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Survey and Monitoring of Onion Thrips (*Thrips tabaci*) Lindeman

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Thrips is a most important global pest of onion crop they are direct impact of onion yield and quality. The nymph and adult of thrips feed on leaves by piercing and rasping the leaf tissues and causes lengthwise, silvery stippling or blotching on the onion leaves, resulting in the loss of chlorophyll and reduced photosynthetic efficiency. Thrips attack onion at all the stages of crop growth stages but their count increases from bulb initiation and remains high up to bulb development and maturity. Onion thrips can also transmit several plant pathogens in onion crop that reduced onion bulb size and quality. The above surveys objective to evaluate the damage percentage of thrips in onion crops. Survey was conducted during Kharif 2022 and Rabi 2022-23. The maximum thrips damage rating scale of 3(45%) was recorded at 75 DAT in the Kharif season and Rabi season at 75 DAT thrips damage rating scale was recorded at 4 (65%).The survey result show that the thrips population and damage percentage increased due to increased temperature and relative humidity.

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Keywords: Survey; onion thrips; Thrips tabaci; integrated pest management; crop damage assessment.

1. INTRODUCTION

Onion is important commercial crop of India it is mainly used for cuisine and culinary purpose. Onion is cash crop and export oriented most earning of farmers and valuable foreign exchange for the country. Onion use for different medicinal like preparation of Homeopathic, Unani and Ayurvedic medicines. Gupta et al., 1984 suggested that thrips (*Thrips tabaci* Lindeman) is an important pest of onion crop and losses as high as 90% in quality and yield. Srinivas and Lawande (2004) reported that due to crop damage by thrips yield loss recorded in the range of 46-87% in onion crop. According to Waiganjo et al., (2008) reported that the leaf damage of onion crops by thrips around 40-60% and yield losses 10-20% in the crop. Shibru and Negeri (2014) suggested that due to onion thrips crop damage and yield was reduced 23-85%. Anonymous. 2000, Jaun, 2002 and Kritzman et al., 2002.reported that onion thrips are a major vector for several plant viruses such as tomato spotted wilt virus failure to control this pest by timely and show marketable yield losses in crops. Maniania et al*.,* 2003 and Lebedev et al., 2013 suggested that Insecticides play important role for controlling of thrips population but again and again use of same group insecticides develop resistance power to thrips against insecticides further Shitole et al.,2002, Alston & Drost 2008 recorded that the farmers are uses some insecticides and repeated again and again develop of resistance to insecticides. Pathak et al*.*, (2018) reported that the highest seed yield and minimum thrips population were recorded use of fipronil. Tirkey, Kumar (2017) and Kurbett et al., (2015) reported that the thiamethoxam were effective for control thrips population in onion. Asgar et al*.,* (2018) suggested that the insecticides reduced the thrips population compared to the control and the highest yield was recorded by the use of Dimathoate insecticide. Kumar and Singh (2011) and Das et al., (2017) reported that the spray of Imidaclorprid at 15 days interval was recorded the lowest thrips population and highest gross yield. According to Pandey et al*.,* (2013) recorded that the use of fipronil 1.0 ml/L for better controlling of thrips population and increased the yields of onion crop.

1.1 Origin of Onion Thrips

Onion thrips reported first time in 1889 by Russian Entomologist *Karl Eduard Lindeman* based on specimens collected in Bessarabia, Russia, that caused severe damage to tobacco plants.

1.2 Geographic Distribution of Onion Thrips

Thrips *tabaci* are a global pest of onion grown between sea level and 2000 m (Lewis1973) According to Mound1977 thrips is a native of the Mediterranean region but has become a major pest of agricultural crops throughout most of the world.

1.3 Biology of Onion Thrips

Onion thrips life cycle deepened environmental conditions, like temperature, humidity and nutrient quality of their food sources. The Stages in the developmental life cycle are the egg, first larval stage, second larval stage pre-pupa, pupa, and adult. Because of their small size, this pest species like other thrips can readily be identified as a species even with a hand lens. Morse et al*.,* 2005 suggested that the adult specimens are usually needed to make species identification under high microscope magnification. Brain A.N.2006 recorded that the biology of onion thrips was as follows the entire life cycle (egg to adult) required about 19 days large populations can develop quickly under dry weather conditions where there are many overlapping generations throughout year. Females have a, saw -like structure that help to make an incision in plant tissue for egg laying. Eggs are placed singly just under the epidermis of succulent leaf, flower, stem, or bulb tissue. Eggs are elliptical, approximately 0.2 mm in length. They are whitish at deposition and change to an orange tint as development conditions. Hatching occurs in 4-5 days. Larvae are whitish to yellowish. There are two larval stages and besides the adults, they are the only damaging stages. Larval development is completed in about 9-10 days.

Thrips *tabaci* are two non-feeding stages called the pre-pupa and pupa does not feed and occurs primarily in the soil. Combined pre-pupal and pupal development is completed in 4-6 days. Thrips adult is about 1 mm in length their body color ranges from pale yellow to dark brown, wings are unbanded and dirty gray. The males are wingless and exceedingly rare while the female have long, narrow fringed wings. Onion

thrips Female live for 12-30 days and lay 50-60 kidney- shaped eggs singly inside leaf tissue with a sharpe ovipositor.

1.4 Economic Importance

Thrips is a serious pest a wide range of fruit, vegetable, flower and Agronomics crops. Thrips are members of the order Thysanoptera, which contains several genera and species. Among species of thrips that attack onion are onion thrips (*Thrips tabaci*). According to (Nault LR 1997) onion thrips incidence is a major problem due to the damage caused by feeding on vegetative parts of crops which caused discoloration, deformities and reduced marketable yields of the crops.

1.5 Damage Symptoms

According to Bailey 1938 the onion thrips feeding in onion leaves cause slivery leaf spots that turn into white blotches along the leaves due to removal of cellular content followed by the development of silvery patches and curling of leaves. Lewis 1997b suggested that the thrips *tabaci* causes significant yield loss despite decades of research on control strategies worldwide. *T.tabci* feeding can reduce onion bulb weight (Kendall and Capinera 1987, Fournier *et.al*.,1995, Rueda et al.,2007, Diaz-Monato et al*.,* 2010, Waiganjo et al*.,* 2008 reported that yield loss up to 60%. According to Pozzer et al.,1994, Kritzman e. al., that the addition injury by feeding of *T.tabaci* transmits IYSV and is the only confirmed vector of this pathogen. IYSV was first identified on onion in southern Brazil in 1981(Pozzer et al., 1994) and was confirmed in the United states in 1989 and worldwide (Gent et al.,2006). (Gent *et.al*., 2004) reported that IYSV symptoms on leaves appear as lesions (i.e., straw color to white, dry, and sometimes elongate along the edges indicated that IYSV infection can reduced bulb size. According to (Diaz-Montano et al., 2010) the IYSV infects onion crops early transplanted and onion yield reduce.

1.6 Weather Factors on Outbreak of Onion Thrips

Hamdy, M.K. et al., 1994 reported thrips population depending to relatively high temperatures and lack of rainfall have been increase in onion thrips population, while high relative humidity and rainfall reduce thrips population. Murai T. 2000 suggested that the thrips population and activity depended of temperature and relative humidity further influence the intrinsic rate of natural increase of the thrips. Hamdy, M.K. and Salem M. et al., 1994 reported that the rate of development of thrips *tabaci* is positively affected by increased temperature and decreased by increased relative humidity. According to Bailey1934 and Rueda et al*.*, 2007 the thrips intensity increased due to climatic condition hot, dry weather and Lewis1973 suggested the damage severity of thrips injury increased due to water stress. Environmental factors play important role for increased or decreased of thrips population in onion crops.

2. MATERIALS AND METHODS

The survey of onion thrips was conducted during *Kharif* 2022 and Rabi 2022-23 in Nashik district taluka Niphad, Maharashtra. During the survey five villages were selected for survey in and five onion fields in each village for observation of thrips damge scale. The survey conducted twice a season at 45 days after transplanting and 75 days after transplanting. The thrips damage rating scales at least 10 plants randomly in each field should be scored using rating scale given below.

List. 1. Thrips damage rating

Scale	Foliage damage rating
1	1-20%
2	21-40%
3	41-60%
4	61-80%
5	81-100%

3. RESULTS AND DISCUSSIONS

3.1 Kharif 2022

The twenty five different onion fields were surveyed in 5 villages during September and October 2022.The survey for thrips infestation in onion crop was done in all the 25 fields in month of September on 29.09.2022 at different Villages likes –Chitegaon,Chandori,Saikheda ,Chatori and Berewadi of Taluka Niphad District Nashik, Maharashtra.The thrips damage rating scale ranged from 1 to 2 scale were recorded during survey. Based on the survey onion thrips infested fields were recorded 25% at 45 DAT in Saikheda village farmers fields. The mostly farmers transplanting was done of kharif onion in 15th August.During the survey period crop is under vegetative stage.

At 75 DAT further the survey of thrips infestation was done in same villages and same 25 onion fields at Taluka Niphad District Nashik in month of October on 29.10.2022. The thrips damage rating ranged from 1 to 3 scale were recorded during survey. Based on the survey onion thrips infested fields were recorded 45% in Saikheda village farmers fields. During the survey period crop is under bulb maturity stage.

Table 1. Thrips damage rating in villages at 45 DAT

Sr.no	Villages	Damage rating
1	Chitegaon	1
2	Chandori	1
3	Saikheda	2
4	Chatori	1
5	Berewadi	1

Table 2. Thrips damage rating in villages at 75 DAT

Sr.no	Villages	Damage rating
1	Chitegaon	1
2	Chandori	2
3	Saikheda	3
4	Chatori	2
5	Berewadi	1

Table 3. Thrips damage rating in villages at 45 DAT

Sr.no	Villages	Damage rating
1	Chitegaon	1
2	Chandori	1
3	Saikheda	2
4	Chatori	1
5	Berewadi	2

Table 4. Thrips damage rating in villages at 75 DAT

Sr.no	Villages	Damage rating
1	Chitegaon	2
2	Chandori	2
3	Saikheda	4
4	Chatori	2
5	Berewadi	3

The result show that overall highest thrips damage rating was recorded 2 (25% damage) at 45 DAT in farmers village Saikheda Taluka Niphad. Further the same places survey result show that at 75 DAT the overall highest thrips damage rating was recorded 3 (45% damage) at same village Saikheda Taluka Niphad due to higher temperature of this week. During this period temperature range from 20.24 to 32.42 ^{0}C and relative humidity range from 77.90 to 86.87% in village Saikheda.

3.2 Rabi 2022-23

The survey of onion thrips Nashik district taluka Niphad was conducted during *Rabi* 2022 on 45 DAT and 75 DAT. During the survey five villages were selected for survey in each taluka and five onion fields in each village for observation of thrips damge scale. The twenty five different onion fields were surveyed in 5 villages during January and February 2023.

The survey for thrips infestation in onion crop was done in all the 25 fields in month of January at different Villages likes–Chitegaon, Chandori, Saikheda, Chatori and Berewadi of Taluka Niphad District Nashik, Maharashtra. The thrips damage rating scale ranged 1-2 scale were recorded during survey. Based on the survey onion thrips infested fields were recorded 30% at 45DAT.

At 75 DAT further the survey of thrips infestation was done in same villages and same 25 onion fields at Taluka Niphad District Nashik. The thrips damage rating ranged from 1-4 scale were recorded during survey. Based on the survey onion thrips infested fields were recorded 65%.

The result show that overall highest thrips damage rating was recorded 2 (30% damage) at 45 DAT in village Saikheda and Berewadi and minimum thrips damage sacle 1 (20%) were recorded in farmers field Chitegaon village Taluka Niphad. Further the same places survey result show that at 75 DAT the overall highest thrips damage rating was recorded 4 (65% damage) at village Saikheda Taluka Niphad due to higher temperature of this week and minimum thrips damage scale 2 recorded in farmers fields villages Chitegaon,Chandori and Chatori. During this period temperature range from 12.05 to 26.28 ^{0}C and relative humidity range from 62.26 to 72.83% in village Saikheda.

The survey and monitoring study of onion thrips (*Thrips tabaci*) in Maharashtra reveals that environmental conditions, particularly temperature and relative humidity, play a crucial role in pest population dynamics and the extent of crop damage. Thrips population and damage levels were observed to be highest during the bulb maturity stage, with a strong positive

correlation with temperature increases. These findings align with studies in Colombia and Venezuela, where the incidence of pests like thrips in onions, tomatoes, and other vegetables is exacerbated by warm, dry conditions (Campos, 2023; Campos et al. 2023). For instance, thrips thrive in Colombia's warmer regions with prolonged dry spells, indicating a similar response to environmental conditions across different geographic locations (Zingaretti and Olivares, 2018; Rodriguez et al. 2023). Likewise, in Venezuela, studies have documented that high temperatures coupled with low rainfall contribute to thrips outbreaks, highlighting the pest's dependency on climatic factors common to the region.

The influence of humidity on thrips populations in the Maharashtra study also parallels observations in Latin America. Thrips populations in Venezuelan onion fields are notably lower in regions with high rainfall and humidity, as humidity disrupts thrips' ability to feed and reproduce effectively (Viloria et al. 2023). In Colombia, thrips management strategies for onions and other bulb crops often rely on irrigation schedules that enhance moisture levels during critical pest development phases, which has shown to reduce pest prevalence). This tactic highlights the importance of integrated pest management (IPM) strategies that incorporate environmental control measures to manage pest pressure (Olivares, 2016; Olivares et al. 2021). Both studies demonstrate the need to adapt pest management practices to local climate conditions, emphasizing that temperature and humidity are paramount to thrips population dynamics across these different agricultural systems (Vega et al. 2022; Olivares and Hernandez, 2019a).

Agronomic practices also influence pest dynamics, as evidenced by the current study's recommendations for intercropping, bio-pesticides, and selective insecticides. Colombian and Venezuelan farmers commonly employ intercropping with crops like carrots and tomatoes to manage pest populations, as intercropping reduces pest prevalence by altering microclimates within crop fields (Zingaretti et al. 2016; Viloria et al. 2023). Additionally, the use of organic solutions such as neem oil and botanical-based pesticides, like in the Maharashtra study, is increasingly popular in Latin America, where small-scale farmers seek cost-effective and ecologically sustainable pest control measures. This approach reduces thrips populations by creating less favorable environments for pests while enhancing plant resilience against pest attacks (Olivares et al. 2017; Olivares et al. 2020). The cumulative findings from India, Colombia, and Venezuela highlight that pest management in bulb crops like onions benefits greatly from holistic approaches that Integrate environmental (Hernandez et al. 2020), agronomic (Hernandez and Olivares, 2020) and chemical controls (Hernandez et al. 2018). Future research should focus on developing of pest-resistant onion varieties suited to warm, humid environments. Studies could further assess the efficacy of entomopathogenic fungi and natural predators in both regions to offer alternative pest control solutions, reducing reliance on chemical insecticides and mitigating resistance issues (Montenegro et al. 2021). This comparison underscores the interconnectedness of environmental conditions and agronomic practices in shaping effective, sustainable pest management strategies across diverse agricultural landscapes.

4. CONCLUSION

The present study concluded that the highest thrips damage rating 2 recorded in kharif season at 45 DAT and rating 3 were recorded at 75DAT same village Saikheda further highest damage rating 2 in Rabi season at 45 DAT and 4 rating was recorded in Saikheda village at 75 DAT. Above survey show that the thrips population and damage rating increased due to increased temperature and relative humidity.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Authors hereby declare that NO generative AI technologies such as large language models and text to image generators have been used during the writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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