AgriCos e-Newsletter
ISSN: 2582-7049
AgriCos e-Newsletter
Open Access Multidisciplinary Monthly Online Magazine
Volume: 04 Issue: 12 December 2023 Article No: 28

Integrated Pest Management in Medicinal Crops

Metia T.[1], Anokhe A.[2] and Priyanshu Pawar[3]
[1] M.Sc. Scholar, Division of Plant Pathology, ICAR-Indian Agricultural Research Institute Jharkhand
[2]Scientist, Division of Entomology, ICAR-Indian Agricultural Research Institute, New Delhi
[3]Ph.D., Scholar, Department of Entomology, Jawaharlal Nehru Krishi Vishwavidyalaya Jabalpur, (M.P.)

SUMMARY

Medicinal plants occupy an important position in the sociocultural, health care and spiritual arena of rural people of India Globally also, they constitute one of the integral parts of the biodiversity, ecosystem and biological heritage. These are in use since antiquity for the treatment of many diseases in traditional and recognized systems of healthcare and for therapeutic products in pharmaceutical industry besides as sources of fat, essential oil, bio-pesticide, resin, protein, vitamin, condiment, spice, timber, fibres and other useful substances. They also generate income to the people of many Asian countries, who earn their livelihood from selling collected materials from the forest or by cultivating on their farms. However, when cultivated in large areas and in new areas to meet the increasing demand for pharmaceutical industries, several biotic factors like insects, mites, disease causing organisms, nematodes and abiotic factors limit their successful cultivation. Among these factors insects and mites are key components that cause considerable damage to these plants and sometimes the entire crop could be lost due to their increasing population. Hence, conservation and protection of medicinal plants from the ravages of pests is a daunting task. As the chemicals used for the management of pests are toxic and could depreciate the therapeutic values of these plants, their use needs utmost care. Integrated pest management is the best strategy that could be tapped upon as it involves monitoring of pest populations below economic threshold levels, identify and choose combination tactics to keep the pest population at bay.

INTRODUCTION

Medicinal plants, also called medicinal herbs, have been discovered and used in traditional medicine practices since prehistoric times. Plants synthesise hundreds of chemical compounds for functions including defence against insects, fungi, diseases, and herbivorous mammals. Numerous phytochemicals with potential or established biological activity have been identified. The World Health Organization (WHO) estimated that 80% of the population of developing countries relies on traditional medicines, mostly plant drugs for their primary health care needs. Medicinal plants are the major components of all indigenous or alternative systems of medicine (ayurveda, homoeopathy and naturopathy). Demand for herbal drugs is increasing throughout the world due to growing recognition of natural plant-based products, being nontoxic, having no side effects, easily available at affordable prices and some-times the only source of health care available to the poor. Hence, medicinal plant sector has traditionally occupied an important position in the socio-cultural, spiritual, economic values of rural and tribal lives of both developing and developed countries.

Major insect pests of medicinal plants

These medicinal plants when cultivated in large areas and in new areas, they are much prone to attack by different insect pests including mites that cause considerable damage and limit their successful cultivation. Following is the list of some major pests of the important medicinal plants. [National Medicinal Plants Board, Government of India]

Sl.No.	Medicinal Crop	Important Insect Pests
1	**Amla** (Phyllanthus emblica)	Gooseberry aphid, (*Schoutedenia emblica), S*tone borer (*Curculio sp.),* Fruit midge (*Clinodiplosis sp*), Shoot gall maker (*Betousa stylophora),* Mealybugs (*Nipaecoccu sviridis, N. vestator and Ferrisia virgata*).
2	**Ashwagandha** (Withania somnifera)	Epilachna beetle (*Henosepilachna vigintioctopunctata*), Cut worm, *Agrotis* sp, Fruit borer, *Helicoverpa armigera*

3	**Noni** (*Morinda citrifolia)*	Lacewing Bug (*Dulinius conchatus), Black Fly (Aleurocanthus terminaliae),* Southern Green Sting Bug (*Nezara gramineae),* Mealybug (*Maconellicoccus hirsutus* and *Planococcus citri*)
4	**Kalihari** (*Gloriosa superba*)	Thrips (*Thrips tabaci),* Lily Caterpillar *(Polytela gloriosae),* Semilooper *(Plusia signata),* Tobacco Caterpillar (*Spodoptera litura),*
5	**Makoi** (*Solanum nigrum*)	Mealybugs: *Paracoccus marginatus* & *Phenacoccus solenopsis,* Aphids *(Aphis craccivora),* Red Spider Mite (*Tetranychus urticae),* Yellow Mite *(Polyphagotarsonemus latus),* Red cotton bug (*Dysdercus cingulatus)*
6	**Coleus** (*Coleus barbatus Benth*)	Mealybug: *Coccidohystrix insolita* & *Paracoccus marginatus,* Fruit Borers (*Leucinodes orbonalis*, *Helicoverpa armigera*), Tingid Bug (*Monanthia globulifera*), Tea Mosquito Bug (*Helopeltis antonii*), Thrips (*Scirtothrips dorsalis)*
7	**Senna** (*Cassia angustifolia*)	Aphids (*Aphis craccivora),* Pierid Butterfly *Catopsilia pyranthe* & *Eurema hecabe),* Pod Borer *(Etiella zinckenella)*
9	**Aloe vera** (Ghrit kumari)	Aloe vera aphid (*Aloephagus myersi*), Spider mite (*Eriophyes aloines),*
10	**Shatavari,** (*Asparagus racemosus)*	Chrysomelid beetle, (*Lema* sp),
11	**Sarpagandha** (*Rauwolfia serpentina)*	Lab lab bug (*Riptortus pedestris),* Weevil (*Indomia cretaceous*), Sphingid (*Deilephila nerii),* Bug (*Riptortus pedestris*)
13	**Brahmi** (*Bacopa monnieri*)	*Spodoptera litura*
12	**Mint** (*Mentha piperita)*	*Thanatus albini*, *Aphids (Aphis gossypii & Aphis nerri), Thrips (Frankliniella tritici)*
15	**Belladona** (*Atropa belladona*)	Thrips (*Taeniothrips atratus),* larvae of *(Barathra brassicae* Li. and *Heliothis peltigera),* Leaf Defoliator (*Archips micaceana*)
16	**Tulsi** (*Ocimum sanctum*)	Lace bug (*Monanthia globulifera),* Black headed hairy caterpillar (*Spilosoma oblique),* Tingid bugs, (*Cochlochilo bullita)*
17	**Blond psyllium** (*Plantago ovata*)	Tiger moth (*Amsacta moorei),* cotton aphid (*Aphis gossypii*), Seed Beetle (*Lasioderma serricorne*), Tobacco caterpillar (*Spodoptera litura*)
18	**Bael** (*Aegle marmelos*)	Green leaf hopper (*Nephotettix virescens)*
19	**Safed Musli** (*Chlorophytum borivillianum*)	Mole cricket (*Gryllotalpa orientalis*), White grubs (*Holotrichia spp.*), Armyworm (*Spodoptera mauritia)*
20	**Arjun** (*Terminalia arjuna*)	Flat headed borer (*Sphenoptera cupriventris* & *Indarbela quadrinotatais)*
21	**Chandan** (*Santalum album*)	Leaf webber (*Cacoecia micacaena),* Defoliator (*Letana inflata),* Aphids (*Jassus indicus),* Thrips (*Crotonothirips davidi* & *Mesothrips marii)*
22	**Dalchini**	Cinnamon butterfly (*Papilio clytia*)

	(*Cinnanamomum zeylanicium*)	
23	**Bach** (Acorus calamus)	Mealy bugs and caterpillars
24	**Gambhari** (*Gmelina arborea*)	Leaf defoliator (*Calopepla leayana*, Shoot weevil (*Alcides gmelinae),* Trunk Borer *(Dihammus cervinus)*
25	**Kokum** (Garcinia indica)	Leaf miner and mealy bugs
26	**Pippali** (*Piper longum*)	Mealy bugs (*Helopeltis theiveora)*
27	**Tejpat** (Cinnamomum tamala)	Common mime/ Cinnamon butterfly (*Chilasa clytia*), Leaf miner (*Conopomorpha civica, Phyllocnistis chrysophthalma* & *Acrocercops spp*.), Chafer beetle (*Popillia complanata)*
28	**Periwinkle** (*Catharanthus roseus)*	Oleander Hawk Moth (*Deilephila nerii*), Blister Beetle (*Mylabris pustulata*)

Integrated Pest Management

It is a decision-based process involving coordinated use of multiple tactics for optimizing the control of all classes of pests (insects, pathogens, weeds, vertebrates) in an ecologically and economically sound manner. These include cultural, mechanical, physical, biological and chemical management methods in combination or alone to arrest the pest population. The practices or the tactics used to manage these pests on medicinal crops that could be integrated and are eco-friendly are discussed here. [1]

Cultural Practices

- Solanaceous plants serve as alternate host for H. vigintioctopunctata, its infestation can be reduced on Ashwagandha by removing alternate host
- By changing the time of sowing of Senna to Second week of July, damage of C. pyranthe can be minimized
- Infestation of leaf roller, Psora stultalis and leaf webber, Pronomis profusalis on Patchouli can be reduced by removing and destroying infested leaves
- Removal of plants of Ashwagandha, Black isabgol, Abutilon, Solanum etc infested with mealybug and destroying of same will check its further spread
- Removal of plants of basil can reduce the further spread of mite infestation
- Summer ploughing in Sarpagandha exposes the larvae and pupa of Agrotis sp. to avian predators
- Deep ploughing after harvest to expose the diapausing larvae have been recommended against stone borer, Curculio sp. and fruit midge, Clinodiplosis sp. for Indian gooseberry. [1]

Mechanical Practices

- This method is very effective in control of Lepidopteran, Hemipteran and Coleopteran pests.
- Collection and destruction of fallen fruits reduce fruit fly population.
- Collection of egg masses and early instar larvae and killing them effectively reduce the population of foliage caterpillars and Epilachna Beetle.
- Plants infested with sucking pest like scales, aphids, mealy bugs, mites, true bugs are removed either completely or the part infested and destroyed.
- Use of light traps to attract lepidopteran moths whose larvae are defoliators/borers and yellow sticky traps for aphids are another mean of mechanical control.

Chemical Control

- To check severe damage from feeding of Epilachna beetle, H. vigintioctopunctata on Indian ginseng, quinalphos (25EC) at 2 ml l−1 is recommended

- This practice followed by spraying of chlorpyriphos (0.05%) at the beginning of crop season can help to avoid further gall midge attack
- Spraying of carbaryl (0.2%) or quinalphos (0.05%) were effective against stone borer and fruit midge'
- Further, spraying of dimethoate 30 EC (0.06%) or Spinosad (0.25 ml/l) was recommended whenever there is severe infestation of mealybugs (Nipaecoccu sviridis, N. vestator and Ferrisia virgata).
- The most effective way to control armyworm, Spodoptera mauritia, which severely affect the musli leaves is spraying of any of the following insecticides on early larval stages, e.g. chlorpyriphos (20EC) at 2.5 l ha−1, quinalphos (25EC) at 2 l ha−1, triazophos (40EC) at 2 l ha−1, dichlorvos (76SL) at 600 ml ha−1.
- Botanicals
- In Indian ginseng, cutworms can effectively be controlled by integrating hand picking of larvae, poison baiting to lure and then killing them, and by spraying of 5% NSKE at 500 l ha−1[7]
- For red spider mite 5% cow urine, 2% NO, 5% NSKE, 5% M. pinnata seed extract, 5% Datura stramonium L. leaf extract, 5% Calotropis procera leaf extract reported maximum reduction in plant damage (71–76%) with higher yield (3.5–3.9 q ha−1).
- Similarly foliar spray of NSKE 5% at 15 days interval during early stage of infestation reduces the damage of H. vigintioctopunctata in Ashwagandha.
- Azadirachtin 1% is found most effective for the control of hadda beetle on Ashwagandha & tropical pierid butterfly on Senna
- NSKE (0.045%) containing 1500 ppm of azadirachtin completely destroyed gooseberry aphid, Schoutedenia emblica populations on Indian gooseberry a week after spraying

Biological Control

- For Gram caterpillar, Helicoverpa armigera it is suggested the field release of T. chilonis at 100,000 eggs ha−1, spraying of Bt at 0.5 kg ha−1 or Helicoverpa nuclear polyhedrosis virus (NPV) at 250 larval equivalent ha−1 and installation of pheromone traps (12 traps ha−1)[7]
- Mealybugs can be managed by releasing parasitoids viz., Acerophagus papaya against Paracoccus marginatus infesting Withania somnifera & Solanum nigrum.[4]
- Chrysoperla carnea 50,000 eggs/ha (three releases on 15 and 30 DAS, 15 DAH); T. chilonis 6.25 cc/ha (two releases on 45 and 60 DAS);
- B. thuringiensis 750 g/ha (three sprays on 50 and 80 DAS, 50 DAH); neem oil 3% (three sprays on 20, 40 and 70 DAS);
- Bio-intensive module
- Use of bio-intensive module consisting of vermicompost 2 t/ha + karanj cake 250 Kg/ha + bio-fertilisers 2 Kg/ha + NPK (40:40:40 Kg/ha).[4]
- Frapioned Triterpenoids 4% + Neem oil 0.22% was most effective for the control of aphids on isabgol [4]
- Profenophos was effective in managing the sucking pests and defoliators of S. nigrum with maximum leaf yield (21.75 kg leaf /12m2 / harvest) and among the botanicals, azadirachtin (1%) and aqueous extract of Andrographis paniculata (2%) recorded maximum reduction in the pest population.[4]
- Soil application before planting, of a mixture of vermi-compost at 2 t ha−1 + cake of M. pinnata at 250 kg ha−1 + biofertilizer at 2 kg ha−1, and fertilizer containing 20 kg nitrogen + 60 kg phosphorus + 50 kg potash ha−1[4]

CONCLUSION

Since in most cases, biomass of medicinal plants forms a major source of raw material for pharmaceutical industries, protection during early stages of plant development becomes imperative A pest-management program could be enhanced by adopting prevention and suppression techniques. The methods that are most effective and environmentally friendly have to be selected while implementing IPM program in order to minimize the health hazards. Therefore, the future package of practices should be based on the principles of integrated management. Despite the information readily available to farming communities in some developing countries, plant protection measures are not readily perceived, accepted and adopted by planters. Extension activities in crop growing areas may therefore play a significant role in educating farmers, traders and industrialists as well

REFERENCES

1. Babu, N., Srivastava, S. K., Prusty, M., & Sahoo, T. (2016). Medicinal and aromatic plant production technologies: A step towards farm women prosperity.

2. Chowti, S. P., Rudrapur, S., & Naik, B. K. (2018). Production scenario of medicinal and aromatic crops in India. Journal of pharmacognosy and phytochemistry, 7(3S), 274-277.
3. Gahukar, R. T. (2018). Management of pests and diseases of important tropical/subtropical medicinal and aromatic plants: A review. Journal of Applied Research on Medicinal and Aromatic Plants, 9, 1-18.
4. Marimuthu, T., Suganthy, M., & Nakkeeran, S. (2018). Common pests and diseases of medicinal plants and strategies to manage them. New Age Herbals: Resource, Quality and Pharmacognosy, 289-312.
5. MH, S. K., Srinivas, M. P., Hanumatharaya, L., & Revannavar, R. (2018). A review on integrated pest management in medicinal and aromatic plants in India. Journal of Pharmacognosy and Phytochemistry, 7(3S), 220-224.
6. Mishra, P. P., & Sasmal, A. (2020). Pests of Medicinal and Aromatic Plants and Their Integrated Pest Management Techniques. Applied Entomology and Zoology, 15.
7. Sharma, P. C., Kumar, A., Mehta, P. K., & Singh, R. (2014). Survey studies on insect-pests associated with important medicinal plants in Himachal Pradesh. Indian J Sci Res Technol, 2(4), 2-7.