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RESEARCH PAPER

Temporal Trends in the Population of Onion Thrips and Associated Natural Enemies

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ABSTRACT

Onion (*Allium cepa* L.) is a major horticultural crop in India valued for its culinary, medicinal, and nutritional properties. However, its productivity is significantly threatened by onion thrips (*Thrips tabaci Lindeman*), a globally distributed pest known for causing substantial yield and quality losses. The present study was conducted over two consecutive *rabi* seasons (2017–2019) at the Entomological Research Field, Chiplima, OUAT, Odisha, to evaluate the seasonal incidence of *T. tabaci* and its natural enemies. Observations revealed that thrips population initiated during the 50th standard meteorological week (SMW), peaked at 24.86 thrips/plant in the 8th SMW, and declined thereafter. Peak incidence was associated with dry, moderately warm weather, particularly low rainfall and high morning humidity. Significant correlations were observed between thrips abundance and key weather variables such as maximum and minimum temperature, relative humidity, and rainfall. Additionally, natural enemies including Spiders, green lacewing and coccinellids were documented as major biocontrol agents. The study underscores the influence of climatic parameters on thrips population dynamics and highlights the potential role of natural enemies in regulating infestations, offering valuable insights for optimizing sowing time and ecological pest management strategies in onion cultivation.

HIGHLIGHTS

- Thrips incidence is seasonal and climate-driven, peaking in early-mid *rabi* season.
- Natural enemies act as bio-regulators, peaking slightly after the pest.
- Importance of weather-based forecasting.
- Conservation of natural enemies.
- Adoption of ecological pest management strategies for sustainable onion cultivation.

Keywords: *Allium cepa*, Natural enemies, Population dynamics, *Thrips tabaci*

Onion (*Allium cepa* L.), commonly referred to as the "Queen of the Kitchen," is a vital crop in both Indian and global agriculture due to its culinary, medicinal, and nutritional value (Singh *et al.* 2017). Rich in flavonoids like quercetin and sulphur compounds such as allyl propyl disulphide, onions exhibit anti-inflammatory, antibacterial, antioxidant, and even potential anticancer properties (Griffiths *et al*. 2002). India is the second-largest onion producer after China, with major growing regions in Maharashtra, Uttar Pradesh, Gujarat, and other states. The increasing area under onion cultivation is attributed to its high profitability, storability, and wide consumer demand (Yadav *et al*. 2018). However, pest and disease pressure, particularly due to onion thrips (*Thrips tabaci* Lindeman) remains a critical barrier to maximizing productivity (Dharmasena, 1998; Sudharma and Nair, 1999).

Thrips tabaci is a globally distributed pest that causes severe yield and quality losses by lacerating leaf tissue and sucking chlorophyll-rich sap, which

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results in silvering, curling, and reduced bulb size (Lewis, 1973). Under favorable climatic conditions, particularly hot and dry weather, thrips populations can multiply rapidly due to reduced rainfall and increased plant stress, sometimes leading to yield losses of up to 90% when infestations occur during early growth stages (Gupta *et al*. 1984; Zen *et al*. 2008). Their population buildup has been observed from February, peaking around April, and then gradually declining (Sathe and Pranothi, 2015). Given the variations in agroclimatic conditions across regions, pest occurrence, intensity, and damage level can differ significantly.

Natural enemies such as *Aeolothrips fasciatus*, Anthocorid bugs (Anthocoridae), lacewing larvae (Neuroptera), ladybird beetles (Coccinellidae), and hoverfly larvae (Syrphidae) have been frequently observed to play a regulatory role in thrips population dynamics (Kirk, 1997; Sabelis and van Rijn, 1997). These natural enemies of the pest can substantially reduce thrips infestations, especially when supported by favorable ecological conditions. Therefore, understanding the temporal population trends of both onion thrips and their natural enemies is essential for developing effective integrated pest management (IPM) strategies that reduce reliance on chemical control and promote ecological sustainability.

MATERIALS AND METHODS

Experimental Site and Soil Preparation

The study was conducted during *rabi* seasons of 2017–2019 at the Entomological Research Field of College of Agriculture, OUAT, Chiplima. The site lies at 21°33'595'' N latitude, 83°93'51'' E longitude, and 150.75 m above sea level, within Odisha's West Central Table Land Zone. The climate is warm and sub-humid, with temperatures ranging from 9°C to 44.2°C and an annual rainfall of 1426.2 mm, mostly concentrated during June to September.

The soil at the site ranged from sandy loam to clayey in texture. The field was ploughed once using a disc plough followed by two passes with a nine-tine cultivator. Farmyard manure was incorporated after the first ploughing. Final field layout was done post-levelling to ensure proper seedbed preparation.

Crop Establishment

Seedlings of onion variety Arka Kalyan were raised in a nursery and transplanted at four weeks after sowing seeds during December with a spacing of 15 × 10 cm. Prior to transplanting, seedlings were root-dipped in 0.1% Bavistin (Carbendazim) solution to prevent early fungal infections. Regular irrigation was provided based on crop requirement.

Data Collection and Statistical Analysis

Weekly observations on thrips and the natural population were recorded from five randomly selected plants per plot across three replications, from transplanting until harvest. Observations were made early in the morning. Weather data, including rainfall, maximum and minimum temperature, and morning and evening relative humidity, were recorded concurrently from the meteorological unit of the research farm. Correlation analysis was carried out to study the association between different weather parameters and thrips population.

RESULTS AND DISCUSSION

Population Dynamics of Onion Thrips

Observations conducted during the Rabi seasons of 2017–2019 (Fig. 1) revealed that the population of *T. tabaci* on onion varied significantly across the standard meteorological weeks (SMWs). The infestation ranged from 4.64 thrips/plant in the 50th SMW to a peak of 24.86 thrips/plant in the 8th SMW. The population began increasing from the 50th SMW and remained consistently high from the 3rd SMW (15.80 thrips/plant) to the 8th SMW, after which it began to decline gradually. The peak incidence observed during the 8th SMW coincided with weather conditions comprising a maximum temperature of 26.7°C, minimum temperature of 12.3°C, low rainfall (0.3 mm), high morning relative humidity (90%), low evening relative humidity (59%), and wind velocity of 3.7 km/h. These findings suggest that dry and moderately warm weather conditions favor the population buildup of *T. tabaci*. The current findings are consistent with previous reports by Reddy (1976), who noted increased thrips infestation under dry and warm conditions. Similarly, Lorine *et al*. (1986) observed rising thrips populations from early October, attributed

to declining rainfall and increasing temperatures. Gupta *et al*. (1994) also recorded serious infestations in summer-grown onion crops. Kadri and Goud (2005) reported higher thrips populations in transplanted onion during March to May, while Gill *et al.* (2015) noted thrips densities ranging from 0.1–0.4 thrips/leaf, with peak numbers in December to February. Kannan and Mohamed (2001), and Moraiet and Ansari (2014) documented a steady increase in thrips numbers from February to March, aligning with the present observations. Hossain *et al.* (2015) confirmed that thrips populations typically build up during dry periods and decline with increased rainfall or crop maturity.

The damaging stage of thrips, including both nymphs and adults, typically resides between the leaf sheaths and stem, where they lacerate the leaf epidermis and suck the exuded sap (Lewis, 1997). The damage is most severe from bulb initiation onward (Ibrahim and Adesiyun, 2010), causing silvery blotches, leaf curling, and eventual plant wilting (Jenser *et al.* 2004). Statistical correlation analyses (Table 1) supported the climatic influence on thrips population.

Table 1: Correlation of thrips population with different weather parameters during January-June under field conditions

Weather Parameters	Var: Arka Kalyan	
	Rabi 2017-18	*Rabi* 2018-19
Maximum Temperature (°C)	-0.189	0.928**
Minimum Temperature (°C)	-0.942**	-0.954**
Relative Humidity (%)	0.526	-0.960**
Rainfall (mm)	-0.773*	-0.946**

**: Significant at P = 0.05 **: Significant at P = 0.01.*

During 2017–18, significant negative correlations were observed with minimum temperature (r = -0.942) and rainfall (r = -0.773), while other factors such as maximum temperature (r = -0.189) and relative humidity (r = 0.526) were not significant. In 2018–19, thrips populations showed a strong positive correlation with maximum temperature (r = 0.928) and negative correlation with minimum temperature (r = -0.954), relative humidity (r = -0.960), and rainfall (r = -0.946). These findings are corroborated with Patel and Patel (2015), Satyanarayana and Singh (2015), and Waiganjo *et al.* (2008), who reported similar relationships between weather variables and thrips abundance. Therefore, thrips incidence on onion is closely linked to environmental conditions, especially temperature and rainfall. Their population tends to rise with increasing temperature and low rainfall, indicating the importance of monitoring weather patterns for early detection and timely management of thrips outbreaks.

Seasonal Incidence of Natural Enemies Population

The population dynamics of natural enemies—namely spiders, green lacewings, and beetles—showed a progressive increase across the cropping season, with notable peaks observed around the 10th to 11th standard meteorological week (SMW). The spider population exhibited a steady upward trend from SMW 1 through SMW 14, starting from a low density (~8 individuals/plant) and gradually reaching a peak of approximately 65 individuals/plant by SMW 14. This consistent increase suggests that spiders were positively influenced by the growing prey availability and favorable climatic factors such as moderate temperature and high relative humidity (Fig. 1).

Similarly, green lacewings followed a comparable trend, beginning with a low population (~7 individuals/plant) and increasing steadily to peak at around 55 individuals/plant during SMW 10–11. A slight decline was noted during SMW 12–13, but the population showed signs of recovery by SMW 14. Beetles also displayed a rising pattern, with their numbers growing from about 6–10 individuals/plant in the initial weeks to over 50 individuals/plant by SMW 10–11, after which the population stabilized slightly (Fig. 1).

The simultaneous population peaks of all three groups during SMW 10–11 likely indicate a synchronized response to pest outbreaks—particularly thrips—and environmental conditions conducive to their development and predatory activity. The rise in natural enemy populations during this period underscores their potential role in exerting natural biological control, thereby reducing pest pressure and contributing to the ecological balance within the onion ecosystem.

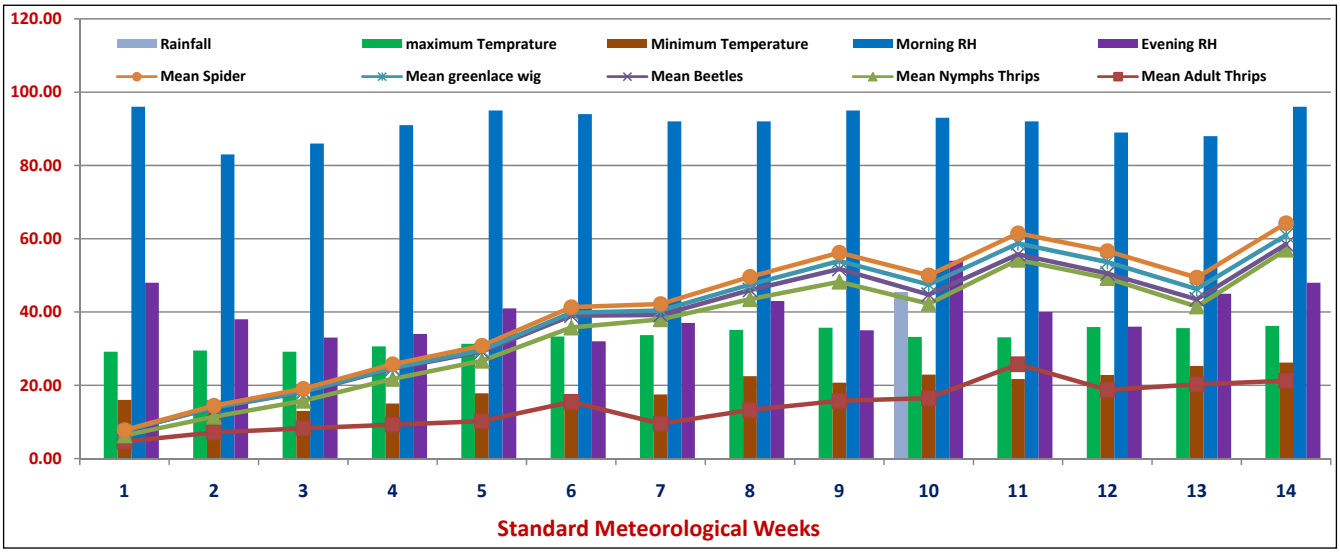

Fig. 1: Seasonal population dynamics of Thrips tabaci on onion and Ladybird beetle in relation to different weathers parameters during 2017-2019 (pooled)

CONCLUSION

The study revealed that thrips populations in onion peaked during the 8th SMW, influenced by higher maximum temperatures and low rainfall. Natural enemies like spiders, green lacewings, and beetles increased gradually, with peaks during the 10th–11th SMW, showing a strong ecological link with thrips abundance. The findings suggest that weather parameters significantly affect both pest and predator dynamics, and timely forecasting along with conservation of natural enemies can aid in sustainable thrips management in onion crops.

REFERENCES

Dharmasena, C.M.D. 1998. Present status of managing chilli leaf curl complex in the North Central Province of Sri Lanka. *Tropical Agricultural Research and Extension,* **1**: 154–158.

Gill, H.K., Garg, H., Gill, A.K., Gillett-Kaufman, J.L. and Nault, B.A. 2015. Onion thrips (Thysanoptera: Thripidae): Biology, ecology, and management in onion production systems. *Journal of Integrated Pest Management,* **6**(1): 6.

Griffiths, G., Trueman, L., Crowther, T., Thomas, B. and Smith, B. 2002. Onions—a global benefit to health. *Phytotherapy Research,* **16**: 603–615.

Gupta, R.P., Srivastava, V.K., Bhardwaj, B.S. and Pandey, U.B. 1984. Chemical control of *Thrips tabaci* L. infesting onion crop. *Journal of Entomological Research,* **8**(2): 196–198.

Hossain, M.M., Khalequzzaman, K.M., Mamun, M.A.A., Alam, M.J. and Ahmed, R.N. 2015. Population dynamics and management of thrips in bulb onion using vegetable intercrops. *International Journal of Sustainable Crop Production,* **10**(3): 8–15.

Ibrahim, N.D. and Adesiyun, A.A. 2010. Seasonal abundance of onion thrips, *Thrips tabaci* Lindeman in Sokoto, Nigeria. *Journal of Agricultural Science,* **2**(1): 107–144.

Jenser, G. and Szénási, Á. 2004. Review of the biology and vector capability of *Thrips tabaci* Lindeman (Thysanoptera: Thripidae). *Acta Phytopathologica et Entomologica Hungarica,* **39**(1–3): 137–155.

Kadri, S. and Goud, K.B. 2005. Survey and seasonal incidence of onion thrips, *Thrips tabaci* (Lindeman). *Karnataka Journal of Agricultural Sciences,* **18**(2): 510.

Kannan, H.O. and Mohamed, M.B. 2001. Impact of irrigation frequency on population density of thrips, *T. tabaci* and yield of onion in El Sudan. *Annals of Applied Biology,* **138**: 129–132.

Kirk, W.D.J. 1997. Predators. *In* T. Lewis (Ed.), Thrips as crop pests (pp. 259–354). CAB International.

Lewis, T. 1973. *Thrips: Their biology, ecology and economic importance.* Academic Press.

Lewis, T. (Ed.). 1997. *Thrips as crop pests.* CAB International.

Lorine, I., Torrer, L. and Gumaraes, D.R. 1986. Population fluctuations of thrips in an onion crop. *Empresa Brass Pesqui Agropeca Brasilera,* **62**(4).

Moraiet, M.A. and Ansari, M.S. 2014. Population dynamics of onion thrips, *Thrips tabaci* Lind. on onion cultivars. *Journal of Agroecology and Natural Resource Management,* **1**(3): 141–147.

Patel, H.C. and Patel, J.J. 2015. Population dynamics of thrips (*Thrips tabaci* Lindeman) on onion in relation to different weather parameters. *Trends in Biosciences,* **8**(2): 531–534.

Reddy, D.N.R. 1976. Faunistic study of terebrantian thrips and control of onion thrips, *Thrips tabaci* L. in Southern Karnataka. M.Sc. (Agri) Thesis, *University of Agricultural Sciences, Bangalore,* **9**(5): 88–92.

Sabelis, M.W. and van Rijn, P.C.J. 1997. Predation by insects and mites. *In* T. Lewis (Ed.), Thrips as crop pests (pp. 259–354). CAB International.

Sathe, T.V. and Pranothi, M. 2015. Occurrence and hosts for a destructive *Thrips tabaci* Lind. (Thysanoptera: Thripidae). *International Journal of Recent Scientific Research*, **6**(4): 2670–2672.

Satyanarayana, P. and Singh, P.P. 2015. Population dynamics of thrips (*Thrips tabaci* Lind) on onion in relation to abiotic factors. *Ecology, Environment and Conservation*, **21**(4): 2143–2145.

Singh, A.K., Janakiram, T., Singh, M. and Mahajan, V. 2017. Onion cultivation in India – A way forward. *Indian Horticulture*, **62**(6).

Sudharma, K. and Nair, G.M. 1999. Assessment of loss caused by *Polyphagotarsonemus latus* (Banks) on chilli. *Entomology*, **24**(1): 197–198.

Waiganjo, M.M., Gitonga, L.M. and Mueke, J. 2008. Effects of weather on thrips population dynamics and its implications on the thrips pest management. *African Journal of Horticultural Science*, **1**: 82–90.

Yadav, M., Prasad, R., Kumar, P., Pandey, C., Kumar, P. and Kumar, U. 2018. A review on onion thrips and their management of bulb crops. *Journal of Pharmacognosy and Phytochemistry*, **1**: 891–896.

Zen, S.M., Okuda, S., Fuji and Iwanami, T. 2008. The seasonal occurrence of viruliferous *Thrips tabaci* Lind. and the incidence of iris yellow spot virus disease on Lisianthus. *Journal of Plant Pathology*, **9**(3): 511–515.