

The Use Of Plant Parts In Pest Control Activities In Traditional Sri Lankan Agricultural Systems

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Abstract: Sri Lankan Agriculture has a very long history and was based on very successful and environmentally healthy principles. The insect Pest management practices known as "Kem" methods were very successfully performed with the use of plant based materials and cultural practices, in the form of religion based rituals. Even without a distinct knowledge of the chemical constituents of the plants they were using, the ancient Sri Lankan rice farmers had identified a set of indigenous plants to develop this successful system of plant protection. These methods of kem had different modes of actions of, pesticidal effect, sticky traps, and light traps. With the development of the modern technology, the hidden success of the kem methods can be explained as the right selection of the chemical basis of the plants on the respective insect species. Burning kaduru (*Cerbera manghas*) sticks near the paddy fields was a kem, effective against insect pests as a light trap as well as a use of chemical repellent. Cycasin is one of the constituents of the cycas (*Cycas circinalis*) and it has insecticidal and inhibitory properties. This clearly reveals that the modern findings match with the ancient fundamentals of kem. There are many plant species of this nature like, Warā (*Calotropis gigantea*), Mella (*Diospyros ovalifolia*), Kappettiya (*Croton laccifer*), Daluk (*Euphorbia antiquorum*) etc. that were very systematically fitted with the traditional practices. This effort is to identify the scientific fundamentals of the traditional kem methods used in pest management that has been neglected at present Agricultural systems.

Index Terms: kem, Pest Management, Rice, Sri Lanka, Traditional Agriculture

1 Introduction

It has been revealed that the Sri Lankan Agriculture has been started a long time ago than the recorded history (Premathilake and Epitawatta, 2001). Sri Lankan farming systems were quite simple and rather successful than the Agriculture now we see in the country. There are many important features that account for this success, like compatibility of soil and climatic factors with the plants and crop ecosystem. The equilibrium between pests and the beneficial factors resulted a self-regulated and a very stable Agricultural system. The farmers had well understood the natural environment, how the ecosystem balances each other and did not interrupt this balance in pest management practices. Insect pests and diseases were among the major problems that caused crop losses, therefore, starting from the very initiative point of selecting the land for cultivation, until the harvest was stored in the granary, they followed environmentally sound procedures to manage the pests. Their farm lands were surrounded by natural vegetation where a vast diversity of species inhabited including the natural enemies, important in insect pest control. In traditional farming, cereals, pulses and vegetables of different families were cultivated as mixed cropping, on the same land, which made the crop diversity very high. This provided the ideal conditions for natural control of insect pests and diseases. Traditional pest management methods (Kem methods) were used by the farmers to protect the crops from pests. They used only common ingredients from their surroundings for these pest management activities.

These environmentally sound methods affected only the target organisms and did not cause any adverse effect on non-target beings. In most of the traditional pest management methods, a specific time of the day has been defined to perform the task, because some larval stages hiding inside plant tissues, come out only at this specific time of the day. Also, some methods have been practiced only in early morning, because the volatile compounds used here would not retain their effectiveness for a long time, when the sun is up. Another common practice, attached with these traditional pest management methods was that, after the task was practiced, the farmer forbids the land for about two days. During this time no one, including the owner of the farmland, is allowed to trespass the boundaries of the premises. This indeed was helpful for the natural forces in the crop ecosystem, to start to act on the pests, without been disturbed by humans. Use of plant parts in kem methods had different modes of action. In some practices, that was the chemical compounds emitted from the plant parts that had the pesticidal effect, while in some, it worked as a light or sticky trap to destroy the insect pests. Also in some traditional pest control practices, sound waves or vibration has been used to repel the insects away. Traditional Sri Lankan farmer used an identified set of plant species, found around their farming grounds in pest control activities. They were not aware of the exact chemical composition of those plants that accounted for their respective activity of pest control. But the traditional knowledge originated a long time ago, with their instinct, enriched by the experience and transferred generation to generation, had been able to give promising results. These kem methods were performed in the form of rituals based on religious practices. In this study, an effort has been made to identify the scientific and chemical background of the traditional pest control methods in Sri Lanka, with special reference to Rice farming.

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2 MATERIALS AND METHODS

Different traditional *kem* methods practiced in various parts of the country of Sri Lanka were recorded by a survey and discussions with farmers. Also the traditional knowledge on pest management that has been already recorded by other authors was gathered through a comprehensive literature review. These findings include the traditional pest management systems, the rituals and recommendations attached with each method and how they differ with different areas of the country and how these methods have changed with time. The firsthand experiences of the farmers, the effectiveness of traditional pest control methods as it is perceived by the farmers, Successfulness of those methods in comparison to modern pest control methods in farmers view were discussed with the farmers. The effect of the chemicals extracted from plant parts used in traditional pest management and the pesticidal properties of those compounds were recorded. The scientific background of traditional knowledge regarding pest control using *kem* methods were justified with facts and recent findings by contemporary sciences.

3 RESULTS

Traditional pest control methods acted in the form of either chemical barriers and insecticides, light traps, sticky traps or sometimes the vibration, sound waves and physical methods also were used to make the crop environment unfavourable for the pest insects to chase them away.

Chemical Barriers and Insecticidal Chemicals

Kappettiya (*Croton laccifer*) of Plant Family Euphorbiaceae is a common plant species with a strong odour, found in deserted lands of Sri Lanka. When the paddy field is under attack of Paddy bugs, the farmer performed "kappettiya sweeping" on paddy field, to control the problem. Early in the morning some *kappettiya* branches are detached from the plant and tied to a bunch. Then this bunch is taken near the Paddy field and beaten with a stick to damage the leaves. The farmer, then goes around the field, sweeping the paddy plants with this bunch of leaves. Then farmer leaves, after placing the *kappettiya* branches in the field. *Kaduru* (*Cerberamanghas*) is another common plant found in traditional pest management activities in Sri Lanka. The splitted wood of this plant has been used to make fire near the paddy fields, when pest populations, specially paddy bug damage was high. The male reproductive structure of *Madu* (*Cycascircinalis*) when decaying, emits a strong odour and in traditional Agriculture, this property of *Madu* has been used in pest management activities. Raja Mamannanand Natarajan, 2010). This male flower was cut early in the morning and parts of it were hung in several locations of the field, under pest attack. Until next morning no one was allowed in the treated field. Next day, water was splashed on those *Cycas* flower parts. *Mella* (*Diospyrosovalifolia*) is a plant with a strong odour and its extract has been used to be applied on Palmyra leaves and kept in the paddy fields. This plant extract is rich in Alkaloids, Flavonoids, Tannin, Terpenoids and essential oils that work as deterrents and insect oviposition reducers.

Sticky traps

A winnowing fan, a stick, or a rope, applied with a sticky material has been used as the sticky traps. When those traps were moved along the field, the insects were trapped in the glue. To prepare this sticky mixture, the latex of *Warā* (*Calotropisgigantea*), and *Daluk* (*Euphorbia antiquorum*), have been used (De Silva *et al.*, 2008) *Warā* plant contains Alpha and Beta calotropeol and Beta amyryn. Also the latex of *Daluk* has been found to be very successful in terms of pest control.

Light traps

Oil extractions from *Mee* (*Madhukalongifolia*), *Neem* (*Azadirachtaindica*) and *Kekuna* (*Canariumzeylanicum*) have been used to light lamps near the Paddy fields, to attract the flying insects to the flame and destroy them.

4 DISCUSSION

Above findings basically concentrates on several plant species, commonly found in traditional pest management systems in many areas of Sri Lanka. Their successful use to manage pests was due to the unique chemical compounds and their specific pesticidal properties. *Kappettiya* (*Croton laccifer*) contains two important phytochemicals: 5 hydroxy – 3,7,4 – trimethoxyflavone and Sitosterol that account for its insecticidal and insect repellent effect. Also the trichomes make the leaf surface of this plant rough and it also assists a better sweep of the paddy bugs away. Since the *Kappettiya* leaves are beaten prior to sweeping, the plant tissues are ruptured and the phytochemicals responsible for insect repellence are released. The bark of the *Kaduru* (*Cerberamanghas*) wood contains Phenylpropionic acid for which insecticidal properties have been established. This chemical emitted from the bark, with its burning was spread in the field, having a repulsive effect on pests. This method has been recommended to be performed in the evening. Therefore other than the chemical effect, the insects were attracted to the flame and got burnt. In one way it worked as a light trap. The chemical compound in *cycas* (*Cycascircinalis*) responsible for the control of insect pests is Cycasin, and also it is an insect growth disruptor. Water splashed on the flower, accelerated the decaying thus encouraged the emitting of Cycasin. *Mee* (*Madhukalongifolia*) contains Saponin, which has insecticidal properties. *Neem* contains Azadirachtin, where it is now a well established fact that it is a chemical with strong insecticidal properties, (Boaduet *al.*, 2001) to disrupt nerve system of insects, block mating and sexual communication, to reduce lifespan of insects, an insect Growth Regulator, anti – feedant and for sterilization of Male Insects. Also there are many commercial preparations available, based on Azadirachtin. When these practices were performed, wind direction was a common concern. The farmer carefully observed the wind direction prior to implementation of any of these pest management activity, so as the wind current would carry the chemical effect all throughout the plot. Some of the *kem* methods have been recommended to be performed all the farmers of the field together, at the same time. So the insects had no chance to move from one to next plot to survive. Sri Lankan traditional pest management activities are consisted of its own ritualistic component. They mostly come to function with a religious base. This includes the worship to Lord Buddha and other regional Gods, and

offering flowers and food in the name of them, and Chanting Spells. Many differences can be observed with those rituals with the respective area of the country. Towards the southern part of Sri Lanka, this ritualistic component is given more priority. Most of the farmers with this traditional knowledge belong to previous generations and now not engaged in Agriculture, as a profession. But during their times they have completely relied on *kem* systems for pest control, and experienced the successfulness of the traditional methods. The existing farming community of Sri Lanka is not getting the use of the traditional knowledge, mostly because the modern commercial Agriculture, introduced to the country is not compatible with these traditional practices.

5 CONCLUSION

Kem :Traditional pest management system can be found in most of the parts of the country and specific differences can be observed area wise. Those who have practiced *kem* alone, to manage insect pests, have obtained very good results. These traditional pest control methods have a strong scientific background as they practice. The timing, selection of plants and rituals are correlated with each other to give a successful nature friendly pest control, but with the current commercial based cultivations, farmers cannot completely rely on them. Therefore the greatest threat is there that this traditional knowledge might disappear soon.

6 REFERENCES

- [1]. Premathilake, T.R. and Epitawatta, D.S. (2001), Late quaternary vegetation climate and land use history of the Horton Plains, central Sri Lanka, *Vidyodaya Journal of Science* 10: 1 – 20.
- [2]. Boadu, K.O., Tulashie, S.K., Anang, M.A. and Kpan, J.D. (2011), Production of natural insecticide from Neem leaves (*Azadirachta indica*), *Asian Journal of Plant Science and Research* 1(4):33-38.
- [3]. RajaMamannan, M.A. and Natarajan, G. M. (2010), Bio-safety evaluation of cycas seed extract on Tilapia, *Oreochromis mossambicus* by oxidative metabolism, *Journal of Biopesticides* 3(1) : 232 – 236.
- [4]. De Silva, W. A. P. P., Manuweera, G. K. and Karunaratne, S.H.P.P. (2008), Insecticidal activity of *Euphorbia antiquorum* L. latex and its preliminary chemical analysis, *Journal of National Science Foundation Sri Lanka* 36(1): 15-23.