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INSECT PEST PROBLEM IN MEDICINAL PLANTS - A REVIEW

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ABSTRACT

Medicinal plants now a days are being cultivated in the fields to meet the increasing demand for pharmaceutical industries. Like any other plants, medicinal plants too have to bear the devastating attacks of injurious insect pests. Information in this review has, therefore, been presented on survey, incidence and population levels, nature and extent of damage of different insect pests on different medicinal plants.

The plants have been used to cure diseases since antiquity. The ancient Indians were having a vast knowledge of medicinal plants. This is evident from the ancient treatise such as *Materia Medica, Nighantus and Koshas. Rigveda*, which is supposed to be written between 4500 BC and 1600 BC has also mentioned plants with medicinal properties. In India, the Ayurvedic system of medicines flourished from vedic period down to the invasion by Mohammadans. During the twentieth century, there occurred a tremendous development in the field of synthetic drugs. Inspite of this, their side effects forced people towards the natural products. Besides their safety, there are certain diseases for which permanent cure is possible only by drugs of plant origin. Therefore, considerable revival of the use of plants for medical purposes has taken place throughout the world, because of common feeling that anything from nature is safer to synthetics. For the sustained supply of the raw materials for pharmaceutical industries and preventing them from becoming extinct, these days major emphasis is being laid on their cultivation.

The medicinal plants are grown on a large scale away from their natural conditions, in cultivated fields. These plants in a new situation may prove ideal food for indigenous herbivores, thus,constituting pest problems. Introduction of exotic pests into a new area along with the crop may also produce disastrous results. In a new area, these exotic pests grow in an unrestricted manner in the absence of their natural enemies and cause adverse effects on the quality as well as quantity of the produce. The epidemics of pests sometimes result in the complete failure of the crop. Therefore, various management strategies are adopted for increasing productivity and quality of medicinal plants. But, before adoption of any pest control methods, assessment of population as well as estimation of the damage caused are necessary, in order to determine their pest status. Practically, not much attention has been paid so far to the insect pest problems of medicinal plants.

Insect pests generally infest their hosts to a lesser extent in their natural homes. Medicinal plants now-a-days are being cultivated in the fields to meet the increasing demand for pharmaceutical industries. Thus, they are likely to be attacked by a more number of insect pests in the man made agro-ecosystems. Thus, literature pertaining to their incidence on cultivated medicinal plants in Western Himalayas and elsewhere irrespective of plant species has been reviewed here.

Survey

Survey on insect pest incidence on different medicinal plants have been attempted by various workers. Fletcher (1917) reported *Heliothis armigera* Hubn., *Agrotis ypsilon* Rott., *Prodenia litura* Fab., *Chrotogonus* sp., *Euxoa segetum* Schf., *Atmetonychus peregrinus* Olivier, to be pests of *Papaver somniferum* Linn. and *Heliothis armigera* Hubn., *Pempheres*

affinis Fst. and *Diacrisia obliqua* Walk. as serious defoliators of *Cannabis sativa* Linn. Whereas, Sinha *et al.* (1979) reported *Cannabis sativa* as a new host for two species of cutworms *viz.*, *Agrotis ypsilon* and *Mythimna separata* Walk.

In Indian continent, various species of mint are grown for various medicinal preparations. It is one of the most affected cultivated medicinal plants by insect pests. *Syngamia abruptalis* Walk (*Pyralidae*) has been reported as a pest of this crop from Burma (Shroff, 1919) and south India (Kareem *et al.*, 1960). In addition to this a large number of defoliators are reported to attack the mint crops, the most important being *Syngamia abruptalis* Walk., *Laphygma exigua* Hubn., *Autographa nigrisigna* Walk., *A. chryson* Esper, *Euxoa segetum* Schf., *Diacrisia obliqua* Walk., *Chrysolina exanthematica* Wied. (Mathur and Srivastava, 1962). *Pyrausta fumalis* Gn. was reported as a pest of *Mentha piperita* Linn. by Berry (1974) in Oregon, USA.

The larvae of a weevil, *Pseudobaris nigrina* were recorded for the first time during 1976 in mint fields of Idaho (USDA, 1977). Hameed *et al.* (1975) reported *Aphis gossypii* Glov. on *Mentha sylvestris* Linn. from Kullu and Lahaul region of Himachal Pradesh. In Ukraine region of erstwhile USSR, leaf beetles, *Chrysolina polita, C. hyperici* Forster, *C. cuprina* Duftschmid, *C. geminata* Payk., *C. menthastri* Suffr., *C. graminis* Linn., *C. cerealis* Linn., *C. varians* Schall. And *C. staphylaea* Linn. attack medicinal herbs such as *Mentha* spp., *Thymus serphyllum* Linn., *Melissa officinalis* Linn., *Hypericum perforatum* Linn., *Achillea millefolium* Linn. and *Tanacetum vulgare* Linn. (Brovdii, 1978). *Aphis affinis* del Guercio was reported for the first time as a pest on Japanese mint in Punjab during 1986 by Sagar (1989). The bug *Nisia atrovenosa* Leth. was found as a pest for the first time in 1979 at village Dhaipai of district Ludhiana (Sagar, 1983). Bhutani (1984) found cutworms, Bihar hairy caterpillar, polyphagous lipidopterous larvae and some chrysomelid beetles attacking *Mentha arvensis* Linn., *M. piperata* Linn. and *M. spicata* Linn. The cabbage semilooper, *Thysanoplusia orichalcea* Fab. and gram caterpillar, *Heliothis armigera* Hubn. have been recorded as key pests of *Mentha arvensis* Linn. (Sagar, 1985a and b, 1988). In a field study at Alexandria, Egypt in 1993-94, *Mentha viridis* Linn. and M. *piperita* Linn were found to be attacked by *Bemisia tabaci* Genn., Jassids, *Spodoptera littoralis* Biosd., *Aphis gossypii* Glov., mites, *Brevipalpus obovatus* Donn. *and Tetranychus uritcae* Koch. (El-Nabi *et al.*, 1996). They further reported that *B. tabaci* and *Cicadellids* were the most dominant pests on each of the two mentha species. Mint was more susceptible to infestations by *B. tabaci* than peppermint and susceptibility of the mint to mite infestation was dependent on weather, particularly temperature and relative humidity.

Eldredge and Baird (1995) recorded for the first time the orange mint moth, *Pyrausta orphisalis* in a peppermint (*Mentha piperita*) field in Idaho. Mareggiani and Bachur (1998) noted the occurrence of *Kaltenbachiella pallida* on mint (*Mentha* spp.) in Argentina.

Chopra (1933) reported two pests, *viz.*, *Agrotis flammatra* Schf. and larvae of tenebrionid, *Gonocephallum* sp. on *Atropa acuminata* Royle ex lindley. While, surveying the insect pests of medicinal plants at Jammu and Kashmir, Mathur and Srivastava (1964) recorded *Epilachna viginioctopunctata* Fab. feeding on *Datura stramonium* Linn., *D. metel* Linn., *D. innoxia* Mill., *Solanum aviculare* Forst., *S. surrathensis* Burn, *S. nigrum* Linn. and *Withania somnifera* Dunal. Shamshad (1980) reported Bombay locust, *Patanga succincta* Linn. damaging *Datura stramonium* Linn., *Ricinus communis* Linn., *Acyranthes aspera* Linn. and *Abutilon indicum* (Linn.)

Sweet. Dhankhar *et al.* (1982) found *Solanum kharianum* Clarke to be infested with brinjal shoot and fruit borer, *Leucinodes orbonalis* Guen. While, Hossain *et al.* (1995) found *Euproctis fraterna* Moore, *Ergolis merione* Cramer, *Dichocrocis punctiferalis* Guen., *Empoasca flavescens* Fab. and *Spodoptera litura* Fab. as common pests of *Ricinus communis*, during a survey study carried out in Rajshashi, Bangladesh.

Papilio machaon Linn. and *Hyadaphis coriandri* Das. are the chief pests of *Anethum graveolens* Linn. (Mathur and Anand, 1964). The citrus butterfly, *Papilio demoleus* Linn. has been reported to be a pest of *Psoralea corylifolia* Linn. (Beeson, 1961). Purohit *et al.* (1966) also recorded *Psoralea corylifolia* as an alternate host plant of *P. demoleus* Linn. David and Kumarswami (1978) also reported this insect on *Aegle marmelos* Corr and *P. corylifolia* Linn., While Patil and Rajasekhargouda (1985) reported it on *Michelia champaca* Linn. and *Annona squamosa* Linn. in Karnatka.

The seeds of *Plantago ovata* Forsk. have been reported for the first time to be attacked by the grubs of cigarette beetle, *Lasioderma serricorne* Fab. (Patel and Makadia, 1981). During a survey in south India, seven pests *viz.*, *Acrida exaltata* Walk., *Orthacris simulans B.*, *Amrasca biguttula biguttula* Ishida, *Nezara viridula* Linn., *Anomis flava* Fab. and *Daphnis* (*Deilephila*) *nerri* Linn., were found infesting *Catharanthus rosens* Linn. (Reddy *et al.*, 1981).

Singh and Verma (1983) observed *Cirphus* sp. as a new pest of *Fagopyrum cymosum* Meissn in Bhutan and Sikkim for the first time.

Insect pests attacking eight medicinal plants of forest origin *viz.*, *Cassia fistula* Linn., *Solanum indicum* Linn. and Makoy, *Operculina turpenthum* Linn., *Psoralea corylifolia* Linn., *Abelmoschus crinitus* Linn., *Nyctanthes arbortristis* Linn., *Tylophora asthamatica* (Burm. F.) Merr. and *Urginea indica* Roxb. have been reported. These included *Catopsilia crocale* Gram., *Dasychira mendosa* Hubn., *Euproctis scintillans* Walk., *Nephopteryx rhodobasalis* Hampson, *Adoretus* spp., *Eurema blanda* Boisduval, *Selepa discigera* Walk., *Indarbela quadrinotata* Walk., *Oxyrhachis mangiferana* Distant, *Selepa docilis* Butler, *Euzophera* sp., *Helcystogramma* sp., *Paplio demoleus* Linn., *Anomis flava* Fab., *Earias vitella* Fab., *Dysdercus cingulatus* Fab., *Nezara viridula* Linn., *Agathodes* sp., *Eupterote hibisci* Fab., *Psilogramma menephron* Cram., *Dichromia sagitta* Fab., *Brithys crini* Fab., in Madhya Pradesh (Joshi *et al.*, 1992).

Neem has been reported to be attacked by *Parasahilaris* Westwood (Suresh, 1992). While Karthikeyan *et al.* (1993) found the tea mosquito bug, the mealy bug, the scale insect and the leaf webber as very important among 13 pests on neem in southern Tamil Nadu. Kumar *et al.* (1997) reported *Myllocerus lartivirens* Marshall, as a new pest of neem in Rajasthan.

A new record of semilooper, *Plusia signata* Fab. on *Polianthus tuberosa* Linn. was reported by Savithri *et al.* (1992). Mehta *et al.* (1996) reported *Nysius ericae* on *Artemisia annua* Linn. plants along with the larvae of *Plusia orichalcea*, nymphs and/or adults of *Frankliniella* sp. and *Dolycoris indicus* Stal.

Arzone *et al.* (1998) found *Spodoptera littoralis* as the worst defoliator in Liguria, Italy, infesting basil in the greenhouse as well as in the field. Shamshad and Shakila (1999) recorded *Brevipalpus juncus* sp. nov. from *Ocimum basilicum*, *B. solidus* sp. nov., *B. hafizii* sp. nov. from *Azadirachta indica* and *B. portheo* sp. nov. from *Thuja orientalis*, belonging to the *Californicus*, *Obovatus* and *Phoenicis* groups from Pakistan.

El-Kordy *et al.* (1999) reported that

during vegetative stage, valerian (*Valeriana officinalis*) and nigella (*Nigella sativa*) plants were infested with *Myzus persicae*, while fennel (*Foeniculum vulgare*) and roselle (*Hibiscus sahdariffin*) were infested with *Brevicoryne brassicae* and *Aphis gosypii*. Fennel was also attacked by *Hyadaphis coriandri* during flowering and fruiting stage.

Considerable damage to the leaves of *Calotropis gigantea* Ait. due to feeding of *Danaus plexippus* Linn. was observed in Hawaii by Etchegaray and Nishida (1973). Larvae of *D. chrysippus* Linn. were observed in large number feeding on *C. gigantea* leaves in Maharashtra (Wadnerkar *et al.*, 1979). Mishra *et al.* (1995) found *Atmetonychus peregrinus* Olivier as a pest of *Terminalia arjuna* Bedd. and *T. tomentosa* W.&A. in Ranchi, Bihar. Hanumanthaswamy (1995) reported *Polytela gloriosae* Linn. as a major pest, causing severe loss to *Gloriosa superba* Linn. among the fourteen insects pests. Swamy and Rajagopal (1995) recorded *Polytela gloriosae* as a major defoliator, causing severe losses during the cultivation of *Gloriosa superba* during the course of studies at the University of Agricultural Sciences, Bangalore. In all, fourteen insect pests, *viz.*, *Diabolocatantops pinguis*, *Oxya fuscovittata*, *Monolepta signata*, *Curculio* sp., *Myllocerus undecipunctata* (*M. undecipustulatus*), *M. viridanus*, *Ptochus* sp., *Amsacta lactinea*, *Utethesia pulchella*, *Plusia signata* (*Argyrogramma signata*), *Polytela gloriosae*, *Archips micaceana* (*A. micaceanus*), *Lygaeus hospes* (*Spilostethus hospes*) and *Graptostethus servus* were observed as pests of this medicinal plant.

Swamy and Rajagopal (1995) found. the pyrgomorphid *Neorthacris acnticeps*, the curculionids *Blosyrus inaequalis* and *Myllocerus undecimpunctatus* (*M. undecmpustulatus*), the noctuid *Anadenidia peponis*, the lygacids, *Graptostethus servus* and *Lygaeus hospes* (*Spilostethus hospes*), and the scutellarid, *Chrysocoris stollii* feeding on *Adhatoda vasica* in Bangalore.

Skaria *et al.* (1996) observed extensive wilting and drying of the *Indigofera tinctoria* crop due to the infestation by the psyllid, *Arytaina punctipennis* and this was a new record of the pest from southern India. They further observed that spraying with quinalphos (*Ekalus* 20 AF) at 20 ml/litre gave good initial control of the pest, but recurrence was observed after 3 weeks. No pest attack was observed following treatment with monocrotophos (Nuvacron 36 EC) at 1.5 ml/ litre.

Tripathi *et al.* (1997) recorded the outbreak of *Spodoptera litura* on brahmi (*Bacopa monnieri*) an important medicinal plant in a greenhouse at Lucknow.

Sharma (1998) reported *Helicoverpa armigera* (mean infestation 28.1%) and *Plusia orichalcea* (mean infestation 13%) as the most important insect pests of Kalazira (*Bunium persicum*) in the Kinnaur district of Himachal Pradesh, India, along with some minor pests. Kumar (2003) reported the cabbage semilooper, *Thysanoplusia orichalcea* (Fabr.) as the major pest out of nine species of insects infesting *Bunium persicum* (Boiss).Fedtsch. He further evaluated seven insecticides against the lepidopterous pests and found cypermethrin and deltamethrin highly effective under the field conditions.

Incidence and population level

Incidence and population levels of different insect pests of cultivated medicinal plants have been studied by various workers.

The mentha leaf webber, *Syngamia abruptalis* Walk. has been reported as a serious pest during May-June in South India (Kareem *et al.*, 1960) and during August-October in northern parts of India (Mathur and Anand, 1964; Sagar, 1982, 1983). Sandhu *et al.* (1975) graded it as a serious pest of Japanese

mint, *Mentha arvensis* Linn. *Heliothis armigera* Hubn and *Thysanoplusia orichalcea* Fab. invaded the mentha crop simultaneously from April to first harvest of the crop in Punjab (Sagar and Mann, 1978; Sagar, 1985a). An outbreak of *T. orichalcea* Fab. was observed in village Rakba, Ludhiana in the year 1982 (Sagar, 1985b). A study on the population dynamics of *T. orichalcea* and *Heliothis armigera* on improved variety of Japanese mint, *Mentha arvensis* Linn. selection (MAS-1) at village Rakba, district Ludhiana, revealed that the *T. orichalcea* significantly out numbered the *Heliothis armigera* on all dates of observations and peak populations for both pests was recorded on May 23, 1990 (Sagar, 1992). The aphid, *Aphis affinis* del Guercio appeared in a serious form in Punjab during February to April causing considerable damage to the mint crop (Sagar and Singh, 1981). Sagar (1983) observed highest infestation of *Syngamia abruptalis* Walk. on *M. citrata* Ehch. followed by *M. piperita* Linn. and *M. arvensis* Linn., respectively at Ludhiana, Punjab.

In Hawaii, the adults of *Danaus plexippus* Linn. was especially abundant during December-February. During other months, *D. plexippus* was scarce, even though *Calotropis gigantea* was present all the year round (Etchegaray and Nishida, 1973). However, Verma *et al.* (1978) reported that *Danaus* sp. was abundant from July to August on *Calotropis procera* (Willd.) Dryand ex W. Ait. Larvae were found feeding over leaves while pupae were found to be attached with the leaves of host plants. It was further observed that the larvae of *Danaus* sp. were the major defoliators of *Calotropis procera* in Gorakhpur district of Uttar Pradesh. Whereas, Wadnerkar *et al.* (1979) observed 5-8 laravae of *D. chrysippus* Linn. per plant of *C. grigantea* in Maharashtra during June and July, 1978. In Rajasthan, Parihar (1981) made observations on this pest and found that it was present on the shrubs of *C. procera* throughout the monsoon season, from July to October. The peak larval population was recorded in August (42.5-112.5/5 plants). Subsequently, sharp and sudden reduction in larval number was noticed in the month of September-October (7.5-8.5/5 plants).

Nature and extent of damage

Various workers have worked out the nature and extent of damage inflicted in different cultivated medicinal crops, due to feeding of various insect pests.

The first and second instar larvae of *Syngamia abruptalis* Walk. prefer to remain on lower surface of the leaves of Japanese mint and gnaw away the parenchyma, making very small patches of injury without making any webs of leaves. Third instar larvae remain on lower surface of the leaves and make webs by joining the edges of upper and lower leaves with silken strands. Wehereas, the fourth instar larvae were the most active and destructive (Sagar and Reddy, 1987). Ramji and Sagar (1989) observed that the first and second instar larvae of cabbage semilooper *Thysanoplusia orichalcea* Fab. cause injury by scrapping the lower surface of leaf which results into irregular patches. However, the most active and destructive stage was the fourth instar larvae which fed voraciously leaving behind the mid rib only.

Veda *et al.* (1995) while studying the incidence of painted grasshopper (*Poekilocerus pictus* Fab.) on ak (*Calotropis procera*), reported that the pest was most active during July and August. Leaf defoliation per 5 branches was 57.66 and 47.57 per cent during 1990-91 and 1991-92, respectively.

CONCLUSION

Various control strategies are adopted for the improvement of the productivity and quality of medicinal plants. But, before adoption of any pest control strategies, assessment of

population as well as estimation of the damage caused are necessary, in order to determine their pest status. Their studies have, therefore, to be given due importance because with the rapid expansion of drug industry, large-scale cultivation of these plants is being taken up.

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