



Integrated pest management approaches and their influence on leaf miner infestation in Kinnow Mandarin (*Citrus reticulata*)

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Summary

Kinnow (*Citrus reticulata*) is the most important juicy fruit crop within the citrus group, which is mostly vulnerable to leaf miner, and this insect poses a major concern to farmers. Farmers injudiciously spray the various non-label claim insecticides either alone or in mixture for the control of leaf miner. Excess applications of insecticides may disturb the ecological balance of beneficial insects, rhizospheric microorganism and contributes in water and soil pollution. Application of IPM approaches is only substitutes to overcome these problems. The present study comprising of Integrated Pest Management (IPM) approaches and farmer adopted practices against leaf miner (*Phyllocnistis citrella*) Stainton showed that, lowest leaf miner infestation (3.07 ± 2.54 , 1.04 ± 0.63 and 1.33 ± 0.37 no. of affected leaves /10 leaves of a shoot) was recorded in IPM plot having need based spray of neem seed kernel extract (NSKE) @ 5% and imidacloprid 17.8SL @ 200ml in 500 liter of water as compared to farmer practice (3.87 ± 2.98 , 1.89 ± 0.77 and 2.01 ± 0.45 no. of affected leaves /10 leaves of a shoot) and control (5.08 ± 3.70 , 2.58 ± 0.92 and 3.13 ± 0.71 no. of affected leaves /10 leaves of a shoot) during the year of 2021, 2022 and 2023, respectively. Similarly, the least mean leaf infestation (1.81 ± 1.09) was also observed in IPM in comparison to farmer practice (FP) (2.59 ± 1.11) and control (3.60 ± 1.31) plots. The highest reduction of leaf miner damage (49.72%) was noticed in IPM compared to Farmer practice (28.05%). The validated IPM techniques are an economically viable alternative to farmers for effective management of the leaf miner.

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Keywords: Kinnow, leaf miner, population dynamic and IPM approaches

Introduction

Citrus is one of the most important fruit crops globally, cultivated on over 109.6 million hectares with a total production of 14.25 million tonnes (FAO 2023). Among citrus species, Kinnow mandarin holds significant importance, particularly in Haryana, Punjab, and Rajasthan, with Haryana accounting for 90% of the total area and production dedicated to this crop (HDH 2024). Kinnow mandarin, a hybrid plant, is valued for its high juice content and rich vitamin C composition (Lotha & Khurdiya 1994). However, its yield and fruit quality are adversely affected by various biotic factors, particularly insect pests and diseases.

Citrus cultivars are infested by 34 insects and mite in various regions (Sharma et al. 2007; Nawaz et al. 2019), including the leaf miner *Phyllocnistis citrella* Stainton (Lepidoptera: Gracillariidae), which is damaging the new emerging leaf of Kinnow mandarin and is also associated with other plants (Singh 2014). Leaf miner has 16 generations in one year (Sharma et al. 2016), mostly appears in nurseries and attack on young nursery plants and tender leaves (Sandhu, 1964) and is considered a destructive insect (Beattie, 1989). Adults are tiny silvery-white moth about 2 mm long with

fringed wings, seen on young flush leaves when disturbed. Young pale-yellow larvae when they come out from the egg, feed between the epidermal layers of the leaf. The leaf miner larvae make serpentine mines on the underside of the leaf are major damaging symptoms of leaf miner (Kalidas & Shivankar 1994). Usually, each leaf has only a single mine, but in the case of heavy infestation, there may be several mines per leaf. This mining causes leaves to curl up, distorted and thereby reducing the photosynthetic area of the young foliage (Chen et al. 2017; Costa et al. 2017; Haldhar et al. 2025). The infestation of leaf miner started from March-April, June- July and September-October months and caused average damage 17 to 57 per cent (Patil 2013) and reduced the fruits yield (Dhiman et al. 2000).

Currently, leaf miner control in Kinnow mandarin mainly relies on the indiscriminate use of chemical insecticides. This practice not only increases to insecticides residues in fruits, soil, and water but also disrupts the abundance of beneficial natural enemies, soil microflora, and poses significant health risks to humans and animals (Kranthi et al. 2002). Additionally, pest control measures are often prescribed based on non-scientific advice from local pesticide dealers, and insecticides are applied according to a fixed calendar rather than pest monitoring and Economic threshold levels (ETL). To mitigate the overuse of insecticides and their adverse impacts, it is essential to develop and

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implement a validated Integrated Pest Management (IPM) approach aimed at maintaining leaf miner populations below the economic threshold level (ETL). Therefore, the present three-year study (2021-2023) was undertaken to evaluate and formulate effective leaf miner management practices for Kinnow mandarin, to integrate them into a sustainable IPM framework suitable for widespread adoption by the Kinnow farmers.

Materials and Methods

The IPM approaches were validated against leaf miner population in a farmer participatory mode with the collaboration of Krishi Vigyan Kendra (KVK), Sadalpur, Choudhary Charan Singh Haryana Agricultural University, Hisar (Haryana) during 2021-2023. All IPM approaches against leaf miner were evaluated on a one-acre field using a Randomised Complete Block Design (RCBD) with a plant spacing of 6 × 6 feet. 120 plants of local variety were maintained in each orchard. 25 plants were randomly selected from seven replications for recording of leaf miner observations in IPM and farmers' practice plots. The affected leaves were calculated by counting of no. of affected leaves /10 leaves of a shoot. For comparison of leaf miner damage with T₁-IPM and T₂-farmer practice, one control plot was also maintained. The IPM approaches mentioned in Table 1 like deep summer ploughing; pruning the excess branches and bottom leaves of tree for proper ventilation; destruction of rotten and dropped infected fruits; regular monitoring of the orchard to assess the damage of leaf miner; remove and destroy affected shoots, leaves, and flushes to reduce larval population; growing intercrop with onion/garlic/chickpea between rows of trees which helps in moisture and natural enemies' conservation

and reduces irrigation frequency, and suppression of weeds; installation of yellow sticky traps @ 20/ha placed 1–1.5 m above tree canopy height and distributed uniformly across the orchard; conservation of natural enemies (Spider, green lacewing and ladybird beetle) to enhance their population through ecological engineering (marigold, sunflower etc.); need-based spray of neem seed kernel extract (NSKE) 5% on young leaves in the months of March, June, and September of Kinnow mandarin and need-based spray of label claim imidacloprid 17.8SL @ 200ml in 500 liter of water and thiamethoxam 25% WG insecticides in 50gm/500 liter water to manage leaf miner were validated in T₁-IPM treatment. In T₂-farmer practice treatment, farmers not practice IPM practices and often use 8-12 sprays of insecticides such as such as quinalphos 25 % EC @ 2ml/l; spirotetramat 15.31 % w/w OD @ 1ml/l; and cyantraniliprole 10.26 % OD @ 1.25ml/l. and mostly rely on local shop dealers for advice and used higher doses of insecticides. In T₃-only control treatment. The recommended dose of fertilizers (urea, muriate of potash), minerals (copper, manganese, boron, zinc, etc.) and farm yard manures were applied as and when required during fruiting stage. All IPM inputs like yellow sticky traps, NSKE 5%, and label-claimed insecticides etc., were supplied to the farmers in IPM plots. Demonstration of yellow sticky traps, Kisan ghosti, Farmers field school (FFS), identification, and awareness about leaf miner and their natural enemies were also provided to the farmers. Observations were transformed into square root values to normalize data before statistical analysis. The data is expressed as the mean ± standard error of the mean (Haldhar et al. 2014). Randomized complete block design (RCBD) was used to decrease experimental error.

Table 1. Details of IPM approaches used in IPM, farmer practice and control

Management practice	Details
T ₁ - Integrated pest management (IPM)	Common practices: Deep summer ploughing; pruning the excess branches and bottom leaves of tree for proper ventilation; destruction of rotten and dropped infected fruits; regular monitoring of the orchard to assess the damage of leaf miner. IPM practices: 1. Remove and destroy affected shoots, leaves, and flushes to reduce larval population 2. Growing intercrop with onion/garlic/chickpea between rows of trees which helps in moisture and natural enemies' conservation and reduces irrigation frequency, and suppression of weeds. 3. Installation of yellow sticky traps @ 20/ha placed 1–1.5 m above tree canopy height and distributed uniformly across the orchard. 4. Conservation of natural enemies (Spider, Chrysoperla and Coccinellidae) to enhance their population through ecological engineering (marigold, sunflower etc.). 5. Need-based spray of neem seed kernel extract (NSKE) 5% on young leaves in the months of March, June, and September of kinnow mandarin. 6. If populations of insects are above ETL then use need-based spray of label claim imidacloprid 17.8SL @ 200ml in 500 liter of water and thiamethoxam 25% WG in 50gm/500-liter water to manage leaf miner.
T ₂ - Farmer practice (FP)	1. Generally, farmers do not practice IPM techniques and injudiciously use 8-12 sprays of pesticides such as Quinalphos 25 % EC @ 2ml/l; Spirotetramat 15.31 % w/w OD @ 1ml/l; and Cyantraniliprole 10.26 % OD @ 1.25ml/l. 2. Farmers mostly depend on local shop dealers for advice and use higher than recommended doses of pesticides.
T ₃ - Control	Control

Results and Discussion

From the investigation, it is evident that the IPM approaches used against leaf miner poses significant effect on leaf damage by leaf miner and the seasonal dynamics of leaf miner in IPM compared to Farmer practice and control plots. The effect of validated practices on leaf miner damage and seasonal dynamics was recorded from 11th to 52nd standard meteorological week (SMW) in IPM, FP and control plots and is presented in Table 2. It was evident that least leaf damage of leaf miner (3.07 ± 2.54 , 1.04 ± 0.63 and 1.33 ± 0.37 no. of affected leaves /10 leaves of a shoot) recorded in T₁-IPM compared to T₂-farmer practice (3.87 ± 2.98 , 1.89 ± 0.77 and 2.01 ± 0.45 no. of affected leaves /10 leaves of a shoot) and T₃-control (5.08 ± 3.70 , 2.58 ± 0.92 and 3.13 ± 0.71 no. of affected leaves /10 leaves of a shoot) during 2021, 2022 and 2023, respectively (Table 2). The lowest mean leaf infestation of leaf miner was recorded in T₁-IPM (1.81 ± 1.09) treatment, while the highest mean leaf infestation was noticed in T₂-farmer practice (2.59 ± 1.11) and T₃-control (3.60 ± 1.31) treatments. The highest reduction of leaf infestation over the control was also observed in T₁-IPM (49.72%) compared to T₂-farmer practice (28.05%). In our investigation, the removal and destruction of affected shoots, leaves, and flushes after pruning were found to be effective in reducing larval populations. Similar observations were reported by Zhang et al. (1994), Binglin & Mingdu (1996), and Ateyyat & Mustafa (2001), who found that summer pruning of infested citrus branches reduced larval populations without disturbing parasitized larvae, thereby supporting the findings of our study. In our findings, we observed the influence of growing intercrops (onion/garlic/chickpea) between rows of Kinnow trees that conserve the moisture and natural enemies and reduce unwanted weeds. Use of good agriculture practices like clean cultivation, monitoring of pests, and intercropping of onion, garlic, chickpea helped in reducing the leaf miner infestation and also give favorable conditions for augmentation of beneficial insects (Sreedevi 2010; Gogi et al. 2014; Deka et al. 2016; Hussain et al. 2017; Haldhar et al. 2021), which are supporting findings of our study. Installation of yellow sticky traps @ 20/ha placed 1–1.5 m above tree canopy height and distributed uniformly across the orchard was found effective in monitoring, mass trapping and early detection of leaf miner. Although yellow sticky traps catch only psylla along with adult leaf miner, which indicates the presence of leaf miner. Jawwad et al. (2014) reported that yellow sticky traps exclusively monitored and managed the citrus psylla and adult leaf miner in Florida. The higher populations of beneficial insects (spider, green lacewing and ladybird beetle) were observed when growing of marigold and sunflower between rows of Kinnow mandarin, which also managed the leaf miner. The leaf infestation of leaf miner was started from March, when a new flush started on shoots and persisted till September-October months and significantly reducing the fruit yield of Kinnow. Besides, neem seed kernel extract (NSKE) 5% spray on new

leaves in the months of March-April, June-July and August-September reduced the infestation of leaf miner larvae. The neem extract contains the azadirachtin compound, which reduces the feeding activity and reproduction of many insects. The lowest infestation of leaf miner in Kinnow was recorded in neem extract treatment compared to control after spray of nimbecidine 0.03% (Devi & Yadav, 2024). Similarly, Murthy et al. (2009) studied the efficacy of neem (Azadirachtin) 1500 ppm @ 3 ml/l of water, which also able to reduce the damage of leaf miner. Bermúdez et al. (2020) tested neem extract against leaf miner that caused 77.17% mortality within 48 hours after application. The aqueous extract of neem also inhibits the feeding of larvae and showed 88.80% repellency of adult leaf miner which is also supporting to our findings. Kumar and Biradar (2024) reported the bio-efficacy of bio-rationals against citrus leaf miner in acid lime and found that two applications of neem extract recorded significantly lesser number of live mines/shoots that also corroborates to our investigation. Earlier workers, Gawhale et al. (2018), Ananda (2021) and Kumbhar et al. (2022) also found that azadirachtin (10000 ppm) highly effective in controlling citrus leaf miner on citrus crop. When infestation of leaf miner was observed above ETL then we used need based spray of label claim imidacloprid 17.8SL @ 200ml in 500 liter of water and thiamethoxam 25% WG in 50gm/500 liter water. Devi & Yadav (2024) reported bio-efficacy of different insecticide against leaf miner and found lowest leaf damage with spinosad 45 SC, followed by imidacloprid 17.8 SL and thiamethoxam 25 WG, i.e., 5.46 to 4.78%, 7.73 to 5.35% and 8.28 to 6.23%, respectively. The present investigation is in conformity with the results observed by Anon, 2021, who reported that imidacloprid 17.8 SL (0.003%) and triazophos 40 EC (0.03%) managed citrus leaf miner excellently compared to control plots. Parekh & Virani (2015) noticed that thiamethoxam 0.0125 followed by spinosad 0.018, and imidacloprid 0.00725 were highly effective against citrus leaf miner over control under field conditions. The activity of the Kinnow leaf miner started from March and continuously persisted till December month. The leaf miner appeared during 11th SMW in IPM, farmer practice and in control and reached a peak in 20th, 24th and 42nd SMW during the years of 2021-2023. In some weeks, the infestation declined, but when a new flush started, the damage of leaf miner simultaneously increased (Figure 1). Patel et al. (2013) observed the peak infestation of leaf miner in August and September. Similarly, Sharma et al. (2006) showed the highest leaf miner infestation peak was observed in the months of April-May and August-September, which corroborates the study's findings. Besides, Sharma and Khokhar (2019) noticed that leaf miner infestation started in the month of April and reached on peak in June and August month but declined in July month due to rain. Thereafter, the damage of leaf miner again had an increasing trend and reached a peak in the month of September (15.4

per 10 cm terminal shoot), which also remained in close agreement with our study.

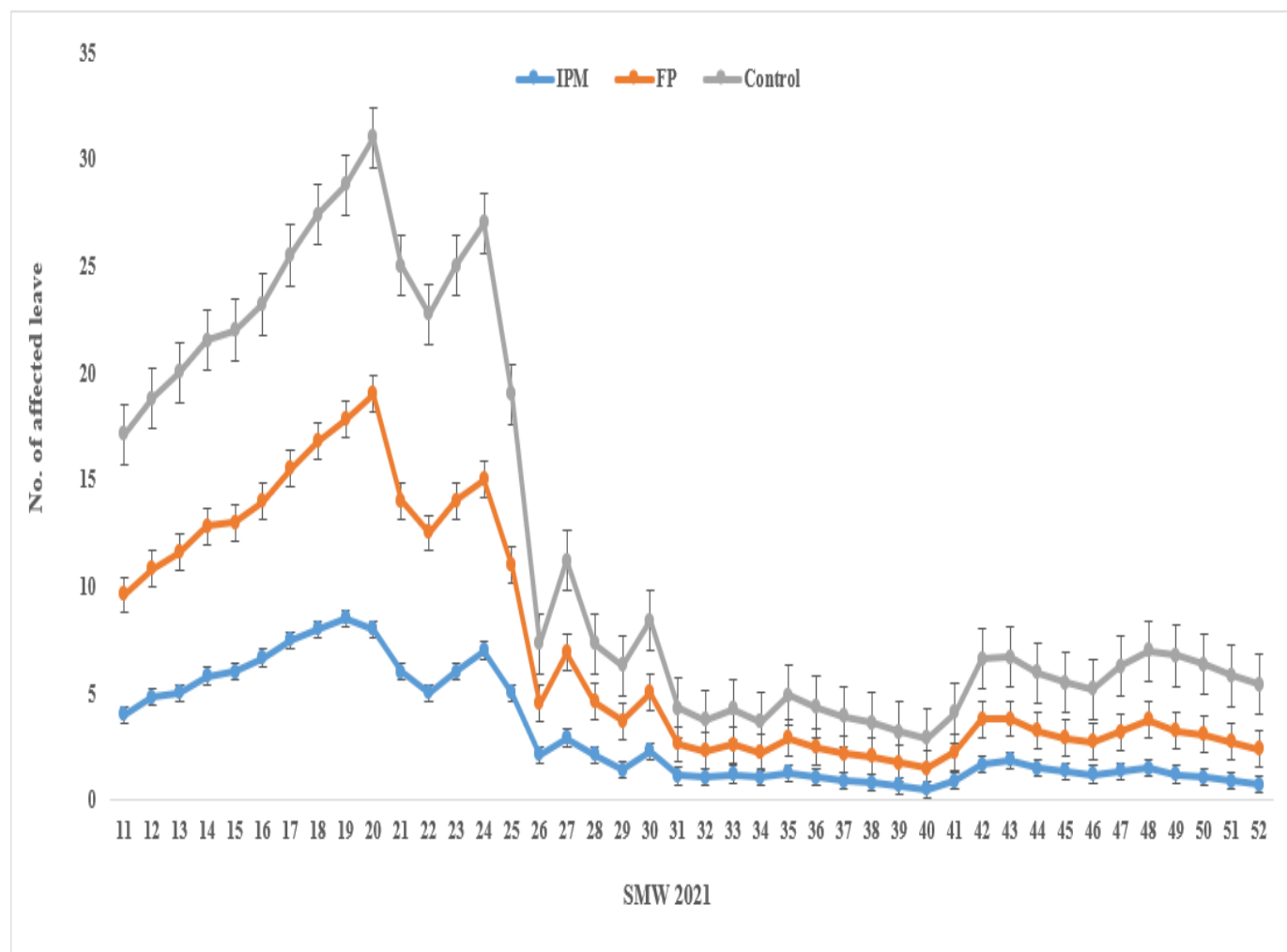
Table 2. Effect of IPM approaches against leaf miner infestation in IPM, FP and Untreated Control plots

SMW	Treatment	2021 Leaf miner (No. of affected leaves /10 leaves of a shoot)	2022 Leaf miner (No. of affected leaves /10 leaves of a shoot)	2023 Leaf miner (No. of affected leaves /10 leaves of a shoot)	Pooled Mean	Reduction of leaf miner infestation over untreated control (%)
11-52	IPM	3.07±2.54	1.04±0.63	1.33±0.37	1.81±1.09	49.72
11-52	FP	3.87±2.98	1.89±0.77	2.01±0.45	2.59±1.11	28.05
11-52	UC	5.08±3.70	2.58±0.92	3.13±0.71	3.60±1.31	-
	SEm(±)	0.06	0.02	0.07	0.23	
	CD at p<0.5	0.15	0.07	0.11	0.12	

UC-Untreated control; Mean of seven replications

Additionally, farmers were trained and empowered with improved knowledge and awareness to adopt effective Integrated Pest Management (IPM) approaches. Demonstrations and application of Neem Seed Kernel Extract (NSKE) 5%, pruning of infested branches and shoots, Farmers' Field Schools (FFS), farmers' ghosthis, and Kinnow Mandarin Day programs were organized to enhance awareness of the farmers. These interventions emphasized critical components of IPM, including leaf

miner and their natural enemies identification, assessment of insect infestation, and implementation of ecologically sustainable insect management strategies. The adoption of IPM approaches significantly reduces the pesticide residues in soil, conserving beneficial insects, and improves farmers' income. Furthermore, it strengthens farmers' decision-making abilities by fostering informed, knowledge-based IPM protection practices.



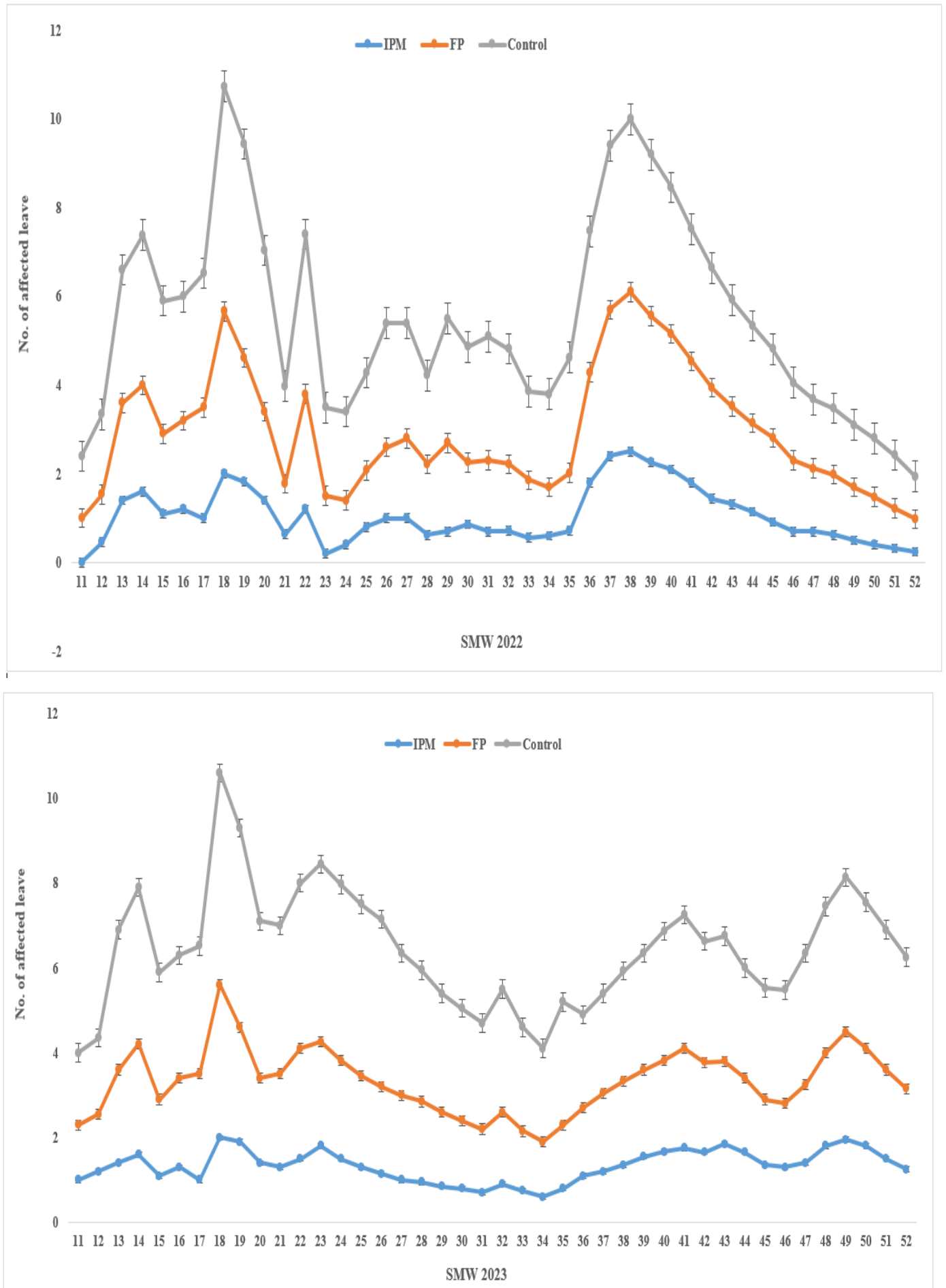


Figure 1. Seasonal dynamics of leaf miner in Kinnow at Hisar, Haryana during 2021-23

Conclusion

To conclude, the present results demonstrate that IPM approaches comprising (cultural, mechanical, and chemical practices) are feasible alternatives for the management of leaf miner. The validated IPM techniques against leaf miner were found to be effective and efficient in IPM compared to the farmer practice. The validated IPM module, like removal and destruction of affected shoots, leaves, and flushes to reduce larval population, followed by spray of neem seed kernel extract (NSKE) @ 5% and imidacloprid 17.8SL @ 200ml in 500 litres of water against leaf miner are thus recommended as a key management approach in Kinnow mandarin.

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Author contribution statement

PNM: Conceptualisation, investigation, final draft preparation. DR: Investigation, formal analysis. NK: Resources. SMH: Estimations, Investigation. RT: proofreading.

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References

- Ananda KR. 2021. Population dynamics, biology and management of citrus leaf miner, *Phyllocnistis citrella* Stainton on acid lime. PhD Thesis, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India.
- Anonymous. 2021. Package of Practices for the Cultivation of Fruit Crops. PAU, Ludhiana. Pp.13.
- Ateyyat MA & Mustafa TM. 2001. Cultural control of citrus leaf miner, *Phyllocnistis citrella* Stainton (Lepidoptera: Gracillariidae) on lemon in Jordan, *International Journal of Pest Management*. 47: 285-288, DOI: 10.1080/09670870110047145.
- Beattie GAC. 1989. Citrus leaf miner. NSW Agric and Fisheries, *Agfact* H2 AE 4:1-4.
- Bermúdez EC, Bernardo NC, Silvia MC, Hugo CAB, Onesimo CL & Nestor BM. 2020. Effect of neem on *Phyllocnistis citrella* Stainton and its parasitoid *Ageniaspis citricola* Logvinovskaya in Ecuador, *Enfoque UTE*, Abr. pp. 1-10. <http://ingenieria.ute.edu.ec/enfoqueute/e-ISSN:1390-6542DOI:10.29019/enfoque.v11n2.519>
- Binglin T & Mingdu M. 1996. Managing the citrus leaf miner in China. In M. A. Hoy (ed.), *Proceedings, International Meeting: Managing the Citrus Leaf miner*, 22-25 April 1996, Orlando, Florida (Gainesville: University of Florida, Gainesville), pp. 49-52.
- Chen J, Shen ZJ, Lu WZ, Liu X, Wu FH, et al. 2017. Leaf miner-induced morphological, physiological and molecular changes in mangrove plant *Avicennia marina* (Forsk.) Vierh. *Tree Physiology*. 37(1):82-97. doi: 10.1093/treephys/tpw097.
- Costa EM, Freitas RMO, Silva PAF & Araujo EL. 2017. Determination of damaged leaf area and physiological responses of melon plants submitted to different infestation levels of *Liriomyza sativae*. *Horticulture Brassica*. 35 (4):571-575. doi: 10.1590/s0102-053620170415.
- Deka S, Kakoti RK, Sabir N, Ahuja DB, Chattopadhyay C & Barbora AC. 2016. Survey and surveillance of insect pests and their natural enemies in Assam. *Journal of Insect Science*. 29:158-161.
- Devi Meenakshi & Yadav SS. 2024. Bio-efficacy and residue of different insecticides against leaf miner, *Phyllocnistis citrella* Stainton and citrus butterfly, *Papilio demoleus* Linnaeus in/on Kinnow mandarin. *International Journal of Research in Agronomy*. 7(12): doi.org/10.33545/2618060X.2024.v7.i12a.2073.
- Dhiman JS, Batra RC & Sharma DR. 2000. Synchronous attack of insect pests and diseases in Kinnow; Hitech citrus management. In *Proc. International Symposium on Citri culture* at Nagpur, (Nov. 23-27), 810-817.
- FAO. 2023. Citrus Fruit-Fresh and Processed Statistical Bulletin. <http://www.fao.org/economic/est.com>.
- Gawhale RP, Sadawarte AK, Ingle YV & Paithankar DH. 2018. Bio-rational management of citrus leaf miner (*Phyllocnistis citrella*) under shade net nursery of Nagpur mandarin. *International Journal of Chemical Studies*. 6(2): 940-942.
- Gogi MD, Arif MJ, Arsad M, Khan MA, Bashir MH, Zia K. et al. 2014. Impact of sowing times, plant to plant distances, sowing methods and Sanitation on Infestation of Melon Fruit Fly (*Bactrocera cucurbitae*) and yield components of 40 Bitter Gourd (*Momordica charantia*). *International Journal of Agriculture Biology*. 16: 521-528.
- Haldha SM, Singh AK & Sarolia DK. 2021. Evaluation of different IPM modules against ber stone weevil, *Aubeus himalayanus* in hot arid region of India. *Journal of Agriculture and Ecology*, 11: 69-77. <https://saaer.org.in/journals/index.php/jae/article/view/379>.
- HDH. 2023. Horticulture Department of Haryana: 2023-24, Horticulture Database, (2023-24). <https://hortharyana.gov.in/en/statistical-data>.
- Hussain MA, Ahmad Tufail, Tekeste Mical, Teklemariam Nahom, Abraham Nardos & Mehari Niyat. 2017. A case study of insect pest complex of citrus and their management at Keren, Eritrea, and a note on their natural enemies, *Journal of Entomological Zoological Studies*. 5, (3): 1226-1230.
- Jawwad A, Qureshi, Lukasz L, Stelinski & Philip AS. 2014. Management of Asian citrus psyllid and citrus leaf miner. Published from *citrus industry*, 12-18.
- Kalidas P & Shivankar VJ. 1994. Final Report of the project "studies on chemical control of insect pests of Nagpur mandarin with special reference to citrus blackfly, psylla and leaf miner. NRCC, Nagpur, pp.35.
- Kranthi KR, Jadhav DR, Kranthi S, Wanjari R, Ali SS & Russell DA. 2002. Insecticide resistance in five major insect pests of cotton in India. *Crop Production*, 21: 449-460.
- Kumar Dileep NT & Biradar AP. 2024. Bio-efficacy of bio-rational against citrus leaf miner (*Phyllocnistis citrella*) in acid lime (*Citrus aurantiifolia*). *Indian Journal of Agricultural Science*. 94 (5): 545-551, doi.org/10.56093/ijas.v94i5.132715.
- Kumbhar RA, Ghonmode IA & Tarate SP. 2022. Bio-efficacy of bio-rational insecticides against citrus leaf miner, *Phyllocnistis citrella* on acid lime. *Journal of Pharmaceutical Innovation*. 11(6): 1943-1947.
- Lotha R & Khurdiya D. 1994. Effect of methods of juice extraction from Kinnow mandarin on the composition and quality of juice, and peel. *Journal of Food Science and Technology*. 31, (5):380-384.
- Murthy KSRK, Reddy AR & Yogi K. 2009. Efficacy of certain eco-friendly pesticides against Citrus butterfly, *Papilio demoleus*. *Indian*, 37(1/2):46-49.

25. Nawaz R, Abbasi NA, Hafiz IA & Khalid A. 2019. Influence of varying environmental conditions on biennial bearing habit of Kinnow fruit (*Citrus nobilis* Lour x *C. deliciosa* Tenora) grown at different clusters in the Punjab province, Pakistan. *Citrus Research Technology*. 40: e1053. doi: 10.4322/crt.17019.
26. Parekh KT & Virani VR. 2015. Seasonal incidence and management of citrus pest complex in Citrus. M. Sc Thesis submitted to Junagadh Agricultural University, Junagadh.
27. Patel, NC, Valand VM, Shekh AM & Patel JR. 2013. Effect of weather factors on activity of citrus leaf-miner (*Phyllocnistis citrella*) infesting lime (*Citrus aurantifolia*). *Indian Journal of Agricultural Sciences*. 64(2).
28. Patil SK. 2013. Evaluation of insecticides against citrus leaf miner, *Phyllocnistis citrella* Stainton in acid lime. *Pest Management of Horticulture Ecosystem*. 19(2):237–239.
29. Sandhu MS. 1964. Bionomics of *Phyllocnistis citrella* Stainton. Doctoral dissertation, Zoology, PAU, Ludhiana.
30. Sharma DR, Singh G, & Devi HS. 2016. Comparative biological studies of citrus leaf miner on Kinnow and rough lemon during different seasons in Punjab. *Indian Ecology Society*. 43(2):491–495.
31. Sharma DR, Singh S & Arora PK. 2007. Current status of insect and mite pests of fruit crops and their management in Punjab. 9. In: 10th Punjab Science Congress, held at DAV Institute of Engineering and Technology, Jalandhar, Punjab.
32. Sharma DR, Singh Sandeep & Arora PK. 2006. Population dynamics and management of citrus leaf miner, *Phyllocnistis citrella* Stainton on Kinnow mandarin. Nat Sem Integ Prod Post Harvest Mgmt Trop Fruit held at Bidhan Chandra Krishi Viswa vidyalaya, Mohanpur Nadia, West Bengal. 44pp.
33. Sharma RK & Khokhar Y. 2019. Studies on seasonal population dynamics of the citrus leaf miner, *Phyllocnistis citrella* Stainton (Lepidoptera: Gracillariidae) on kinnow in the submontaneous region of Punjab. *Journal of Agrometeorology*. 21 (3): 385-387.
34. Singh G. 2014. Bioecology of citrus leaf miner, *Phyllocnistis citrella* Stainton. Doctoral dissertation, Punjab Agricultural University, Ludhiana.
35. Sreedevi K. 2010. Survey and surveillance of insect pests and their natural enemies in acid lime ecosystems of south coastal Andhra Pradesh. *Pest Manage in Horticulture Ecosystem*. 16: 131-135.
36. Zhang A, O'leary C & Quarles W. 1994. Chinese IPM for citrus leaf miner. Update. *IPM Practitioner*, 16, 10-13.
37. Haldhar SM, Choudhary BR, Bhargava R & Sharma SK. 2014. Development of an organic integrated pest management (IPM) module against insect-pests of muskmelon in arid region of Rajasthan, India. *Journal of Experimental Biology and Agricultural Sciences*, 2(1): 19-24.
38. Haldhar SM, Meena PN, Choudhary M, Khokhar M & Singh N. 2025. IPM: an eco-friendly approach for regenerative agriculture. In books: *Regenerative agriculture: strengthening rural livelihoods* (Eds. Rajkhowa D, Haldhar SM, Pande R and Hazarika BN). Biotech Books, New Delhi; pp: 24-64; ISBN-978-81-7622-640-0.