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Influence of dibbling time and weather factors on seasonal dynamics of thrips (*Thrips tabaci* Lindeman) on garlic in Maharashtra

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ABSTRACT

A study was conducted for three successive seasons (2014-17) to evaluate the effect of dibbling time on population dynamics of onion thrips (*Thrips tabaci*) on garlic dibbled on ten different dates starting from 1st September to 15th January at fortnight interval. The significant difference was observed in thrips population load among the dibbling dates. The garlic dibbled on early-December had maximum thrips load (41.8 thrips/plant) followed by both early and late-November sown crop (40 thrips/plant). The least mean of thrips population recorded with early-September planted garlic. Irrespective of sowing dates, highest thrips population peaks were recorded during 1st to 6th Standard Meteorological Week (SMW) of January and February. The maximum average of 59 thrips/plant were registered during early February (5th SMW). The dry spell coupled with optimum temperature (Tmax= 29 to 33°C and Tmin= 9 to 14 °C) favoured thrips population build-up. The correlation analysis between thrips incidence and weather parameters showed significant negative correlation between thrips population and temperature as well as with precipitation.

Key Words: Thrips incidence, climatic variability, sown date, garlic, pest management

Garlic (*Allium sativam* L.) is one of the important bulb vegetables grown in India. The cloves are often used for seasoning and as condiment in number of forms for its flavour (Ferruci *et al.,* 2010). The cloves containing properties are known for its medicinal value for various human health hazards like indigestion, anti-cancer, reducing blood pressure, heart diseases and arthrosclerosis (Bayan *et al.,* 2014). In India, garlic is grown as a *rabi* vegetable and is planted mostly during October-November and harvested in March-April. Globally, India rank second position next to China in terms of garlic cultivation area (14% of world area) and production (5%) (Thangasamy and Chavan, 2017). The states including Madhya Pradesh, Gujarat, Rajasthan, Uttar Pradesh and Maharashtra are the major garlic growing states. However, the productivity is much lower than world average and is in static. Among the various constraints, insect pests are major constrains in garlic production.

Garlic hosts of many arthropod pests including mites (Karuppaiah *et al.,* 2018). Among the different insect pest attacking garlic, onion thrips, *Thrips tabaci* Lindeman (Thysanoptera: Thripidae) is one of the key and destructive pest of garlic in India. The pest can cause yield losses either causing direct damage (15.35 to 46.82%) or by transmitting viral disease (Gent and Schwartz, 2008); also aggravate fungal disease like purple blotch (Arantha, 1980). On garlic, *T. tabaci* prefers to feed on young leaves confined to neck region of the plant. The pest sucks the plant sap, injured plants shows curling and blister white patches in the leaves that leads to reduction in photosynthesis ultimately resulted in formation of undersized bulbs (Hussein *et al.,* 2015).

The attack of *T. tabaci* in garlic is prevailed in all the stages of crop growth. However, fluctuations in occurrence and population peaks are recurrent phenomenon that are predominantly regulated by various abiotic and biotic factors. Of these various abiotic factors, temperature and rainfall are the key factors that regulates the population fluctuations on garlic. Under changing climatic scenario, changes in agronomic practices for instance altering planting date, use of pest tolerant varieties, optimal use of water and nutrient would be some of mitigating strategies for sustainable crop protection (Mondal *et al.,* 2013). In this context, the present study was undertaken to determine the effect of garlic dibbling date and weather factors on the occurrence of onion thrips on garlic under western Maharashtra, Pune.

MATERIALS AND METHODS

The present study was conducted during *rabi* seasons for three years (2014-15 to 2016-17) at ICAR-Directorate of Onion and Garlic Research, Pune (18.32° N 73.51° E) under

Table 1: Effect of dibbling date on thrips population (Pooled data for 3 years)

Dibbling time	Thrips population (Mean) (Number of thrips/plant) Actual value	$\sqrt{X}+0.5$
D_1-1st September	12.7	3.5^{d}
D_2-15th September	30.6	5.4^{abc}
D_3-1st October	30.0	5.5^{abc}
D_4-15th October	35.2	5.9^{ab}
D_5-1st November	40.0	6.3^{a}
D_6-15th November	40.0	6.3^{a}
D_7-1st December	41.8	6.3^{a}
D_8-15th December	35.6	5.8^{ab}
D_9-1st January	25.4	5.0^{bc}
D_{10}-15th January	20.5	4.5^{cd}
CD (0.05)		1.23

*Values in the same column and different letters are significant at 5%

All India Network Research Project on Onion and Garlic (AINRPOG). The garlic (variety: Bhima Omkar) was dibbled at ten different dates *viz*., D_1-1st September, D_2-15th September, D_3-1st October (early dibbling); D_4-15th October, D_5-1st November, D_6-15th November (normal dibbling); D_7-1st December, D_8-15th December, D_9-1st January and D_{10}-15th January (late dibbling). The experiments were laid out in randomized block design with three replications and bed size of 5 m × 1.2 m in raised beds (broad bed furrow). The plant to plant and row to row spacing was followed as 10 cm and 15 cm. The crop was irrigated at regular intervals with drip system. All the recommended agronomic practices were followed except insecticides application.

The visual counts were made to observe the thrips populations from 3rd week of dibbling onwards and continued till maturity of the crop. The total number of thrips (nymphs &adults) in top five leaves of each plant were counted. The count was made from five randomly selected garlic plants of each replication at weekly intervals. The weekly means of thrips population and date-wise means were also worked out. Before analysis, the data on thrips population were subjected to normalization using square root transformation. An analysis of variance was performed to determine the effect of dibbling date of garlic and location on thrips populations. The weather parameters including maximum temperature (Tmax, °C), minimum temperature (Tmin, °C); morning relative humidity at 7 am (RHI, %), evening relative humidity at 2 pm (RH II, %) and weekly rainfall (mm) were also simultaneously obtained from institute observatory. Correlation analysis was performed between weather parameters and thrips population of pooled data of three years. All the test were performed at the 0.05 significance level.

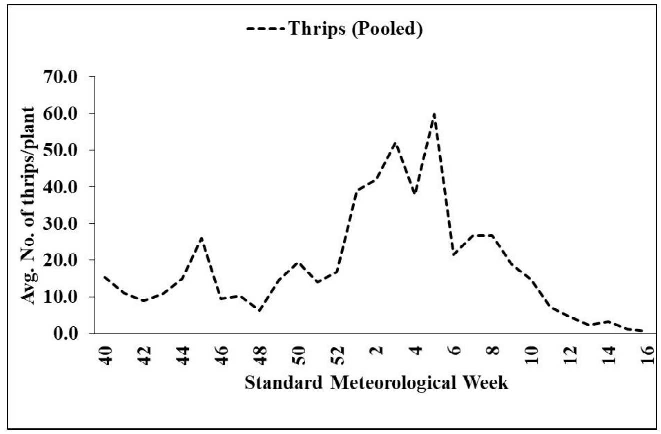

Fig 1 : Trend of *T. tabaci* on garlic during 2014-17 (Pooled data)

RESULTS AND DISCUSSION

The pooled data (2014-17) on mean thrips populations among ten different garlic dibbling dates are presented in the Table 1. Among ten dibbling dates, the maximum thrips population (41.8 thrips/plant) were recorded in 1st December planting date followed by 1st November (40 thrips/plant) and 15th November (40 thrips/plant) sown crop. However, population trend was statistically similar in all the three sown dates. On other hand, the garlic dibbled during 1st September recorded least thrips load (12.7 thrips/ plant). Overall, date-wise mean showed significant (p= 0.05) difference in pest load among ten dibbling dates. The pooled data on weekly mean of thrips population revealed that, irrespective of dibbling dates population peaks mainly recorded during *rabi* months (January-February) i.e. 1st to 6th standard meteorological weeks (SMW). Besides, occurrence of one more peak during 45th SMW was also recorded. The pooled data of three years weekly thrips population revealed the highest peak (59.8 thrips/plant) occurrence during 5th SMW followed 3rd SMW (52.2 thrips/ plant) and 26.7 thrips/plant during 7th & 8th SMW and 26 thrips/plant during 45th SMW. The lowest number of thrips < 3 thrips/plant) was recorded in 12 to 16th SMW. Overall seasonal trend revealed that <30 thrips/plant during 40th to 52nd SMW (Fig 1).

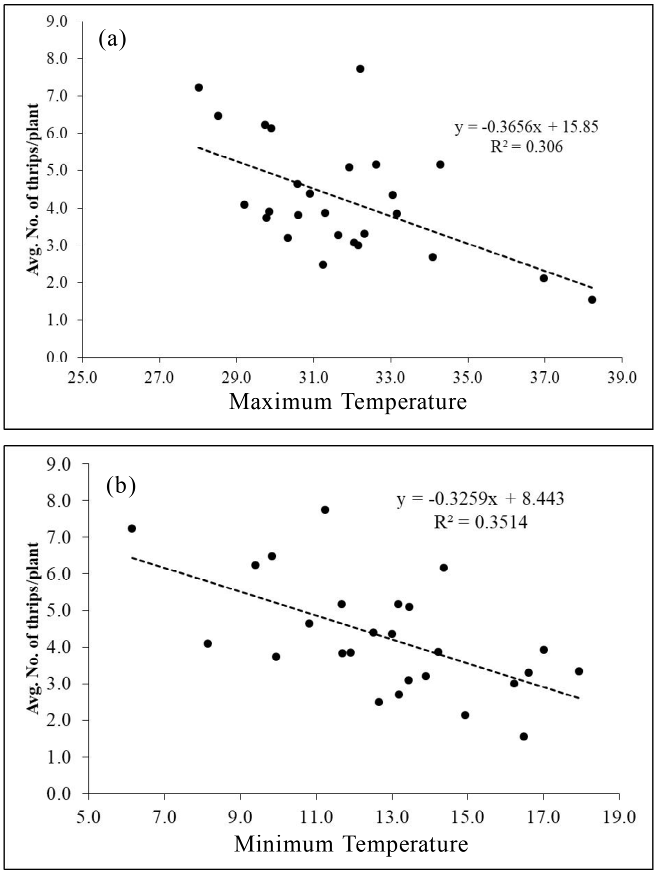

Fig 2 Relation between (a) Maximum temperature and (b) Minimum temperature and thrips population

The garlic dibbled in early (September) and late seasons (January) had lower number of thrips load as compared to garlic planted in regular season (October to November) (Table 1). The similar trend of higher populations level was also registered in a month delayed dibbled garlic crop (December). The significant difference in seasonal mean populations shows that, the dibbling date can have an influence on garlic thrips dynamics. Dibbling of garlic by 15 days early (1st October) exhibited significantly lower thrips load when compared to normal (15th October) dibbling date. The early season dibbling of garlic would help in avoiding the population peaks which are occurring regularly during January and February.

Correlation of weather parameters *viz*., maximum temperature, minimum temperature, morning relative humidity, evening relative humidity and total rainfall with thrips population showed variable relation. The highly significant negative correlation observed between thrips load and maximum (r= -0.554*) and minimum temperature (r= -0.593*). The morning relative humidity had non significant positive correlation (r= 0.122^{ns}) while evening relative humidity showed non significant negative correlation

Table 2: Correlation coefficients between thrips population and weather parameters (Pooled data)

Weather parameters	Thrips population
Maximum temperature (T_{max})	-0.554*
Minimum temperature (T_{min})	-0.593*
Relative humidity at 7 am (RH I)	0.122^{ns}
Relative humidity at 2 pm (RH II)	-0.169^{ns}
Rainfall (RF)	-0.082^{ns}

*Significant at 5%. ns- Non-significant

(r= -0.169^{ns}) and rainfall showed non significant negative correlation (r= -0.082^{ns}) with thrips incidence (Table 2).

The seasonal dynamics of insect pests are mainly driven by abiotic factors (Prasad *et al.,* 2008; Patel *et al.,* 2009; Kataria *et al.,* 2014; Maruthadurai, 2018). Likewise, the role of weather factors is indispensable while considering thrips population dynamics in garlic. In the current study, among the various weather parameters, temperatures found to be most influencing factors that had significantly negative relation with population build up. Most of the peaks were occurred within the temperature range of 29-33° C (Tmax) and 9-14° C (Tmin) (Fig 2a & b). Total rainfall also had negative relation with thrips population. However, it did not show any significant correlation. This might be due to occasional or few rainy days experienced during entire seasons and crop gown in *rabi* months as may be the case. Furthermore, while population peaks (1st -6th SMW) there was no rainfall recorded in corresponding weeks as well as preceding weeks. This shows that, dry spell coupled with prevalence of optimum temperature (Tmax= 29-33° C; Tmin= 9-14 °C) could favours the thrips multiplication in garlic ecosystem. The present study was in accordance with the earlier findings by Janu *et al.* (2017) who reported significant negative relation between thrips population on cotton and maximum temperature. Similarly, negative correlation between thrips population and precipitation was reported by various workers (Shivanna *et al.,* 2009; Sathyan *et al.,* 2017).

CONCLUSION

The present study revealed that, dibbling date in garlic cultivation significantly influenced the thrips population dynamics. Early and late dibbled garlic crop harboured lower thrips population as compared to crop dibbled in normal season. Abiotic factors undoubtedly played major role in determining seasonal dynamics of thrips on garlic. Amongst the weather parameters, temperature play significant role in controlling thrips population dynamics on garlic. Thus, our study suggested that, early-October dibbling of garlic in around western Maharashtra region could avoid population peaks in the later bulb development and clove separation stage.

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