

Use of certain bio-products for insect-pest control

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The present study was carried out in remote villages of the Mandi, Bilaspur, Shimla, Kinnaur and Lahaul-Spiti districts of the Himachal Pradesh to identify the important Indigenous Technology Knowledge (ITKs) in use, methods for managing the insect-pests of the different crops and to document the same. Farmers commonly use ash against chewing and sucking type of insect pests. Use of cattle litter not only enriches the soil fertility but also reduces the insect-pests of the crops significantly. The bioproducts namely aged cow urine, *Vitex negundo* Linn., *Ferula assafoetida* Linn, *Aloe barbadensis* Mill., *Nicotiana tabacum* Linn. and whey were found to be very effective against the insect pests of cabbage, wheat, peas, grams and other crops. Such an assessment was essential because these are the innovative eco-friendly sprays, which are economically viable for small farmers and have already been adopted by the farmers in some locations. The choice of indigenous bio-insecticides has been found to be effective as well as eco-friendly. This will also help in reducing the load of insecticide on the ecosystem.

Key words: Bio-products, Indigenous Insect-Pest Control, Bio-insecticides, Traditional Pest Control Methods

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Over the millennium, indigenous people have developed a close and unique connection with the lands and environment in which they have lived. They have established distinct system of knowledge, innovation and practices relating to the uses and management of biodiversity on the land and environment^{1,2}. Over centuries, people have learnt how to get food and to survive in different environment, what variety of crops to plant, when to sow, which plants are poisonous, which can be used for medicines, how to cure diseases, and how to maintain their environment in a state of equilibrium? The indigenous technical knowledge (ITK) covers a wide range of subjects, viz. crop production, livestock rearing, natural resource management, food preparation, healthcare, insect pest management and many other³.

Indigenous Technology Knowledge (ITK) refers to the unique traditional local knowledge existing within and developed around the specific conditions by women and men indigenous to a particular geographic area⁴. This indigenous technical knowledge that people in a given community have developed over time and continue to develop it, is based on human

experiences on mass scale, dynamic and changing, tested in most cases over centuries of use, endowed with highest possible adaptability to local culture and environment and put greater weightage on minimizing risks rather than maximizing profit⁵.

The use of non-chemical methods for pest control and crop protection is already gaining importance in several countries including India. The integrated pest management strategies developed and promoted by the Governments are now based on the use of plants extracts. If an effort is made towards production of Indigenous Technical Knowledge (ITK) based products on cottage scale, it can be an economically viable option for sustainable development of eco-friendly pesticides/insecticides.

Himachal Pradesh lies between 30°22' and 33°12' North latitude and between 75°22' and 79°4' East longitude. To the North-East, it forms India's border with Tibet, to its North-West lies the state of Jammu & Kashmir, while Uttar Pradesh lies in the South-East, the state of Haryana in the South and Punjab on the South-West. The entire territory of Himachal Pradesh is mountainous with altitude varying from 350-7,000 m above the mean sea level. Geographically, it forms part of Punjab Himalayas and presents an intricate pattern of mountain ranges, hills and valleys. These mountain ranges, generally,

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increase in elevation from West to East and from South to North.

Methodology

For collecting information on Indigenous Technical Knowledge (ITK) based technologies, the field surveys were conducted in the rural areas of Shimla, Kinnaur, Lahual-Spiti, Mandi, Hamirpur and Bilaspur districts belonging to the different agro-ecological zones of Himachal Pradesh. For this purpose one block was selected randomly from each selected district and from each selected block, one *Panchayat* was selected randomly. The *Panchayat Pradhan* was contacted and a suitable date was fixed on which sufficient number (usually exceeding 20) of farmers participated in the meeting. The information about the ITKs, being adopted by the farmers was collected through Participatory Rural Appraisal (PRA) techniques. The interactive PRA techniques were used to ascertain the required information using a well-structured and pre-tested schedule⁶.

The schedule included the following information:

- (i) Title of indigenous technical knowledge (ITK).
- (ii) General description of the ITK including the details of the involved natural resources.
- (iii) Technical specification or procedure of the ITK.
- (iv) Uses of the ITK with details about location and address.
- (v) Application and spread of technology. Compatibility of the ITK with internal resources, socio-cultural and environmental aspects.
- (vi) Details of the benefits of the ITK.

Results and Discussion

Farmers have been using large number of biological products to keep the insect pests and diseases of the crops under economic threshold levels. These products are not only eco-friendly but are also cheaply and readily available. These are also essential for sustainable agriculture through their modes of action i.e. knock down effect is sometimes slower in comparison to chemical pesticides. The methods of pest control based on bio-products and eco-friendly practices have been described as follows:

Management of insect pests through ash

Village Kanam, Tehsil Reongpeo, District Kinnaur

Sprinkling of *Chula* (a traditionally made fire place for cooking food) ash over and around the vegetable

plants and in fields is effective against insect pests viz, beetles, leaf defoliating insects, leaf miners, thrips and aphids. It is the cheapest practice for small farmers. Ash acts as a detergent. Chewing and sucking type of insects, find it difficult to chew plant parts due to deposition of ash.

Sprinkling of ash on and around standing vegetable crops like onion, okra, brinjal, tomato and cucumber protects them from insect pests. This practice is very effective against pumpkin beetle, *hadda* beetle, leaf defoliating insects, leaf miners, thrips and aphids.

It is practiced throughout the hilly areas of Himachal Pradesh. It is simple and easy to apply, cheap and effective method for insect pests, use of local raw material, eco-friendly and has no side effect, it enhances crop productivity, compatible with internal resources of household, technically feasible, and widely used.

Management of insect pests through cow urine + *Vitex negundo* (*Nirgundi*) + *Ferula asafoetida* (*Hing*)

Village Dayothi and Tehsil Theog, Shimla

This mixture in appropriate proportion is considered very effective, eco-friendly insecticidal treatment against insect pests of wheat crop. It repels the insect pests. Leaf decoction of *nirgundi* (about 30-40 leaves in 10 l of water) is prepared till it is left one liter. This mixture is filtered properly. About 10 gm *hing* is mixed in one litre water and then above ingredients are mixed in about 5 l of cow urine and sprayed over affected crops. It is effective for all sowing seasons (early; normal or late sowing seasons) of wheat and paddy crops.

It is practiced in most of the villages in hilly mountain terrain of Himachal Pradesh. It is eco-friendly, technically feasible, compatible with existing farming system and internal resources of the household, simple and easy to prepare, controls insect-pest, it enhances crop productivity.

Management of cabbage aphids through ash + soil mixture and cow urine

Paban, Tehsil Chopal, District Shimla

Cabbage is one of the important cash crops of Shimla district. Many insect pests damage the cabbage crop, the cabbage head/ball becomes loose and ultimately plants fall down. Ash + soil mixture and cow urine are used to protect the cabbage plant from insect pests. This also improves compactness of the ball and the marketable yields.

Cow dung heaped in a selected place is burnt. The ash thus obtained is mixed with soil. The seeds are soaked in ash + soil mixture before sowing.

Fresh cow urine is kept in an earthen pot in an underground pit for 8-10 days. When cow urine gets fermented completely, one glass (500 ml) is mixed with 1 l of water and is sprayed over the crop affected by cabbage aphids.

It is practiced in most of the villages in hilly mountain terrain of Himachal Pradesh. It is simple and easy to follow, use of local raw material, helpful to overcome pest problems, it enhances crop productivity, eco-friendly, and checks insect-pests control, compatible with internal resources of the household.

Management of insect pests of mustard crops through *Aloe barbadensis* (Gwarpatha) + *Nicotiana tabacum* (tobacco) + *Azadirachta indica* (neem) + *Sapindus trifoliatus* Linn. (Aritha)

Village & Tehsil Ghumarwian, District Bilaspur

The mixture is effectively used against the insect pests of mustard crops in Una district. Leaf decoction (1 kg) of *Gwarpatha* and tobacco powder extract (200 gm) are prepared in 5 l of water for 3-4 hrs to make a 2 l solution. Neem leaf extract (200 ml) is added after evaporation process and decoction of 50 gm *aritha* powder is added to the above solution and mixed thoroughly. This is sprayed on the mustard crop at interval of 2-3 weeks.

It is practiced throughout the hilly areas of Mandi district of Himachal Pradesh. It controls insect pests of different crops, it is compatible with existing farming system and internal resources of the household, and eco-friendly method.

Management of pod borers in gram crop through whey (*lassi*) + *Aloe barbadensis* (Gwarpatha) + *Nicotiana tabacum* (tobacco)

Village Gopal pur, Tehsil Sarkaghat, District Mandi

This method is very effective against the pod borers infesting the gram crop.

Tobacco powder (200 gm), *lassi* (2 l) and *Gwarpatha* (2 leaves) are dissolved in 15 l of water. This solution is left undisturbed for 15 days. It is then filtered with a muslin cloth and the filtrate is sprayed over the infested crop at an interval of 2-3 weeks.

It is practiced throughout the hilly areas of Mandi district of Himachal Pradesh. It controls insect pests, it is compatible with existing farming system and internal resources of the household, and eco-friendly method.

Management of paddy insect pests through *Vitex negundo* (Nirgandi)

Village Fatehpur, Tehsil Sarkaghat, District Mandi

Farmers sweep the paddy field with brooms made up of branches of *Vitex negundo*, which are known to act as an insecticide and enhance growth of paddy.

It is practiced throughout the hilly areas of Himachal Pradesh.

It is widely used, technically feasible, compatible with internal resources of the household, it checks insect pests and, ensures better growth of paddy and increased crop production.

Insect pests management and soil fertility up gradation through application of cattle litter

Village Sadhot Tehsil. Sarkaghat District Mandi

It is a common practice in uplands (called BARI) of mid and high hills with low cropping intensity to shift farm cattle from one farm site / location to another after every 2 to 3 days. The cattle litter (dung + urine) gathered during these days add enough plant nutrients to soil to raise 2 to 3 bumper crops and also repel the insect pests and thus reduce their incidence in the crops.

Animals kept in shed and tree canopy are moved from one place to another in rotation in order to manure the entire lands. Depending on season, the animals are kept in temporary sheds or in open fields. Cattle urine and dung gathered for three days on a spot of land is considered equal to a heavy dose of compost. This is commonly done in October / November i.e. after harvest of finger millets and before sowing crops. The practice is repeated in March / April before maize or millet planting. Certain lands are manured intensively by keeping animals for longer durations.

It is practiced in most of the villages in hilly mountain terrain of Himachal Pradesh. It is eco-friendly, enhances crop fertility, helps in soil and water conservation, cost effectiveness, simple and easy method, makes use of material which otherwise goes waste, technically feasible, no risk is involved, and widely accepted.

Farmers have been using ash, cow urine, *Vitex negundo*, *Ferula asafoetida*, *Aloe barbadensis*, *Nicotiana tabacum*, *Azadirachta indica*, *Sapindus trifoliatus*, etc. different bio-products to protect their crops from insect pests and diseases. Their findings are as follows:

- Use of ash to prevent the leaf defoliating, chewing, and sucking insect pests is tremendous but its adoption on large scale is difficult. It can, however, be useful for small farmers, in kitchen gardens and in nurseries.
- Use of cow urine alone and in combination with *Vitex negundo* and *Ferula asafoetida* as eco-friendly insecticides against insect pests of wheat and cabbage crops is tremendous.
- The efficacy of combined application of *Aloe barbadensis*, *Nicotiana tabacum*, *Azadirachta indica*, and *Sapindus trifoliatus* against the insect pests of mustard crop need to be tested while keeping in mind the sustainability issues.
- Cow urine and *Nicotiana tabacum* are considered to be very effective insecticides against the insect pests of pea crop.
- Similarly, efficacy of whey, *Aloe barbadensis* and *Nicotiana tabacum* in combination against the pod borers of grams and *Vitex negundo* against insect pests of rice, the major crop of India needs be confirmed through multi-locational trials and the know how to be disseminated to the farmers.

This practice needs to be assessed on all the important crops against the relevant insect pests and should be incorporated in the package of practices of the different crops so that all the farmers get benefited.

In view of the results obtained, it is felt that there is a need to exploit the potential of indigenous eco-friendly agents having insecticidal properties for their eventual use in the control of the arthropods, as they are safe, biodegradable and eco-friendly as compared to modern insecticides. However, while there is much to admire about traditional agriculture, there is no reason to assume that cultural evolution leads to an optional adaptation any more than biological evolution does⁷. Contribution from scientists and farmers is still required to meet the challenges posed by increasing populations and deteriorating natural environment⁸.

Conclusion

These indigenous techniques can minimize the harmful and expensive synthetic chemical insecticides. Since the chances of development of resistance by pests, towards a cultural control are very low, it is expected to provide a long-term solution for

the control of insect pests of agricultural crops. Although, the effectiveness of these indigenous technical knowledge (ITK) is quite high in the test crops for insect pest management, these need to be worked out for other crops. Ingredients of these insecticides need to be separated and analyzed at biochemical level for a better insight into their insecticidal properties and for working out better management strategies in the future.

The farmers have a very useful collection of indigenous technical knowledge on the use of bio-products as insecticides. But there is an urgent need to assess all these under varied agro-economic, socio-cultural and ecological situations possibly with locally available amendments / refinements / technologies so that this voluminous technical knowledge could be made use of in the larger interest of farming community.

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