of quinoa Cv. S-7 under natural weather condition and is presented in Table 1.

The data revealed that the insect pests' viz., jassids, aphids, thrips, leaf miner, epilachna beetle and spodoptera were found to infest the quinoa crop while, the natural enemies like earwigs, chrysopa and lady bird beetles were noticed on the crop. Jassids were observed from germination till harvest of the crop and ranged from 0.10 to 0.70 per leaf, while aphid population was found to vary from 0.00 to 0.23 per leaf. The population of thrip ranged from 0.03 to 0.17 per leaf. Leaf miner was observed from 0.10 to 0.40 per plant while epilachna beetles were found to infest with a population ranging from 0.00 to 0.50 per plant. Spodoptera infested the crop with a population of 0.00 to 1.20 larvae per plant during the crop period.

The natural enemies were also observed on the crop. The population of earwig was 0.00 to 0.40 per plant and that of

chrysopa was 0.00 to 0.30 per plant while lady bird beetles ranged from 0.30 to 1.00 per plant. Over a period of 11 weeks, the average pest population was 0.25 jassids, 0.15 aphids, 0.09 thrips per leaf and 0.28 leaf miner, 0.34 epilachna beetles and 0.65 spodoptera larvae per plant, respectively. Among, natural enemies, the population of earwigs, chrysopa eggs and adult lady bird beetles was 0.17, 0.15

and 0.55 per plant, respectively. Many workers across globe have reported more or less similar key pests and natural enemies on quinoa which is a newly introduced crop in Marathwada region under Maharashtra State of India (Oeller et al., 2021; Cruces, et al., 2020; Yabar, et al., 2002; Dube et al., 2022; Jagdish, 2023).

Table 1: Seasonal incidence of major pests and natural enemies on quinoa

SMW	Key pests observed						Natural enemies		
	Population / Leaf			Population / Plant					
	Jassid	Aphids	Thrips	Leaf miner	Epilachna Beetle	Spodoptera larva	Earwigs	Chrysopa	LBB
50	0.30	0.00	0.03	0.10	0.00	0.20	0.00	0.00	0.30
51	0.50	0.03	0.03	0.20	0.20	0.70	0.10	0.00	0.70
52	0.70	0.17	0.07	0.20	0.30	1.20	0.10	0.10	1.00
01	0.30	0.23	0.10	0.30	0.30	1.10	0.30	0.20	0.70
02	0.20	0.20	0.10	0.20	0.40	0.60	0.20	0.10	0.50
03	0.10	0.10	0.07	0.30	0.50	0.20	0.10	0.10	0.30
04	0.20	0.10	0.13	0.40	0.50	1.10	0.20	0.10	0.30
05	0.10	0.23	0.13	0.30	0.40	0.30	0.10	0.20	0.30
06	0.10	0.20	0.17	0.40	0.30	0.00	0.20	0.30	1.00
07	0.10	0.17	0.10	0.40	0.30	1.10	0.40	0.30	0.50
08	0.10	0.23	0.07	0.30	0.50	0.70	0.20	0.20	0.50
Avg.	0.25	0.15	0.09	0.28	0.34	0.65	0.17	0.15	0.55

CONCLUSION

Quinoa, being a comparatively new crop introduced in the Marathwada region of Maharashtra, exhibited the occurrence of several insect pests and their associated natural enemies during the cropping period. The present investigation revealed that the crop was infested by sucking pests such as jassids, aphids, and thrips, along with defoliators and borers including leaf miner, epilachna beetle, and spodoptera larvae. Among these, spodoptera larvae recorded comparatively higher population levels, indicating their potential importance as a damaging pest in quinoa cultivation under this region. The average population observed during the 11 weeks of study was 0.25 jassids, 0.15 aphids, 0.09 thrips per leaf, and 0.28 leaf miner, 0.34 epilachna beetles, and 0.65 spodoptera larvae per plant.

The study also confirmed the presence of beneficial natural enemies such as earwigs, chrysopa eggs, and adult ladybird beetles, with average populations of 0.17, 0.15, and 0.55 per plant, respectively. The occurrence of these natural enemies indicates the existence of natural biological regulation within the quinoa ecosystem. Overall, the pest incidence observed during the study remained at low to moderate levels, suggesting that quinoa can be cultivated successfully in the Marathwada region with proper monitoring and integrated pest management practices. Further long-term studies are necessary to understand seasonal pest dynamics and develop suitable eco-friendly management strategies for sustainable quinoa production.

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Conflict of Interest:

The authors declare no conflicts of interest.

Author Contributions:

All authors contributed equally to the manuscript preparation and approval.

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