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Kapil Kumar Bhuyan
Department of Tea Husbandry
and Technology, Assam
Agricultural University, Jorhat
785 013, Assam, India

Gautam Kumar Saikia
Professor, Department of Tea
Husbandry and Technology,
Assam Agricultural University,
Jorhat 785 013, Assam, India

Mukul Kumar Deka
Professor, Department of
Entomology, Assam Agricultural
University, Jorhat 785013,
Assam, India

Bithika Phukan
Jr. Scientist, Regional
Agricultural Research Station,
Karimganj 788710, Assam, India

Subhash Chandra Barua
Professor and Head, Department
of Tea Husbandry and
Technology, Assam Agricultural
University, Jorhat 785 013,
Assam, India

Correspondence

Kapil Kumar Bhuyan
Department of Tea Husbandry
and Technology, Assam
Agricultural University, Jorhat
785 013, Assam, India

Traditional tea pest management practices adopted by small tea growers of Assam

Kapil Kumar Bhuyan, Gautam Kumar Saikia, Mukul Kumar Deka, Bithika Phukan and Subhash Chandra Barua

Abstract

The present study was an effort to gather Indigenous Technical Knowledge (ITK) used for tea pest management prevalent among the small tea growers of different districts of Assam viz. Tinsukia, Dibrugarh, Sivasagar, Jorhat, Golaghat, Nagoan, Sonitpur and Lakhimpur. The information was collected on the basis of personal interview to each of the growers through a questionnaire. The procedures of such practices like materials, method/techniques were noted as per the interview schedule. The results reflected mosaic of ITKs appeared from the tea growers practices and many of them has been found effective by them and may serve as inputs for valid scientific investigation for large scale use in tea pest management. The ingredients used were available locally in abundance made from either plant or animal product. The tea growers were using those traditional practices to control pests like red spider mite (*Oligonychus coffeae*), tea mosquito bug (*Helopeltis theivora*) and looper caterpillar (*Buzura suppresseria*).

Keywords: Indigenous technical knowledge, tea pests, Assam, traditional knowledge

1. Introduction

India has an array of herbal plants with medicinal and insecticidal properties, which can be harnessed for the production of bio pesticides, helping resource-limited farmers in pest management in an eco-friendly and economic way [3]. These traditional agricultural practices have been practiced since many years. From the time when man made the great transition from hunter to tiller, many such practices have been adopted for crop production in different phases of evolution of agriculture [6]. Even in the stage of modern agriculture, such traditional agricultural practices are primarily based on experiences of man and his intimate knowledge on plants and animals. These practices are more prevalent in remote, isolated and inaccessible areas where the modern innovations and technologies have not been adopted [6]. Various plant extracts and plant parts have been reported to have insecticidal properties [4] while some plant extracts possess significant oviposition deterrence or antifeedant or toxic effects on selected tea pests [1].

Application of chemical pesticides has endangered the sustainability of production system [5]. Traditional knowledge or Indigenous Technical Knowledge (ITK) is the result of farmer's thousands years of experience with nature. These are accumulated knowledge, skill and technology of ethnic groups, derived from their direct interaction with environment, which are ecologically sound, low cost and sustainable to deal with issues related to various agro-ecosystems [5]. The role of traditional knowledge in sustainable agricultural production in developing countries has been gaining recognition within scientific circles. Also, many growers adopted these practices as these are eco-friendly, cost-effective, and easily available in their locality [6]. With the change from subsistence farming to the present-day commercial farming, humans brought in drastic changes in farming methods and consequently realized that the present-day technique adopted for commercial agriculture may be unsustainable in the long run [5].

Recently in Assam, these traditional plant protection practices have been adopted by many small tea growers in different pockets of the state [6]. However, information on such practices is not readily available. So, keeping in view the above facts, the present investigation "Traditional tea pest management practices adopted by small tea growers of Assam" was undertaken with the objective of collecting information on ITKs being practiced by the small tea growers at different districts of Assam.

2. Methodology

The study was conducted during 2014-2015 in eight districts of Assam, viz. Tinsukia, Dibrugarh, Sivasagar, Jorhat, Golaghat, Nagon, Sonitpur and Lakhimpur. From each district, a few tea growers were selected for collection of information on Indigenous Technical Knowledge used in relation to tea pest management as shown in Fig. 1 and 2. The procedures of such practices like materials, method and techniques used were noted as per interview schedule and the observations are presented in Table 1.

3. Results and Discussion

Altogether 39 tea growers were selected and interviewed for collection of information on traditional practices used in relation to insect/pest management as presented in Table 1. The procedures of such practices like materials, method/techniques were noted as per the interview schedule. The growers were using those traditional practices to control pests like red spider mite (*Oligonychus coffeae*), tea mosquito bug (*Helopeltis theivora*) and looper caterpillar (*Buzura suppressaria*). The results reflected the use of traditional

practices in the form of ingredients made from either plant or animal product as shown in Fig. 3. The ingredients used were available locally in abundance. Some potential plants useful for the pest management were *Polygonum hydropiper* (Pothorua bihlongoni), *Azadirachta indica* (Neem), *Pongamia pinnata* (Karanj), *Melia azedarach* (Ghora neem), *Clerodendrum viscosum* (Dhopat teeta), *Capsicum annum* (Chilli), *Allium sativum* (Garlic), *Nicotinna tabacum* (Tabacco) *Musa acuminata* (Banana pseudostem), as shown in Table 2. It was found that, (56.41%) of the growers used cow dung and cow urine followed by *Azadirachta indica* (48.71%), *Polygonum hydropiper* (43.58%), and Fish waste (30.78%). Others ingredients are used in small quantities. Similar surveys were also conducted by many other workers [2][6][5]. The procedure of preparation of the traditional practices also varied from area to area and required validation and standardization. As the plantations were small in size, the growers could manage the pests effectively by adopting these practices. Once those practices were standardized, it might help the small growers sector of the tea industry to produce tea organically, which would be better for future tea industry.

Table 1: Traditional practices for tea pest management

Target pest	Materials used	Practice/preparation/method of application	Farmer's observation	Location
Red Spider Mite (<i>Oligonychus coffeae</i>)	Materials: Neem (<i>Azadirachta indica</i>)- 15kg, Pothorua bihlongoni (<i>Polygonum hydropiper</i>)- 10kg, Fish waste- 4kg, Water- 50L and Cow urine- 5L.	Neem and Pothorua bihlongoni are crushed and mixed with water, fish waste and cow urine are kept for 10 days. The solution is then filtered and sprayed on infested bushes at 10L in 100L of water and sprayed at an interval of 10 days.	Satisfactory control	Tingkhong, Dibrugarh
Red Spider Mite (<i>Oligonychus coffeae</i>)	Materials: Neem (<i>Azadirachta indica</i>)- 10kg, Fish waste- 3kg, Water- 50L, Cowdung- 10kg and Cow urine- 5L.	Neem leaves are crushed and mixed with water, cow dung, fish waste and cow urine are kept for 10 days. The solution is then filtered and sprayed on infested bushes at 5L in 100L of water. It was sprayed at 20 days interval.	Satisfactory control	Joypur, Dibrugarh
Red Spider Mite (<i>Oligonychus coffeae</i>)	Materials: Neem (<i>Azadirachta indica</i>) seeds - 5kg, Pothorua bihlongoni (<i>Polygonum hydropiper</i>)- 10kg, Water Hyacinth (<i>Eichhornia crassipes</i>)- 5kg and Water- 50L.	Neem seeds, Pothorua bihlongoni and water hyacinth are crushed and soaked in water for 15 days and after filtered sprayed in the field at 10L in 100L of water. It was sprayed at 30 days interval.	Satisfactory control	Joypur, Dibrugarh
Red spider mite (<i>Oligonychus coffeae</i>)	Materials: Water- 100L, Pothorua bihlongoni (<i>Polygonum hydropiper</i>) - 30kg and Cow urine- 50 L.	Pothorua bihlongoni is crushed and soaked in water and cow urine for 10 days and after filtration sprayed in the field at 15L in 100L of water at an interval of 20 days.	Satisfactory control	Hatikhuli Tea Estate, Golaghat
Red spider mite (<i>Oligonychus coffeae</i>)	Materials: Dhopat teeta (<i>Clerodendrum viscosum</i>)- 2kg, Bahek teeta (<i>Adhatoda vasica</i>)- 2kg and water – 100L.	Dhopat teeta and bahek teeta leaves are crushed and dip in 100L water for 6 to 22 hours and then filtered and sprayed in the field. It is sprayed in the interval of 8 days.	About 80% control	Tingkhong, Dibrugarh
Tea mosquito bug (<i>Helopeltis theivora</i>)	Materials: Neem (<i>Azadirachta indica</i>)- 2kg, Chilli (<i>Capsicum annum</i>)- 2kg, Garlic (<i>Allium sativum</i>)- 2kg, Fish waste- 3kg, Cow urine- 10L and Water- 50L.	Neem, chilli and garlic are crushed and mixed with fish waste and cow urine and kept it for 3 days and then water is added to it. Sprayed in the infested bushes at 1L in 20L of water at an interval of 15days.	About 60% control	Nimonagarh, Sivasagar
Tea mosquito bug (<i>Helopeltis theivora</i>)	Materials: Cattle urine- 15 L and Water-10L.	Cattle urine is collected in a bucket and diluted with water and sprayed in the infested bushes immediately.	About 40% control	Charaipung, Sivasagar
Tea mosquito bug (<i>Helopeltis theivora</i>)	Materials: Ghora neem (<i>Melia azedarach</i>)- 5kg, Pothorua bihlongoni (<i>Polygonum hydropiper</i>)- 5kg, Tabacco (<i>Nicotinna tabacum</i>)- 2kg, Jarmoni bon (<i>Chromolaena odorata</i>)- 2kg, Water- 10L, Fresh cow dung- 2kg and Cattle urine- 5L.	The leaves of all the materials are crushed and mixed with cow dung, cow urine and water are kept for 10 days. 10L of solution in 100L of water is applied in the infested bushes.	About 70% control	Phulbari, Jorhat
Tea mosquito bug (<i>Helopeltis theivora</i>)	Materials: Cattle urine- 10L and Water- 50L.	Cattle urine is collected in a bucket. It is diluted to 50% with water. Then it is sprayed. The solution is applied at an interval of 15	About 30% control	Melamora, Golaghat

		days.		
Tea mosquito bug (<i>Helopeltis theivora</i>)	Materials: Amla (<i>Phyllanthus emblica</i>)-2kg, Neem (<i>Azadirachta indica</i>)- 10kg, Cowdung- 10kg and Water- 50L.	Amla and neem are crushed and mixed with cowdung and water and kept it for 10days and then sprayed in the infested bushes at 10L in 100L of water. The solution is applied at an interval of 20 days.	Satisfactory control	Kaliapani, Dibrugarh
Red Spider Mite (<i>Oligonychus coffeae</i>), Tea mosquito bug (<i>Helopeltis theivora</i>)	Materials: Neem (<i>Azadirachta indica</i>) - 10kg, Neem seed- 2kg, Water- 200L, Cow dung- 5kg and Cow urine- 50L.	Neem leaves and seeds are taken and crushed in traditional crusher and dipped in water. Raw cow dung and cow urine is mixed with this water. Solution is kept for 15 days. After 15 days the mixture is sprayed to the affected areas. The solution is applied at an interval of 15 days.	About 50% control	Titabar, Jorhat
Red Spider Mite (<i>Oligonychus coffeae</i>) Tea mosquito bug (<i>Helopeltis theivora</i>)	Materials: Water- 10L, Fresh cow dung- 1 kg and Fish waste- 4kg.	Fresh cow dung is stirred properly in 10L of water along with fish waste and kept for 3 days and then it is applied 100ml of solution in 100L of water. The solution is applied at an interval of 15 days.	About 80% control	Dangorikumar, Sivasagar
Red Spider Mite (<i>Oligonychus coffeae</i>), Tea mosquito bug (<i>Helopeltis theivora</i>)	Materials: Fish fin- 80kg, Cow urine- 50L, Cow dung- 15kg and Water 100 L.	Fish fins, cow urine, cow dung and water are kept in a plastic drum for 7 days after that it is filtered and sprayed in the field at 2L in 200L of water. It was sprayed at 30 days interval.	Satisfactory control	Deha Tea Estate, Jorhat
Red Spider Mite (<i>Oligonychus coffeae</i>), Tea mosquito bug (<i>Helopeltis theivora</i>)	Materials: Neem (<i>Azadirachta indica</i>)-1kg, Datura seed (<i>Datura stramonium</i>)-500gm, Dry fish- 25gm and Water 10L.	The leaves of neem, datura seed and water are boiled together for two hours. The solution is then sieved and the residual solution is then cooled. For flavour small dry fish first crushing and then keep it 1 day for fermentation. 100 ml of solution in 500L of water. The solution is applied at an interval of 15 days.	About 80% control	Bamuni Gaon, Nagaon
Red Spider Mite (<i>Oligonychus coffeae</i>) Looper caterpillar (<i>Buzura suppresseria</i>) Tea mosquito bug (<i>Helopeltis theivora</i>)	Materials: Neem (<i>Azadirachta indica</i>) - 2kg, Karanj (<i>Pongamia pinnata</i>)-2kg, Pothorua bihlongoni (<i>Polygonum hydropiper</i>) - 2kg, Chilli (<i>Capsicum annum</i>)- 2kg, Cow urine- 5L and Water- 100L.	Neem, karanj, Pothorua bihlongoni chilli are crushed and mixed with cow urine and water and kept it for 7 days and then it is filtered and sprayed in the field at 10L in 200L of water. It was sprayed at 30 days interval.	About 60% control	Phillobari, Tinsukia
Red Spider Mite (<i>Oligonychus coffeae</i>) Looper caterpillar (<i>Buzura suppresseria</i>) Tea mosquito bug (<i>Helopeltis theivora</i>)	Materials: Neem (<i>Azadirachta indica</i>)-3kg, Karanj (<i>Pongamia pinnata</i>) - 5kg, Pothorua bihlongoni (<i>Polygonum hydropiper</i>) - 5kg, Chilli (<i>Capsicum annum</i>)- 1kg, Cow urine- 10L and Water- 100L.	Neem, karanj, Pothorua bihlongoni chilli are crushed and mixed with cow urine and water and kept it for 7 days and then it is filtered and sprayed in the field at 10L in 200L of water. It was sprayed at 10 days interval.	About 70% control	Phillobari, Tinsukia
Red Spider Mite (<i>Oligonychus coffeae</i>) Looper caterpillar (<i>Buzura suppresseria</i>) Tea mosquito bug (<i>Helopeltis theivora</i>)	Materials: Ghora neem (<i>Melia azedarach</i>)- 5kg, Fish waste- 2kg, Cow dung- 1kg and Water- 15L.	Leaves of ghora neem are taken and crushed in traditional crusher and boiled then raw cow dung is made solution with water 1kg in 15L of water and both the solution is mixed together and kept with fish waste overnight. Next day the mixture is sprayed to the affected area @ 250 ml /15L of water. It is applied at an interval of 7 days for 3-4 times. It was sprayed at 15 days interval.	About 50% control	Charaipung, Sivasagar
Red Spider Mite (<i>Oligonychus coffeae</i>) Looper caterpillar (<i>Buzura suppresseria</i>) Tea mosquito bug (<i>Helopeltis theivora</i>)	Materials: Neem (<i>Azadirachta indica</i>)-5kg, Pothorua bihlongoni (<i>Polygonum hydropiper</i>)- 5kg, Karanj (<i>Pongamia pinnata</i>) - 5kg, Garlic (<i>Allium sativum</i>)- 2kg, Bhut jolokia (<i>Capsicum chinensis</i>)-2kg, Lentil (<i>Lens culinaris</i>)- 1kg, Gur (Jaggery)- 1kg, Cow urine- 15L, Cow dung- 15kg, Vermicompost- 2kg and Vermi wash- 3L.	Leaves of are neem, Pothorua bihlongoni, karanj are crushed and then garlic, bhut jolokia, lentil, Jaggery are also crushed separately and mixed with vermin compost, vermin wash, cow urine, cow dung and kept in cool place for 7 to 10 days. Then the extract is filtered and sprayed in the field at 15L in 200L of water as soil and foliar application. The solution is applied at 20- 30 days interval.	Satisfactory control	Tiphook, Sivasagar
Red Spider Mite (<i>Oligonychus coffeae</i>) Looper caterpillar (<i>Buzura suppresseria</i>) Tea mosquito bug (<i>Helopeltis theivora</i>)	Materials: Neem (<i>Azadirachta indica</i>) - 5kg, Karanj (<i>Pongamia pinnata</i>) - 2kg, Vermicompost- 2kg, Vermin wash-1L, Garlic (<i>Allium sativum</i>)- 1kg, Oil cake- 3kg, Citronella Grass (<i>Cymbopogon nardus</i>)- 2kg, Water- 50L, Cowdung- 15kg and Cow urine-15L.	Neem, karanj, garlic, citronella are crushed and mixed with water, oil cake, cowdung and cow urine and kept in cool place for 7 to 10 days. The solution is then filtered and sprayed on infested bushes at 20L in 200L of water. It was sprayed at 30 days interval.	About 80% control	Namtidole, Sivasagar
Red Spider Mite (<i>Oligonychus coffeae</i>) Looper caterpillar	Materials: Ghora neem (<i>Melia azedarach</i>)- 2kg, Water- 50L and Cow dung- 1kg.	Leaves of Ghora neem are taken and crushed in traditional crusher and boiled. Raw cow dung is made solution with water at 1kg in	About 50% control	Melamora, Golaghat

(<i>Buzura suppresseria</i>) Tea mosquito bug (<i>Helopeltis theivora</i>)		15L water. Both the solution is mixed together. Solution is kept overnight. Next day the mixture is sprayed to the affected area at 500ml 15L of water. The solution is applied at an interval of 7 days.		
Red Spider Mite (<i>Oligonychus coffeae</i>) Looper caterpillar (<i>Buzura suppresseria</i>) Tea mosquito bug (<i>Helopeltis theivora</i>)	Materials: Banana pseudostem- 5kg, Fish waste- 3kg, Cow dung- 15kg, Vermicompost- 5kg and Water 50L.	Banana pseudostem are cut into small pieces and mixed with fish waste, cow dung and vermi compost along with water 50L and sprayed in the infested bushes. The solution is applied at an interval of 15 days.	About 60% control	Khelmati, Lakhimpur
Red Spider Mite (<i>Oligonychus coffeae</i>) Looper caterpillar (<i>Buzura suppresseria</i>)	Materials: Ghora neem (<i>Melia azedarach</i>)- 2kg, Jarmoni bon (<i>Chromolaena odorata</i>)- 5kg, Water- 50L, Cow urine- 5L and Cow dung- 10kg.	Leaves of Ghora neem and jarmoni bon are dipped in two different containers separately for 7 days. After which the solution is separated from the leaves. Both the solution is mixed together. Also cow urine is mixed to the solution. the mixture is sprayed to the affected area at 250ml in 15L of water. The solution is applied at an interval of 7 days for 3-4 times. It was sprayed at 10 days interval.	About 50% control	Titabor, Jorhat
Looper caterpillar (<i>Buzura suppresseria</i>)	Materials: Rice starch- 1L and Water- 1L.	Rice starch and water are mixed and spot spaying is done in the infested bushes.	About 60% control	Joypur, Dibrugarh
All pests	Materials: Ghora neem (<i>Melia azedarach</i>)- 2kg, Fish waste- 4kg, Cowdung-10kg, Neem seed- 1kg and Water- 100L.	Neem seeds and leaves are crushed and mixed with cow dung, fish waste and water are kept for 7 days and filtration is done and applied at 10L in 100L of water. It was sprayed at an interval of 10-15 days.	About 60% control	Tingkhong, Dibrugarh
All pests	Materials: Pothorua bihlongoni (<i>Polygonum hydropiper</i>)- 2kg, Bahek teeta (<i>Adhatoda vasica</i>) - 2kg, Neem (<i>Azadirachta indica</i>)- 2kg, Karanj (<i>Pongamia pinnata</i>) - 2kg, Water- 50L, Cow urine- 5L and Vermi wash- 2L.	Pothorua bihlongoni, bahek teeta, neem and karanj leaves and stem are crushed and mixed with water, cow dung, vermin wash and cow urine are kept for 5 to 7 days. The solution is then filtered and sprayed on infested bushes at 10L in 100L of water. It was sprayed at an interval of 10 days.	About 70% control	Joypur, Dibrugarh
All pests	Materials: Neem (<i>Azadirachta indica</i>) - 2kg, Karanj (<i>Pongamia pinnata</i>) - 3kg, Pothorua bihlongoni (<i>Polygonum hydropiper</i>)- 10kg, Sugarcane leaves- 2kg, Chilli (<i>Capsicum annum</i>)- 1kg, Cow dung- 10kg and Water- 50L	Neem, karanj, Pothorua bihlongoni and sugarcane leaves are crushed and mixed with chilli powder along with cow dung and water and kept it for 7 to 15 days and then filtered and sprayed in the field at 16L in 200L of water. It was sprayed at 20 days interval during severe infestation.	About 50% control	Mahmora, Dibrugarh
All pests	Materials: Neem (<i>Azadirachta indica</i>) - 5kg, Fish waste- 2kg, Cow dung- 15kg, Mustard cake- 5kg and Water -50L.	Neem leaves is crushed and mixed with along cow dung, mustard cake, fish waste and water and kept it for 7 to 15 days and then filtered and sprayed in the field at 16L in 200L of water. It was sprayed at an interval of 7 days.	About 80% control	Mahmora, Dibrugarh
All pests	Materials: Onion (<i>Allium cepa</i>)- 2kg, Garlic (<i>Allium sativum</i>)- 2kg, Neem (<i>Azadirachta indica</i>)- 2kg, Pothorua bihlongoni (<i>Polygonum hydropiper</i>)- 2kg and Water- 50L	Onion, garlic, neem, Pothorua bihlongoni are crushed and mixed with water. The extract is then filtered and applied on the infested bushes at 15L in 200L of water. It is sprayed at 15 days interval.	About 80% control	Romai, Dibrugarh
All pests	Materials: Onion (<i>Allium cepa</i>)- 2kg, Garlic (<i>Allium sativum</i>)- 2kg, Neem (<i>Azadirachta indica</i>)- 2kg, Pothorua bihlongoni (<i>Polygonum hydropiper</i>)- 2kg and Water- 50L,	Onion, garlic, neem, Pothorua bihlongoni are crushed and mixed with water and kept it for 5 days. The extract is then filtered and applied at 15L in 200L of water. It is sprayed at 15 days interval.	About 80% control	Sessa, Dibrugarh
All pests	Materials: Neem (<i>Azadirachta indica</i>) leaves - 10kg, Tulsi (<i>Ocimum tenuiflorum</i>)- 3kg, Pothorua bihlongoni (<i>Polygonum hydropiper</i>)- 10kg, Amla (<i>Phyllanthus emblica</i>)- 5kg, Water- 50L, Cowdung- 10kg and Cow urine- 5L.	Neem, Pothorua bihlongoni, tulsi, amla are crushed and mixed with water, cowdung and cow urine and kept for 7 days. The solution is then filtered and sprayed on infested bushes at 15L in 100L of water. The solution is applied at an interval of 15 days.	About 100% control	Kaliapani, Dibrugarh
All Pests	Materials: Ghora neem (<i>Melia azedarach</i>)- 1kg, Pothorua bihlongoni (<i>Polygonum hydropiper</i>)- 2kg, Banana pseudostem- 3kg, Dhopat teeta (<i>Clerodendrum viscosum</i>)- 1kg, Garlic (<i>Allium sativum</i>)- 1kg and Water- 100L.	Leaves of ghora neem, Pothorua bihlongoni, banana pseudostem, dhopat teeta, garlic are crushed and mixed water and keep it for 7 days and sprayed in the infested bushes at 4L in 100L of water. The solution is applied at an interval of 15 days.	About 75% control	Bagargaon, Jorhat
All Pests	Materials: Peepal tree root zone soil-	Rice, black gram are crushed and mixed with	About 100%	Bagargaon,

	4kg, Rice- 2kg, Black gram (<i>Vigna mungo</i>)- 2kg, Cow dung- 10kg, Cow urine- 20L and Water- 200L	peepal tree root zone soil along with cow dung, cow urine and water and sprayed in the field. The solution is applied at an interval of 7 days.	control	Jorhat
All Pests	Materials: Neem (<i>Azadirachta indica</i>) - 5kg, Karanj (<i>Pongamia pinnata</i>)- 5kg, Pothorua bihlongoni (<i>Polygonum hydropiper</i>)- 5kg, Fish waste- 2kg, Cow dung- 10kg and Cow urine- 10L.	Neem, Pothorua bihlongoni, karanj are cut into small pieces and mixed with fish waste along with cow dung, cow urine and water and kept it for 7 days and sprayed in the infested bushes at 2L in 100L of water.	About 70% control	Chenijan, Jorhat
All pests	Materials: Neem (<i>Azadirachta indica</i>) - 10kg, Karanj (<i>Pongamia pinnata</i>) - 5kg, Tobacco (<i>Nicotinna tabacum</i>) - 2kg, Pothorua bihlongoni (<i>Polygonum hydropiper</i>)- 5kg, Cow urine- 5L, Water- 50L and Cowdung- 10kg.	Neem, Pothorua bihlongoni, karanj and tobacco are crushed and mixed with water, cow dung and cow urine and kept for 7 days. The solution is then filtered and sprayed on infested bushes at 5L in 100L of water. The solution is applied at an interval of 15 days.	About 60% control	Bhangamandir, Sonitpur
All pests	Materials: Neem (<i>Azadirachta indica</i>)- 5kg, Pothorua bihlongoni (<i>Polygonum hydropiper</i>)- 10kg, Water hyacinth (<i>Eichhornia crassipes</i>)- 2 kg, Banana pseudostem- 5kg, Mustard cake- 3kg, fish water- 2L, Chilli (<i>Capsicum annum</i>)- 1kg, Cow dung- 10kg, Cow urine- 5L and Lime- 2kg.	Neem, Pothorua bihlongoni, water hyacinth and banana pseudostem are crushed and mixed with chilli powder, mustard cake along with cow dung, fish water and cow urine and kept it for 7 days and then it is filtered and sprayed in the field at 5L in 200L of water. The solution is applied at an interval of 30 days.	About 90% control	Bhangamandir, Sonitpur
All pests	Materials: Neem (<i>Azadirachta indica</i>)- 5kg, Kolmow- 2kg, Banana pseudostem- 5kg, Chilly (<i>Capsicum annum</i>)- 2kg, Mustard oil cake- 2kg, Water hyacinth (<i>Eichhornia crassipes</i>)- 5 kg, Cow urine- 5L, Lime- 1kg and Water- 50L.	All the plant parts are crushed and dip in cow urine, lime and water for 4 to 5 days and filtered and sprayed in the field at 15 to 20 days interval as soil and foliar spray. The solution is applied at an interval of 15 days.	Satisfactory control	Dhekiajuli, Sonitpur
All pests	Materials: Neem (<i>Azadirachta indica</i>)- 3kg, Jarmoni bon (<i>Chromolaena odorata</i>)- 2kg, Banana pseudostem - 5kg, Pothorua bihlongoni (<i>Polygonum hydropiper</i>)- 10kg, Cow dung- 10kg, Cow urine- 5L, Dry fish- 2 kg and Water- 50L.	Neem, Jarmoni bon, Banana pseudostem, Pothorua bihlongoni are crushed and dip in cow urine, cow dung, dry fish and water for 6 to 8 days and filtered and sprayed in the field at 15 days interval.	About 80% control	Hugrajuli, Sonitpur
All pests	Marerials: Banana pseudostem- 5kg, Fish waste- 2kg, Vermi compost- 3kg, Cow dung- 10kg and Cow urine- 50L.	Banana pseudostem is cut into small pieces and fish waste, cow dung, cow urine and vermi compost are mixed in a drum and kept it for 5 days and filtrations is done and sprayed in the infested bushes at 15 days interval.	About 50% control	Nauboicha, Lakhimpur
All pests	Materials: Ghora neem (<i>Melia azedarach</i>)- 3kg, Pothorua bihlongoni (<i>Polygonum hydropiper</i>)- 2kg, Dhopat teeta (<i>Clerodendrum viscosum</i>)- 1kg, Garlic (<i>Allium sativum</i>)- 1kg and Water- 100L.	Leaves of ghora neem, Pothorua bihlongoni, dhopat teeta, garlic are crushed and mixed water and keep it for 10 days and sprayed in the infested bushes at 10L in 100L of water. The solution is applied at an interval of 15 days.	About 70% control	Selenghat, Jorhat

Table 2: Some potential plants useful for tea pest management

Scientific Name	Common Name	Local Name	Parts Used
<i>Pongamia pinnata</i>	Pongum	Karanj	Leaves
<i>Polygonum hydropiper</i>	Knot weed	Pothorua bihlongani	Aerial parts
<i>Azadirachta indica</i>	Neem	Mahaneem	Leaves and seeds
<i>Adhatoda vasica</i>	Basaka	Teeta bahek	Leaves and succulent stems
<i>Clerodendrum viscosum</i>	Clerodendrun	Dhopat teeta	Leaves and succulent leaves
<i>Capsicum annum</i>	Chilli pepper	Jolokia	Fruits
<i>Allium sativum</i>	Garlic	Nohoru	Whole plant
<i>Eichhornia crassipes</i>	Water hyacinth	Meteka	Whole plant
<i>Nicotinna tabacum</i>	Tabacco	Dhopat	Dried Leaves
<i>Phyllanthus emblica</i>	Amla	Amlokhi	Leaves and fruits
<i>Capsicum chinensis</i>	Ghost pepper	Bhut jolokia	Fruits
<i>Melia azedarach</i>	Neem	Ghora neem	Leaves
<i>Musa acuminata</i>	Banana	Kol	Pseudostem
<i>Ocimum tenuiflorum</i>	Tulsi	Tulasi	Leaves



Fig 1: Researcher during the process of his investigation



Fig 2: Spraying at growers garden



a. Fish waste

b. Cow dung and cow urine



c. Banana pseudostem, cow urine and water

d. *Polygonum hydropiper* and cow urine

Fig 3: Ingredients made from plant and animal product

4. Conclusion

From the present investigation, it can be concluded that the ITKs which are prevalent among the small tea growers if scanned, validated and standardized scientifically would definitely help in the management of tea pests.

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6. References

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