AgriCos e-Newsletter
ISSN: 2582-7049
www.agricosemagazine.com
Volume: 01 Issue: 01 May 2020 Article No: 13

Semio-chemicals –A tool of Integrated Pest Management

Turkhade P. D[1]*, Ravindra Singh[2] and Gurve S. S.[3]

[1]Subject Matter Specialist (Plant Protection), [2]Senior Scientist and Head, Shree Siddhagiri Krishi Vigyan Kendra, Kolhapur-II (Kaneri Math),
[3] Subject Matter Specialist (Plant Protection), Krishi Vigyan Kendra, Borgaon (Satara-II)
Corresponding Author*: pturkhade788@gmail.com

INTRODUCTION

The indiscriminate use of insecticides is causing negative impact on environment and animal health. With increasing public concern about the use of these toxic insecticides to control different insect pests, it is need to turn towards other techniques of integrated pest management. Some of these techniques are common sense of approach and other tools are more 'hi-tech' such as the use of odour called semio-chemicals. The word Semio-chemical is derived from greek word "Semeion" means signal. It is a chemical substance or mixture which influences the behaviour of other individuals or which is responsible to modify the behaviour of one organism in response to other's signal. Means it is a chemical substance that carries a message for the purpose of communication. Semio-chemical communication is broadly divided in to two classes i.e. communication between individuals of same species or communication between different species. It is usually used in the field of chemical ecology to encompass pheromones and allelochemicals.

Allelochemicals and their application in IPM

Allelochemicals are non-nutritional chemicals produced by an organism of one species and affect the growth, health, behaviour or population biology of individuals of another species (Wittaker,1970). Simply, allelochemicals perform the chemical communication between individuals of different species. It can be categories in to the signals that benefit the receiver called kairomone, signals that benefit the emitter called allomones or signals that benefit both receiver and emitter called synomones. Allelochemiclas are known to serve important roles at all steps in the host–searching sequence of parasitoids.

Kairomones tending to give adaptive advantage to the receiving organisms i.e. predators and parasitoids, It comprises compounds emitted by herbivorous insects which are used by predators and parasitoids to locate their prey. Natural enemies of insect pest use a variety of chemical stimuli to locate and identify their prey or hosts based on chemical cues emanating from their host body. Volatile compounds emanating from the scales of *Helicoverpa armigera* (Hubner) and *Corcyra cephalonica* (Stainton) moth were identified as hexatriacontane, docosane, monacosane which increased activity of *Trichogramma chilonis* Ishii, an important egg parasitoid of lepidoptra (Ananthakrishanan *et al*., 1991). The involvement of volatile chemical compounds from plants in the host seeking behaviour of *Trichogramma pretiosum* and wild *Trichogramma* sp. in controlling *Helicoverpa zea* reported by Altieri *et al.*, 1981. These chemicals can be used to manipulate behaviour and increase the field performance of *Trichogramma* sp. These chemicals could be applied to the crops in order to attract natural enemies and thereby increase the likelihood of encounter with their pest host and consequently improve the rate of parasitisation (Dhaliwal & Arora, 2010)

Allomones are the chemicals secretion of many insect and act as a defence mechanism that may be poisonous or deterrent to predators. This defence mechanism also observed in plant

species against herbivorous insect. Plants produce a many varieties of allomones to protect themselves from phytophagous insects and other herbivours. Majority of secondary metabolites synthesized by plants like toxic alkaloids, cynogenic glycosides, cardiac glycosides and other toxic plant products likely to deter predation. Including competitive production of morphological characteristics (e.g. spines), biomass and plant secondary compounds which act as protective agents against herbivorous insects. Volatile phytochemicals can serve as airborne allomones, promoting or deterring interactions between plants and insect herbivores. Examples include apple plants, which produce volatiles that attract predatory mites when damaged by spider mites (Takabayashi and Dicke, 1996), and corn and cotton plants, which release volatiles that attract hymenopterous parasitoids that attack larvae of several Lepidoptera species (Tumlinson *et al*., 1993)

Pheromone and their application in IPM

The term pheromone is derived from greek word "pherein" means transport. It is an ecto-harmone which triggers a response of individual of same species. It is classified as Primer pheromones which mediate more long-term, physiological changes and Releaser pheromones which may bring out an immediate behavioural response. In releaser pheromone, sex pheromones, are chemicals which mediate interactions between the sexes of the same species; mainly produced by females and to attract males, whereas some examples of male-produced pheromones are also known. Other types of releaser pheromones include alarm pheromones (which aware other members of the same species to the presence of menace), trail pheromones (which guide social insects to distant food sources), aggregation pheromones (which attract individuals of both sexes), oviposition- deterring pheromones (which discourage females from laying eggs in the same resource as another female), and so on. Mainly sex pheromones are not a single compound, but rather a blend of several compounds which must be present in the proper concentration and ratio to obtain the proper behavioural response (Norduland *et al*., 1981).

There are three main uses of sex pheromones in integrated pest management. The most important use is monitoring of pest populations. The use of sex pheromone is the most widespread and a successful practical application in detection and monitoring of pest populations. For monitoring, pheromones are now available for a wide range of insect pests, mostly Lepidoptera, even though some are available from other orders, include Coleoptera and Diptera. Majority of the pheromone monitoring lures use female sex pheromones, and hence trap adult males. It is a control strategy generally targeted against the insects which larval stages are most harmful.

A second major use is to mass trapping of insect pest to remove large number of insect pests from the breeding and feeding population**.** Mass trapping is the eco-friendly method of pest management with the aim of suppressing or eradicating populations of target pests by capturing as many as individuals as possible. In addition to, many cases of the attempted use of mass trapping to manage a range of insect pest Lepidoptera, Coleoptera, Homoptera and Diptera and classic studies have been intensively reviewed by various research workers. Mass trapping has been successfully used against the codling moth, a serious pest of apple.

A third application is the mating disruption techniques**.** Mating disruption intends to interrupt chemical communication and disrupt normal mating activities which results disturbing the organism's chance of reproduction. Mating disruption can be successful if the large areas are treated. The insect pests *viz*. gypsy moth (*Lymantria dispar*) in North American forests, the codling moth (*Cydia pomonella*) in apple and pear trees worldwide and in EU and

Chile the grapevine moth (*Lobesia botrana*) with highest land area under mating disruption technique were reported. In India, it studied that integrated management of pink bollworm through mating disruption technique using sex pheromone formulation i.e. PB Rope L offers a practical and ideal approach.

Advantages of semiochemicals

Do not have non-target destruction effects as in conventional pesticides. It means application to target harmful insects has no harmful effect on humans, animals and beneficial insects. They are relatively non-toxic and required in low amounts. They are non-persistent and environmentally safe. They appear difficult for insects to develop resistant against. n

CONCLUSION

Semio-chemicals are the species-specific and ecofriendly chemicals can play a significant role in integrated pest management in conventional agriculture as well as in organic farming in India. Semiochemicals have a potential to reduce the load of insecticide and also help to manage the pest population below economic threshold level. It is clear that multidisciplinary research work in the area of ecological chemistry is needed and will provide tools for sustainable methods for management of many insect pests.

REFERENCES

Altieri M. A., Lewis, W. J., Nordlund, D. A., Gueldner and R. C, Todd JW (1981). Chemical interactions between plants and *Trichogramma* sp. wasp in soybean fields. *J. of Environ Prot. and Eco*..1; 3:259-263.

Ananthakrishnan, T. N., Senrayan, R., Murugesar, S. and R. S. Annadurai (1991). Kairomones of *Heliothis armigera* and *Corcyra cephalonica* and their influence on the parasitic potential of *Trichogramma chilonis* (Trichogrammatidae: Hymenoptera). *J. Biosci*. 16:111-119.

Dhaliwal G. S. and Ramesh Arora. Integrated Pest Management- Parasitoids and Predators (Fourth Edition), Kalyani Publishers, Ludhiana, 2010.

Nordlund D. A., Jones, R. L. and W. J. Lewis (1981). Semiochemicals. Their role in pest control, John Wiley and Sons, New York.

Takabayashi J, and M. Dicke (1996). Plant-carnivore mutualism through herbivore-induced carnivore attractants. *Trends Plant Sci* 1: 109–113

Tamoghna Saha and Nithya Chandran Chemical ecology and pest management: A review (2017) *Int. J. of Chemical Studies*; 5(6): 618-621

Tumlinson JH, Lewis WJ, Vet LEM (1993) How parasitic wasps find their hosts. Sci Am 268: 100–106

Whittaker, R. H. (1970). The biochemical ecology of higher plants. In. E. Sondheimer and J. B. Simeone (eds). *Chemical Ecology. Academic Press, New York, USA*, pp. 43-70.