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Insects associated with medicinal crops under shade nethouse conditions

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Abstract
The insects feeding on medicinal plants were collected from the shade-nethouse of Department of plantation, spices, medicinal and aromatic crops, College of Horticulture, Mudigere during 2017-18. The insect taxonomist has identified insect specimen *viz.* black aphid *Aphis craccivora* Koch on chamomile *Matricaria chamomilla* L., long scale insect *Coccus longulus* (Douglas) on ashoka *Saraca asoca* (Roxb.) Wild., scale insect *Saissetia coffeae* (Walker) on madhunashini *Gymnema sylvestre* R. Br., *Aphis gossypii* Glover on mehindi *Lawsonia inermis* L., scale insect *Coccus* sp. on soapnut *Sapindus trifoliatus* L., *Saissetia oleae* (Oliver) on *Adhatoda vasica* Nees. The highest infestation was observed on *S. asoca* plants (96.08%), *M. chamomilla* (87.50%) and the infestation was 60 per cent on *G. sylvestre* plants. The infestation was lesser extent in other medicinal plants *viz. Aphis gossypii* on *L. inermis* (28.85%), *Coccus* sp. on *S. trifoliatus* (26.92%) and *Saissetia oleae* on *A. vasica* was the least (11.67%). The infestation of aphids and scale insects caused symptoms like curling, yellowing, leaf drop, weak plants and severe infestation caused death of medicinal plants. Black ant, *Polyrhachis exercita* (Walker 1859) was associated with *A. craccivora* on chamomile *M. chamomilla*. Small ant, *Lophomyrmes quadrispinosus* was associated with scale insects on *S. asoca*, *G. sylvestre*, *S. trifoliatus* and *A. vasica*.

Keywords: Medicinal plants, Insect infestation, Ant association

Introduction
The active ingradients present in semiochemicals of medicinal plants are responsible for curing diseases of human beings. Medicinal plants protect themselves from herbivores by producing defensive semiochemicals, however medicinal plants are not completely free from insect incidence. Usually medinal plants are maintained in protected structures and grown in smaller scale, however documenting insects associated with medicinal plants has been ignored. The insects associated with medicinal plants have been identified usually by common names without knowing their scientific names.

The scientific identification of insects associated with medicinal crops is much essential because behaviour and management are species specific. More over the importance of medicinal crops is increasing and so area under economic production may also enlarge. Scientific identification of insects which are causing damage to important medicinal plants is fundamental for understanding their bioecology and effective management.

Therefore, the present investigation was carried out during 2017-18 to collect, identify and document insects associated with medicinal crops *viz.* Ashoka (*Saraca asoca*), Madhunashini (*Gymnema sylvestre*), *Mehindi* (*Lawsonia inermis*), Soapnut (*Sapindus trifoliatus*), castor (*Ricinus cummunis*), *Adhatoda vasica* and Chamomile (*Metricaria chamomilla*).

Materials and methods
The medicinal plants maintained in shade net house and planted in open condition were examined frequently at medicinal block of Department of plantation, spices, medicinal and aromatic crops, College of Horticulture, Mudigere during 2017-18. The insects associated with Ashoka (*Saraca asoca*), Madhunashini (*Gymnema sylvestre*), *Mehindi* (*Lawsonia inermis*), Soapnut (*Sapindus trifoliatus*), castor (*Ricinus cummunis*), *Adhatoda vasica* and Chamomile (*Metricaria chamomilla*) were collected and preserved in 70 per cent ethyl alcohol with appropriate locality and host label. Later, specimen were submitted to taxonomists at NBAIR, Bengaluru and UAS, Bengaluru for identification.

The infested medicinal plants were closely observed to describe the presence of insect, feeding, colonisation, other insects associations, per cent infestation, density of insect and symptoms expressed by the infested plant.

Results and Discussion

Chamomile, *Metricaria chamomilla*

The population of aphid, *Aphis craccivora* was concentrated more along the stalk of flowers than central region of flowers, stem and leaves. Aphid colony was associated with ants. The presence of ants is an indicator to detect aphid infestation. Ant and aphid are mutualistic and aphids disperse with the help of ants. Aphids suck the plant sap which leads to yellowing of leaves, later leaves and flowers droop and drop. Thus plant becomes bare without leaves, flowers and finally plant dries up. The relative number of aphids per plant was 32.88 and 87.50 per cent of the plants were infested by *A. Craccivora* (Table 1).

Ashoka, *Saraca asoca*

Scale insect, *C. longulus* population was congregated on apical stems. Though more number of scale insects congregate and suck sap from the stem, plant can tolerate the injury to some extent. However, yellowing and dropping of leaves were seen because of severe and persistent infestation. There were 45.92 scale insects per plant and 96.08 per cent of plants were infested.

The density and per cent plants infested by scale insect, *Saissetia coffeae* (Walker) on madhunashini (*Gymnema sylvestre*) was 02.67 and 60.00, respectively. Similarly aphid, *Aphis gossypii* (Glover) on mehindi (*Lawsonia inermis*) was 04.87 and 28.85, scale insect, *Coccus* sp. on soapnut (*Sapindus trifoliatus*) was 02.50 and 26.92 and scale insect, *Saissetia oleae* (Oliver) on adhatoda, *Adhatoda vasica* was 06.29 and 11.67, respectively. Though infestatoin was less severe in these medicinal crops, plants were suffering to achieve thier normal vigour and growth.

Table 1: Association of insects and their infestation severity on medicinal crops

Sl.No.	Name of the plant	Associated insect	Density (No./plant)	Infested plants (%)
1	Chamamoli *Metricaria chamomilla* L. Asteraceae	Black aphid *Aphis craccivora* Koch Aphididae	32.88	87.50
2	Ashoka *Saraca asoca* (Roxb.) Wild Fabaceae	Long brown scale *Coccus longulus* (Douglas) Coccidae	45.92	96.08
3	Madhunashini *Gymnema sylvestre* Apocynaceae	Scale insect *Saissetia coffeae* (Walker) Coccidae	02.67	60.00
4	Mehindi *Lawsonia inermis* L. Lythraceae	Aphid *Aphis gossypii* Glover Aphididae	04.87	28.85
5	Soapnut *Sapindus trifoliatus* L. Sapindaceae	Scale insect *Coccus* sp. Coccidae	02.50	26.92
6	Adhatoda *Adhatoda vasica* Nees Acanthaceae	Black Scale *Saissetia oleae* (Olivier) Coccidae	06.29	11.67

Black ant, *Polyrhachis exercita* (Walker 1859) was associated with *A. craccivora* on *M. chamomilla.* Small ant, *Lophomyrmes quadrispinosus* was associated with scale insects on *S. asoca, G. sylvestre, S. trifoliatus* and *A. vasica.*

Plate 1: Aphid, *Aphis craccivora* Koch

Plate 2: *Aphis gossypii* Glover

Plate 3: *Ceroplastes floridensis* Comstock

Plate 4: *Lophomyrmes quadrispinosus*

Plate 5: *Polyrhachis exercita*

It is the known fact that the medicinal plants which have been studied in the present investigation are rich in various semiochemicals having medicinal properties and the extracts of these medicinal plants are effective in suppressing pests and diseases. However, the insects listed in Table 1 were successfully feeding and breeding on these medicinal, it could be because of their adaptability and detoxifying mechanisms. Extensive review on insects associated with the medicinal plants during the present investigation confirmed that there are no such research reports or scanty.

Few insect species are potential to survive on medicinal plants. *Jamides celeno* (Cramer) and *Papilio celeno* Cramer feeds on *Saraca asoca* (Gupta and Majumdar, 2012) [4]. Several species of true bugs were reported on 40 cultivated medicinal plants and most of them are the first time report in Hungary (David, 2007) [1]. Phytophagous insects (18 species) were reported on 33 species species of medicinal plants (Debapriya and Gupta, 2016) [2].

It is speculated that the insects reported in the present investigation must have adapted efficient detoxifying mechanisms to overcome the toxic effect of phytochemicals present in the medicinal crops. *Saraca asoca* extract contains alkaloids, blavonoids, glycosides, saponins, phenols, sterioids, tannins and triterpenoids and the extract has antimicrobial and antioxidant property (Mohan, *et al.*, 2016) [6]. Madhunashini (*G. sylvestre*) leaves and extracts contain gymnemic acids which interact with taste receptors and temporarily suppress the taste of sweetness (Gent *et.*, 1999) [3].

The following reviews confirms that some insect species are susceptible for toxicity of these medicinal plants extracts, whereas only few insect species have adapted to tolerate and manage the toxicity of medicinal plants. Crude extract of *Adhatoda vasica* against *Brevicoryne brassicae* caused 90-100 per cent nymphal mortality (Haifa and Ali, 2016) [5]. *L. inermis* seed powder in combination with *Cedrus deodara* oil and *Azadichta indica* oil was more toxic to molluscus than their individual components and other combinations (Singh and Singh, 2001) [8]. Sapindus contains sesquiterpene oligoglycosides and hederagenin saponins were toxic against molluscus (Sharma *et al.*, 2011) [7].

Conclusion

Six species of insects were feeding on six species of medicinal plants maintained under shadenet house. The highest infestation was observed in *S. asoca, M. chamomilla* and *G. sylvestre* and the infestation on *S. trifoliatus* and *A. vasica* was lesser. Black ant, *Polyrhachis exercita* was associated with *A. craccivora* on Chamomile, *M. chamomilla.* Small ant, *Lophomyrmes quadrispinosus* was associated with scale insects on *S. asoca, G. sylvestre, S. trifoliatus* and *A. vasica.* Identification of insect species which are feeding on economically important medicinal plants is essential to monitor and manage them successfully.

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