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A REVIEW ON ECOLOGY AND MANAGEMENT OF MAJOR SUCKING PESTS IN OKRA (*Abelmoschus esculentus* L. MOENCH)

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Abstract;*In India, okra (Abelmoschus esculentus L. Moench) is an essential vegetable crop that makes a substantial contribution to the export-oriented economy of the nation. However, a number of sucking pests, including mites, aphids, leafhoppers, and whiteflies, have a significant impact on its yield. During the Kharif 2024 season in Tamil Nadu, this analysis examines the seasonal incidence, population dynamics, and relationship between meteorological conditions and the main sucking pests and their natural antagonists (coccinellids)..Field studies revealed that aphids, leafhoppers, and whiteflies were prevalent throughout the cropping cycle, with peak infestations observed in the 35th, 44th, and 37th Meteorological Weeks (MW), respectively. Coccinellid populations, acting as natural predators, peaked in the 41st MW. Aphid populations were shown to be negatively correlated with rainfall, humidity, and lowest temperature and favourably correlated with maximum temperature, according to correlation analysis. Leafhoppers showed a significant improvement in association with morning relative humidity and maximum temperature, but whitefly populations showed positive correlations with rainfall, maximum temperature, and humidity. The most effective chemical insecticide among management choices was Flonicamid 50 WG, which was followed by Diafenthiuron 50 WP and Dinotefuran 20 SG. In contrast, among biorationals, ginger garlic-green chilli extract outperformed Neem Seed Kernel Extract (NSKE). In order to maintain sustainable okra production, this research highlights the need of integrated pest management (IPM) techniques that take climate considerations and environmentally friendly control approaches into account.*
Keywords*: Okra, Seasonal incidence, Correlation, Temperature, Pest Management*

INTRODUCTION

India's main vegetable crop, okra (Abelmoschus esculentus L. Moench), is commercially significant and accounts for 60% of exports (Reddy et al., 2013). Tropical and subtropical regions of the globe are where it is grown. A traditional vegetable crop, okra is a member of the Malvaceae family. Its sturdy character, nutritional fibres, and unique seed production have earned it the moniker "perfect villager's vegetable" (Kumar et al., 2010). Known locally as "lady's finger," "bhendi," and "okra," it is referred to as the "Queen of Vegetables."It cultivated in all parts of the world with an area and productivity of 2531.557 mha and 41670 kg/ha respectively. Asia shares 69.5% in global okra production (FAOSTAT 2020). In India Gujarat ranks first in okra production (1019.42MT), followed by West Bengal (882.59 MT), Madhya Pradesh (797.71MT), and Odisha (662.64 MT). (INDIASTAT 2021) Okra's area, output, and productivity in Tamilnadu are 22.88 mha, 204.17 MT, and 8.92 MT/ha, respectively. It is a low-lying, tropical crop that can withstand both heat and drought. Widely grown in southern India throughout the summer and rainy seasons, it is sensitive to low nighttime temperatures (Reddy et al., 2013).Okra has good nutritional value, it contains the nutrient composition of crude protein (14.3 – 15.3%), crude fat (1.4-2.1%), crude fibre (16.9-18.2%), carbohydrate (47.1-49.4%) and the minerals such as sodium (7.6-8.7 mg/100g), magnesium (35.7-41.2 mg/100g), potassium (26.5-28.1 mg/100g), calcium (93.2-95.8 mg/100g), iron (1.6-1.8 mg/100g) and zinc (5.2-5.7 mg/100g) (Omoniyi *et al.,* 2020). The commercial fruit output per plant was reduced by 49.30% as a result of insect infestations. According to Kanwar and Ameta (2007), insect pests reduced okra fruit output by 48.97%, or 77.78 q/ha. The pests that suck consisting of leafhoppers, Amrasca biguttula biguttula (Ishida), whiteflies, Bemisia tabaci (Gennadius), aphids, Aphis gossypii (Glover), and mites, Tetranychus cinnabarinus (Koch), which seriously harm the crop. Whiteflies, one of the sucking pests, harm okra economically by feeding on phloem sap and polluting leaves and fruits with honey dew, which leads to the growth of sooty mould (Anderson et al., 2013). Aphids, whiteflies, leafhoppers, thrips, and mites are among the 72 pest species that impact crops in India (Pal et al., 2013). The most common of them are leafhoppers, whiteflies, and aphids (Pal et al., 2013; Das et al., 2021). Whiteflies spread viral infections, particularly in hot weather, whereas leafhoppers induce necrosis and curng on leaves. Weather factors including temperature, humidity, and sun radiation affect the prevalence of these pests (Burade et al., 2019). Developing successful pest control techniques requires an understanding of these factors and patterns of pest activity.

METHODOLOGY

The relevant journal articles, research proceedings, yearly reports, theses, review reports, survey reports, library books, etc., provided the data for this review study. The purpose of the field experiments was to observe the dynamics of the population and relationship between meteorological parameters and the main sucking insect pests of the Arka Anamika type of okra in Baburayanpettai village, Acharapakkam Block, Kanchipuram District, Tamil Nadu, in 2024. Weekly observations of the insect and natural enemy populations were made from five randomly chosen plants, excluding the boundary rows, starting 15 days after sowing (DAS) and continuing until the last harvest. The presence of leafhopper, whitefly, and aphid nymphs and adults was closely inspected on the lower side of a few chosen leaves. Samples were obtained from three leaves, one from each of the top, middle, and bottom canopy, of five randomly chosen plants that were infesting the crops using the sucking pest sampling approach outlined by Singh and Kaushik (1990). Similarly, using 1 cm2 windows made on card board and at three locations on each leaf, the population of the two-spotted spider mite, Tetranychus urticae Koch, was counted on three leaves each from the top, middle, and bottom canopy of each plant. The result was the number of mites per cm2 (Nain et al., 2017).

RESULTS AND DISCUSSION

Seasonal Incidence of Sucking Pest complex of Okra and Their Natural Enemies

The study examined the seasonal occurrence of sucking pests and their natural enemies as well as the impact of environmental variables, such as rainfall, relative humidity in the morning and evening, and temperature (max and min), on the populations of sucking pests and their natural enemies beneath.

Seasonal Incidence of Sucking Pest Complex of Okra and their Natural Enemies during *Kharif*-2024

Table 1 provides information on the seasonal occurrence of the sucking pest complex and its natural adversaries.

Aphids

Aphid populations for okra crops planted in the third week of July 2024 ranged from 3.42 to 17.91 aphids per three leaves/plant throughout the kharif season.Initial aphid presence was observed in the 30^{th} Meteorological Week (MW), roughly 15 days after sowing, with a population of 3.42 aphids per three leaves/plant. This population steadily increased, reaching a peak of 17.91 aphids per three leaves/plant in the 35^{th} MW, which falls within the last week of August. Interestingly, the aphid population remained relatively stable at 17.51 aphids per three leaves/plant until the end of the cropping season. The current results are consistent with those of Parasai and Shastry (2009), who found that the first week of September, or the 37th MW, was when the aphid population was most prevalent. Results about aphids findings also consistent with those published by Thara et al. (2019), who found that the aphid population grew steadily and peaked in the second week of October.

Leafhopper

The leafhopper population began to emerge on the 30th MW of the 2024 kharif season (6.56 leafhoppers/3 leaves/plant). From the 35th MW (17.10 leafhoppers/3 leaves/plant), the leafhopper population steadily declined until increasing once again and peaking in the final the 44th MW, or the week of October (20.45 leafhoppers/3 leaves/plant).During *kharif* 2024 okra crop experienced leafhopper populations ranging from 6.56 to 20.45 leafhoppers/3 leaves.

Mahmood et al. (1990) made similar findings, revealing that leafhoppers began to emerge in June and continued to be active until the conclusion of the crop season. Additionally, the results support the findings of Hegde et al. (2004), who found maximal population from August to September. The current results are consistent with those of Potai and Chandrakar (2018), who found that a single, unique peak of leafhopper activity occurred on the 38th MW and that the main activity period was seen from August to October. However, according to Thara et al. (2019), leafhopper incidence started the second week after sowing and peaked in the fourth week of September (the 39th standard MW).

Whitefly

The number of whiteflies on the okra crop was monitored all season long during the 2024 kharif.The infestation first started from second week of July *i.e.*, 29th MW with initial mean population of 4.52 whitefly/3 leaves/plant. The infestation ranged from 4.52 - 9.67 whitefly/3 leaves/plant. The 37th MW had the most number (9.67 whiteflies/3 leaves/plant/plant). After then, a steady decline in population was seen. The current results are mostly consistent with those of previous studies. According to Yadav and Singh (2013) and Aarwe et al. (2016), the whitefly population peaked in August (the 34th Standard MW).Findings are also corroborated with Potai and Chandrakar (2018) who reported appearance of pest during second week of August and the population reached at its peak in third week of September (38th Standard MW).

Coccinellids

During *kharif* 2024 season, it was observed that the presence of predatory coccinellids throughout the cropping cycle, alongside various pest species. The initial coccinellid population was recorded during the 31st meteorological week (last week of July), *i.e.* 0.82 coccinellids per 3 leaves/plant. Throughout the season, the population fluctuated between 0.82 and 3.51 coccinellids per 3 leaves/plant. The peak coccinellid activity, with a population of 3.51 coccinellids/3 leaves, occurred during the 41st meteorological week.The studies by Purohit et al. (2006) and Singh et al. (2013) corroborate the current results, noting the highest coccinellid activity in the first week of September and the second week of October, respectively. The current findings are consistent with those of Gaikwad et al. (2020) demonstrated that the coccinellid population was first seen during the 31st MW, with a progressive rise in subsequent weeks.

Table 1. Seasonal incidence of sucking pests on okra and their natural enemies during *kharif*-2024

Month	MW	Mean number of sucking pests / 3 leaves / plant			No. of natural enemies / plant
		Aphids	Leafhoppers	Whitefly	Coccinellids (Grubs / Adults)
July-2022	28	0.00	0.00	0.00	0.00
	29	0.00	0.00	4.52	0.00
	30	3.42	6.56	5.17	0.00
	31	4.65	7.89	4.87	0.82
August-2022	32	4.26	9.47	5.07	1.56
	33	5.30	11.96	4.83	1.79
	34	14.63	15.30	4.23	3.23
	35	17.91	17.10	6.62	1.47
September-2022	36	15.24	16.36	7.33	2.14
	37	8.58	14.85	9.67	1.86
	38	9.17	13.67	8.30	1.25
	39	10.42	13.21	7.74	2.64
October-2022	40	13.61	12.78	7.89	2.49
	41	12.01	16.96	4.45	3.51
	42	14.47	17.61	6.82	2.45

	43	16.96	17.46	6.37	2.98
	44	17.51	20.45	7.00	1.37

Correlation of pests and natural enemies with weather parameters during *kharif*-2024

Table 2 shows the correlation coefficients between several meteorological variables and the populations of sucking pests such aphids, leafhoppers, and whiteflies, as well as their natural enemies, the Coccinellids.

Table 2. Correlation of population of aphids, leafhopper, whitefly and natural enemies with weather parameters during *kharif*-2024

Weather parameters	Correlation coefficient value			
	Aphid	Leaf hopper	Whitefly	Coccinellid
Max. Temperature	0.417*	0.271	0.405	0.153
Min. Temperature	-0.560**	-0.532*	-0.252	-0.200
Morning RH	-0.003	0.035	0.235	0.075
Evening RH	-0.609**	-0.472*	-0.286	-0.185
Rainfall (mm)	-0.105	-0.005	0.225	-0.109

*5% level of significance df 15=0.412

**1% level of significance df 15=0.558

The correlation research examined the association between maximum temperature and diverse insect populations. There was a positive relationship between the maximum temperature and the leafhopper, whitefly, and Coccinellid. But these connections weren't.The correlation coefficients were 0.271, 0.405, and 0.153, which means that they were statistically significant. On the other hand, there was a strong positive association (coefficient 0.417*) between the highest temperature and the number of aphids. The minimum temperature exhibited a substantial negative connection with the whitefly (-0.252) and Coccinellid (-0.200). The aphid and leafhopper populations exhibited a substantial negative association with the minimum temperature, with correlation coefficients of -0.560** and -0.532*, respectively. The populations of leafhoppers, whiteflies, and Coccinellids exhibited a positive but statistically insignificant connection with morning relative humidity, with correlation coefficient values of 0.035, 0.235, and 0.075, respectively. Conversely, morning relative humidity had a negative non-significant connection (-0.003) with the aphid. There was a negative link between evening relative humidity, the whitefly, and Coccinellid, but it wasn't significant since the correlation coefficient values were -0.286 and -0.185, respectively. But the number of aphids and leafhoppers was negatively correlated with the evening relative humidity, with correlation coefficient values of (-0.609**) and (-0.472*), respectively. As regards rainfall positive non-significant correlation showed with the whitefly with correlation coefficient value 0.225. Whereas, aphid, leafhopper and coccinellid with correlation coefficient value -0.105, -0.005 and -0.109 respectively showed negative non-significant correlation with rainfall.The correlation studies between pests, natural enemies, and major meteorological parameters during the kharif season indicated a negative link between aphids and minimum temperature, morning relative humidity, evening relative humidity, and rainfall. despite having a positive association with the highest temperature. Dhandge et al. (2018) found that the number of aphids went up as the temperature rose, but down as the humidity rose in the morning and evening. Potai and Chandrakar (2018) demonstrated a negative association between aphids and lowest temperature, corroborating the current results. Another observation by Badotiya et al. (2023) indicated a negative connection between aphid populations and rainfall.There was a positive relationship between leafhopper and the highest temperature and the relative humidity in the morning. Leafhoppers had a negative connection with lowest temperature, nighttime relative humidity, and rainfall. The current results closely align with those of Ratanpara et al. (1994), which indicated a negative association between minimum temperature and leafhoppers. Anitha (2007) found a favourable relationship between leafhoppers and morning relative humidity. Dhandge et al. (2018) discovered that pest populations had a positive connection with maximum temperature and a negative correlation with evening relative humidity.Studies showed that there is a positive relationship between whitefly and the highest temperature, the morning relative humidity, and the amount of rain. There was a negative association between whitefly and lowest temperature as well as nighttime relative humidity. Purohit et al. (2006) reported a positive association between whitefly and all abiotic variables. These results corroborate the findings of Yadav and Singh (2013), which indicated a positive association between whitefly and maximum temperature. Dhandge et al. (2018) also found that the number of pests was negatively correlated with the relative humidity in the evening.The current research demonstrated a negative link between coccinellids and lowest temperature, evening relative humidity, and rainfall, alongside a positive correlation between maximum temperature and morning relative humidity and natural enemies, namely coccinellids. Purohit et al. (2006) reported a link between coccinellids and lowest temperature and rainfall, corroborating the current results. These findings are similar with reports by Dhaka and Pareek (2007) who revealed correlation between Coccinellid and evening relative humidity. Potai and Chandrakar (2018) demonstrated a positive association between aphid populations and morning relative humidity, corroborating the current results.

Management of Sucking Pest of Okra

Table: 3. Botanicals and Insecticides against okra Sucking pests

S. No.	Treatments	Action	References
1	Neem Seed Kernel Extract	Mortality	Bisen *et al.*, 2020
2	Ginger + Garlic + Green chilli extract	Mortality	Iqbal *et al.*, 2015
3	Flonicamid 50 WG	Mortality	Kodandaram *et al.*, 2017
4	Diafenthiuron 50 WP	Mortality	Naveeda *et al.*, 2016
5	Dimethoate 30 EC	Mortality	Bisen *et al.*, 2020
6	Dinotefuran 20 SG	Mortality	Venkateshalu *et al.*, 2017
7	Untreated control		

CONCLUSION

In kharif 2024, the okra crop was attacked by a number of pests all season long. Aphids initially showed up in the third week of July (30th MW) and reached their highest number of 17.91 individuals per three leaves per plant in the final week of August (35th MW). Leafhoppers There were also some of them throughout season, with their numbers ranging from 6.56 to 20.45 individuals per three leaves per plant. The final week of October was the most active week for them(44th MW). There were between 4.52 to 9.67 whiteflies per three leaves per plant. The most activity was seen in the second week of September (37th MW). Coccinellids, which are natural predators of these pests, showed up in the final week of July (31st MW) and reached their greatest population density of 3.51 individuals per three leaves per plant in the second week of October (41st MW). The correlation studies conducted between pests, natural enemies, and significant weather parameters during the kharif season indicated a negative correlation of aphids with minimum temperature, morning relative humidity, evening relative humidity, and rainfall, alongside a positive correlation with maximum temperature. There was a positive association between leafhopper and maximum temperature and morning relative humidity. On the other hand, leafhoppers had a negative link with the lowest temperature, the relative humidity in the evening, and the amount of rain. Research showed that whitefly is positively related to maximum temperature, morning relative humidity, and rainfall.While, there was negative correlation of whitefly and minimum temperature and evening relative humidity. The current research demonstrated a negative link between coccinellids and lowest temperature, evening relative humidity, and rainfall, with a positive correlation between maximum temperature and morning relative humidity with natural factors. adversaries, which are coccinellids.This review represents the comparative study of different insecticides and biorationals like Flonicamid 50WG, Diafenthiuron 50 WP, Dimethoate 30 EC, Dinotefuran 20 SG, Neem Seed Kernel Extract and Ginger + Garlic + Green chilli extract. Flonicamid 50 WG @ 0.4 g/l was the most effective pesticide for getting rid of the least amount of pests. This was followed by diafenthiuron 50 WP @ 0.6 g/l, dinotefuran 20 SG @ 0.3 g/l, and dimethoate 30 EC @ 2 ml/l.The biorationals were less effective compared to other insecticides.

Among the biorationals ginger garlic green chilli extract @ 5% was found most effective followed by NSKE @ 5%. Flonicamid is a very specific pesticide that works against a wide variety of aphids and other sucking pests. Its method of action is distinct from that of neonicotinoids, which work as agonists on the insect nicotinic acetylcholine receptor (Nauen et al., 2003 and Tomizawa et al.). al., 2007). Diafenthiuron, a thiourea derivative, was identified as the most effective pesticide, surpassing thiamethoxam and dimethoate. Diafenthiuron is effective against sucking pests such aphids, whiteflies, and mites (Streibert et al., 1988 and Ishaaya et al., 1993). According to Anon. (2006), a 5% extract of ginger, garlic, and green chilli proved efficient against leafhoppers in okra. Plant extracts of NSKE 5% and garlic extract 5% were the most efficient against leafhoppers in okra (Iqbal, 2011).

REFERENCES

1. Aarwe R., Pachori, R., Sharma, A.K., Thakur, A.S. and Mandloi, R. 2016. Impact of weather factors on the incidence of major insect pests of okra (*Abelmoschus esculentus.* L Moench). *International Journal of Agricultural Science,* 8(3): 981-983.
2. Anderson, L, and MK Gugerty. 2013. "Control Strategies for Whitefly as a Vector *Elysia Slakie*, Caitlin McKee, Angela Gaffney." *Evans School Policy Analysis and Research,* 1-9.
3. Anitha, K.R. 2007. Seasonal incidence and management of sucking pest of okra. M.Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharwad, Karnataka, India.
4. Anonymous. 2006. “Package of practices for organic cultivation of rice, groundnut and okra.” Centre for Knowledge Systems, 93-108.
5. Badotiya, S.K., Meena, B.S., Singh, R.N. and Sharma, P. 2023. Seasonal incidence of sucking pests of okra (*Abelmoschus esculentus* L.) *The Pharma Innovation Journal,* 12(3): 1643-1645.
6. Bisen, A. V., Sonalkar, V. U., Naikwadi, B. V., & Bhure, K. (2020). Management of major sucking pests in okra, Abelmoschus esculentus using different management modules. *Journal Entomology and Zoology Studies*, 8(4), 1714-1722.
7. Burade D.D., Khobragade A.M. and Shinde P.B. (2019). Influence of weather parameters on pest of okra in Parbhani Kranti variety. *International Journal of Current Microbiology and Applied Sciences*, 8: 806-812.
8. Das R., Saikia D.K., Devee A. and Ahmed S.S. (2021). Succession of Major Pests and Predators in Okra (*Abelmoschus esculentus* (L.) Moench) Ecosystem. *International Journal of Current Microbiology and Applied Sciences*, 10: 2174-2183.
9. Dhaka, S.R and Pareek, B.L. 2007. Weather factors influencing population dynamics of major insect pests of Cotton undet semi-arid agro ecosystem. *Indian Journal of Entomology,* 70(2): 157-163.
10. Dhandge, S.R., Bangale, S.A., Vaja, A.S. and Virani, V.R. 2018. Seasonal Incidence of Sucking Pest of Okra and its Relationship with Weather Parameters in Summer Season. *International Journal of Current Microbiology and Applied Sciences*, 7(11): 2697-2704.
11. Elkhalifa, AEO, E Alshammari, M Adnan, JC Alcantara, AM Awadelkareem, NE Eltoum, K Mehmood, BP Panda, and SA Ashraf. 2021. "Okra (*Abelmoschus esculentus*) as a potential dietary medicine with nutraceutical importance for sustainable health applications." *Molecules,* 26 (3):696.
12. Faostat, F. 2020. “Agriculture organization of the united nations statistics division. *Economic and Social Development Department, Rome, Italy. Available online: http://faostat3.fao.org/home/E.*
13. Gaikwad, B.B., Bhosle, B.B. and Sapkal, S.D. 2020. Seasonal incidence of natural enemies of insect pests on okra. *Journal of Entomology and Zoology Studies,* 8(3): 365-368.
14. Hegde, M., Srinivasa, M., Biradar, D.P., Udikeri, S.S. and Khadi, B.M.(2004). Seasonal incidence of key insect pests and their natural enemies on cotton at Siriguppa. *International Symposium Start for Sustainable Cotton Production* - A Global vision, 23-25, Karnataka, India, pp. 114-115.
15. INDIASTAT 2021. http://www.indiastatagri.com/data/agriculture/agricultural-production.
16. Iqbal, J, M ul Hasan, M Ashfaq, and M Nadeem. 2011. "Association of chemical components of okra with its resistance against Amrasca biguttula biguttula (Ishida)". *Pakistan Journal of Zoology,* 43(6):1141-1145.
17. Iqbal, J., Ali, H., Hassan, M. W., & Jamil, M. (2015). Evaluation of indigenous plant extracts against sucking insect pests of okra crop. *Pakistan Entomologist*, 37(1), 39-44.
18. Ishaaya, I, Zmira Mendelson, and AR Horowitz. 1993. "Toxicity and growth-suppression exerted by diafenthiuron in the sweetpotato whitefly, *Bemisia tabaci*." *Phytoparasitica.* 21(3):199-204.
19. Jayarao, B, BA Khadar, L Naik, and MM Vinaykumar. 2015. "Assessment of biology and morphometric characteristics of different stages of leafhopper, *Amrasca biguttula biguttula* (Ishida) on okra." *The Bioscan,* 10(2):671-674.
20. Kedar, SC, RK Saini, and KM Kumaranag. 2014. "Biology of cotton whitefly, *Bemisia tabaci* (Hemiptera: Aleyrodidae) on cotton." *Journal of Entomological Research,* 38(2):135- 139.
21. Kodandaram, M. H., Kumar, Y. B., Banerjee, K., Hingmire, S., Rai, A. B., & Singh, B. (2017). Field bioefficacy, phytotoxicity and residue dynamics of the insecticide flonicamid (50 WG) in okra [*Abelmoschus esculenta* (L) Moench]. *Crop protection*, 94: 13-19.
22. Kumar, S, S Dagnoko, A Haougui, A Ratnadass, N Pasternak, and C Kouame. 2010. "Okra (*Abelmoschus spp.*) in West and Central Africa: Potential and progress on its improvement." *African Journal of Agricultural Research,* 5(25): 3590-3598.
23. Mahmood, T., Khokhar, K.M., Banaras, M. and Ashraf, M. 1990. Effect of environmental factor on the density of leafhopper *Amrasca devastans* (Distant) on okra. *Tropical Pest Management.,* 36: 282-284.

24. Nain J, Singh R, Rathee M, Gulati R. 2017. Population dynamics of two spotted spider mite, Tetranychus urticae Koch (Acarina: Tetranychidae) on okra. *Indian Journal of Entomology*, 79(1):21-26.
25. Nauen, R, U Ebbinghaus-Kintscher, V Salgado, and M Kaussmann. 2003. "Thiamethoxam is a neonicotinoid precursor converted to clothianidin in insects and plants."*Pesticide biochemistry and physiology,* 76(2):55-69.
26. Naveeda, S., Srivastava, V. K., & Bhadauria, N. S. (2016). Efficacy of Newer Insecticides and Bioagents Against Sucking Pests of Okra. *Advances in Life Sciences*, *5*(6), 2172- 2179.
27. Omoniyi, SA, AM Muhammad, and R Ayuba. 2020. "Nutrient composition and anti- nutritional properties of okra (*Abelmoschus esculentus*) calyx flour." *Nutrition & Food Science*, 15(1): 30-40.
28. Pal S., Maji T.B. and Mondal P. 2013. Incidence of insect pest on okra, *Abelmoschus esculentus* (L.) Moench in red lateritic zone of West Bengal. Journal of Plant Protection Sciences, 5: 59-64.
29. Parasai, S.K. and Shastry, P.P. 2009. Seasonal incidence of key pests and their natural enemies on cotton. National Symposium on *Bt* cotton: Opportunities and Prospects at CICR, Nagpur, November, 17-18. pp. 25-126.
30. Potai, A. and Chandrakar, G. 2018. Studies on Seasonal Incidence of Major Insect Pests and its Natural Enemies on Okra and Correlation with Weather Parameters. *International Journal of Current Microbiology and Applied Sciences,* 6: 204-210.
31. Purohit, D., Ameta, O.P. and Sarangdevot, S.S. 2006. Seasonal incidence of major insect pests of cotton and their natural enemies. *Pestology,* 30(12): 24-29.
32. Purohit, D., Ameta, O.P. and Sarangdevot, S.S. 2006. Seasonal incidence of major insect pests of cotton and their natural enemies. *Pestology,* 30(12): 24-29.
33. Rai, S, M Hossain, and F Hossain. 2012. "Evaluation of okra [*Abelmoschus esculentus* (Moench) L.] as bast fibre crop." *Journal of Crop and Weed,* 8(1):101-104.
34. Ratanpara, A.M., Shekh, J.R., Patel and Patel, N.M., 1994. Effect of weather parameters on brinjal leafhopper *Amrasca biguttula biguttula* (Ishida). *Gujarat Agriculture Journal,* 19(2): 39-43.
35. Reddy, M, K Babu, M Ganesh, K Reddy, H Begum, R Reddy, and J Babu. 2013. "Correlation and path coefficient analysis of quantitative characters in okra (*Abelmoschus esculentus* (L.) Moench)." *Songklanakarin Journal of Science & Technology,* 35 (3):243-250.
36. Shah, D, and A Shukla. 2014. "Chemical control of two-spotted spider mite, *Tetranychus urticae* (Koch.) infesting gerbera (*Gerbera jamesonii* L.) under polyhouse condition." *Pest Management in Horticultural Ecosystems* 20(2):155-161.
37. Shah, MAS, TK Singh, and RK Radhakrishore. 2009. "Comparative biology of cotton aphid, *Aphis gossypii* Glover (Homoptera-Aphididae) on okra and brinjal". *Journal of Experimental Zoology, India* 12(2):373-375.
38. Singh G, Kaushik S. 1990. Comparative efficiency of sampling techniques for jassid population estimation on okra, Indian Journal of Ecology, 17:58-60.
39. Singh, Y., Jha, A., Verma, S., Mishra, V.K. and Singh, S.S. 2013. Population dynamics of sucking insect pests and its natural enemies on okra agro-ecosystem in Chitrakout region. *African Journal of Agricultural Research*, 8(28): 3814-3819.
40. Streibert, HP, J Drabek, and A Rindlisbacher. 1988. "Diafenthiuron: A new type of acaricidel insecticide for the control of the sucking pest complex in cotton and other crops." *Brighton Crop Protection Conference-Pest and Diseases*, 1988, 25. U.K.
41. Thara, K.T., Sharanabasappa, Narasa Reddy, G., and Girish, B.R. 2019. Seasonal incidence of sucking insect pests on okra agro-ecosystem. *Journal of Pharmacognosy and Phytochemistry*, 8(1): 2568-2571.
42. Tomizawa, M, D Maltby, K Medzihradszky, N Zhang, K Durkin, J Presley, T Talley, P Taylor, A Burlingame, and J Casida. 2007. "Defining nicotinic agonist binding surfaces through photoaffinity labeling." *Biochemistry,* 46(30):8798-8806.
43. Venkateshalu, V., & Mahesh Math, M. M. (2017). Bio-efficacy of dinotefuran 20 per cent SG against sucking insect pests of okra. *Asian Journal of Bioscience,* 12(1): 8-14.
44. Yadav, K. and Singh, R.P. 2013. Seasonal incidence of insect pests of okra. *Plant Archives*, 22(2): 37-40.