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INDIGENOUS TECHNICAL KNOWLEDGE ON CROP PROTECTION OF MISHMI TRIBE, ARUNACHAL PRADESH, INDIA

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ABSTRACT

On January 2022, a study was conducted with an aim to identify and document the ITKs on crop protectionin the Anjaw district of Arunachal Pradesh, focusing on two sub-tribes, Kaman Mishmi and Tawrah/Taraon Mishmi, residing in different blocks. All CD blocks, 4 in total, within the district were included in the study. Eleven villages were randomly selected from each block for the study making it a total of 33. The research design was descriptive and multistage purposive cum random sampling design was followed. A total of 220 respondents were randomly selected for the study. A total of 18 ITK on crop protection were identified. A magico-cultural practice known as *Neongkshatotowat/Kalyuõkabigoya* was reported in rice *jhum* fields to control pest and disease infestations. Botanicals were also used for pest control, although the efficacy of this practice in the current situation remains questionable. *Tahmah-shung/Lükap-ashang* (*Gynocardia odorata*) and the root of *Chapukk/Chikãpum* (*Stephania japonica*) were reported to be used against locusts. The utilization of *Kasak/Maku* or carbon soot was also reported. Other cultural practices included late sowing of crops and cultivating crops in larger areas than required. To preserve and uplift the ITK practices concerned agencies should undertake extensive scientific validation and field trials to integrate the valuable insights from both the scientific world and Indigenous Technical Knowledge.

(Key words: ITKs, crop protection, pests, diseases, mishmi, Arunachal pradesh)

INTRODUCTION

Indigenous Technical Knowledge (ITK) is local knowledge unique to a given culture or society. It is an integral part of the culture and history of a local community. It is the knowledge that a community has cultivated through experiences, often validated over an extended period, adapted to local culture and environment. This knowledge is dynamic, evolving, and prioritizes risk minimization rather than profit maximization. 'Indigenous' in this context suggests that the knowledge is generated by the local people.

However, it is probable that it continues to evolve due to exposure to external factors, agencies, and individual innovations. 'Technical' in this context refers to the particular knowledge that individuals possess due to their own experiences in a specific subject area. Recognizing people's knowledge implies a more detailed understanding than that of others who lack the same experiences or skills in observing similar situations.

Variations in socio-economic, cultural, heritage, and ethnic systems among farmers in different regions, combined with diverse agro-climatic conditions in our country, lead to significant differences in farming practices and technological statuses from one place to another. It is commonly observed that farmers in specific regions possess indigenous technical knowledge influenced by geographical diversities and ethnic communities. These indigenous communities offer valuable insights into the sustainable use of natural resources, conservation, and restoration. Chandola *et al*. (2011) stated that the farmers are still managing pests with indigenous methods in Uttarakhand hills and identified various indigenous pest management practices and scientific basis of practicing them. Talisosang (2012) studied on indigenous rodent management by the Ao-Nagas of Nagaland and identified five indigenous practices *viz*., *Longnen*, *Merang sang*,

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Konglen, *Tsungtem* and *Tongi*. It was reported that all indigenous practices were considered effective except *Tongi* by the farmers. Benjongtoshi (2014) in his study on agricultural indigenous pest control method in *jhum* field crops in Mokokchung district, Nagaland identified and recorded 10 indigenous pest control methods, which were considered effective by the respondents. Gopi *et al.* (2016) identified the use of wood ash, kerosene, table salt, lime, cow urine, cow dung, some unique indigenous plants and indigenous techniques like insertion of bamboo pegs for the management of various pests and disease in Sikkim. Nath *et al.* (2017) concluded that identification of scientifically sound indigenous practices may serve as the input for valid scientific management for large scale use of insect pest management and in generation of low cost, location specific and appropriate technology. All in about 30 ITKs were collected and documented. The percentage of farmers practicing different ITKs ranged from 11.00 per cent to 78.65 per cent.Unfortunately, the knowledge systems of these farmers are frequently not systematically documented in written form, making them less accessible to agricultural researchers, extension workers, and development practitioners. Despite being overlooked by the development community, numerous indigenous organizations are actively operating in rural communities, striving to identify and implement solutions to community challenges.

Recent research on indigenous agricultural knowledge has started to demonstrate its influence. Notably, it has shaped the viewpoints of policy makers and agricultural development planners in recent years, triggering a renewed interest in this type of knowledge.Through this study it was also observed that traditional farmers place high value on hard work and manual labour and familiarity with labour intensive nature of traditional agriculture as it has been a part of their farming practices for many years.

MATERIALS AND METHODS

The study was conducted in the Anjaw district of Arunachal Pradesh, focusing on two sub-tribes, Kaman Mishmi and Tawrah/Taraon Mishmi, residing in different blocks. All blocks within the district were included in the study, namely Hayuliang-Goiliang CD Block, Manchal CD Block, Chaglagam-Metengliang CD Block, and Hawai-Walong CD Block. Eleven villages were randomly selected from each block for the study, namely Naraliang, Amliang, Kongra, Paya, Hayugham, Nenuliang, Glotonglat, Goiliang, Gemliang, Duiliang, and Challang from Hayuliang-Goiliang CD Block; Khalega-Metengliang, Tarampa, Chipra, Tegamna, Abohagam, Metengliang, Bomna, Methumna, Chipro, Teapani, and Roiliang from Chaglagam-Metailiang CD Block; Mepoglat, Qunboo, Khoiliang, Dhanbari, Greliang, Phonglonglat, Kanning, Hutong, Randam, Quibang, and Manchal from Manchal CD Block; and Watong, Chengung, Marbo, Kamlat, Ngi, Surnung, Sarti, Khamti, Yasong, and Warti from Hawai-Walong CD Block. The research design was descriptive and multistage purposive cum random sampling design was followed for the study. A total of 220 respondents were selected for the study, with 5 respondents chosen from each village. The selection of respondents was conducted randomly. Data collection was carried out through individual interviews and group discussions, utilizing a structured interview schedule.In this study, the effectiveness indigenous practices was assessed by using a structured schedule with five options, *viz*., no success, up to 25% success, up to 50% success, up to 75% success, up to 100% success where score ranges from 0 (no success) to 4 (up to 100% success). Each respondent was asked to put his/her opinion against each practices as per his/her experience in any one of the above mention alternatives as outlined by Talukdar *et al*. (2012). The effectiveness score of each practice was computed using the formula:

$$E_X = \Sigma X_i/n,$$

Where,

X_i= effectiveness score of i^{th} respondent for a particular practice (say, X),

ΣX_i = summation of individual respondent-wise effectiveness score for a particular practice

n= number of respondents who furnished response as to effectiveness of a particular practice (say, X)

E_x= effectiveness score of a particular practice (say, X).

The effectiveness scores were collected only for those practices and traps that were still practiced at the time of survey.

RESULTS AND DISCUSSION

Plant protection refers to the various measures and strategies employed to safeguard plants from pests, diseases, weeds, and other factors that can negatively impact their health and productivity. A total of 10 cultural methods and 8 mechanical methods of crop protection were identified and documented.

Table 2 revealed that *Neongkshatotowat /Kalyuõkabigoya* magico-cultural practice was followed by 89 respondents. From which 19.10 per cent of the respondent's perceived it to be up to 100.00 per cent effective while 65.16 per cent of the respondents perceived it to be up to 75.00 per cent effective and 15.73 per cent of the respondents perceived it as up to 50.00 per cent effective respectively. The *Mishmi* tribe of Anjaw district follows a magico-cultural practice known as *Neongkshatotowat/ Kalyuõkabigoya*. This ancient practice has been in existence for generations and is still observed by local communities in few pocket areas. The *Mishmi* ethnic tribe commonly engages in animistic religious activities, with magic playing a significant role in their practices. They hold the belief that spirits from the unknown world exert influence over various aspects of human life and the environment. *Neongkshatotowat/Kalyuõkabigoya* was primarily carried out to control pests and diseases in rice crops and promote the healthy growth of plants. The practice involves addressing damage symptoms observed in the plants, such as dead heart symptoms and brown discoloration that starts from the leaf tip. Magico-cultural

practices are deeply rooted in the cultural practice of the *Mishmi* community, which have been passed down through generations and hold significant cultural and historical value thus maintained by few farmers.

Tahmah-sit/*Lükap-sik* application was followed by none of the respondents. The local insecticide, known as *Tahmah-sit*/*Lükap-sik*, was primarily used to combat pests like hoppers. However, due to a decrease in hopper attacks, the application of *Tahmah-sit*/*Lükap-sik* was no longer followed.

Kasak/*Maku* or carbon soot application was followed by none of the respondents as most of the respondents were unaware about such practice. In the past, agricultural fields were situated far away from the villages and were cultivated on a larger scale. However, as the area dedicated to agricultural crops decreased and the fields became closer to settlements and village vicinity, the appearance of wild animals also decreased. Consequently, there has been a significant reduction in the opportunity to practice this traditional method (ITK). Over time, as the practice fell out of use, it became obsolete, and the knowledge about it gradually faded away from society.

Kasak/*Maku* application with ash and tobacco was followed by 8 respondents. All of the respondents perceived it to be up to 75.00 per cent effective. Due to decrease in the cultivation area of colacasia crops, the occurrence of pest attacks was rarely reported. Colacasia was cultivated on a larger scale as it served as an alternative food source and was also used as animal feed, particularly for pigs. However, over time, there has been a shift in the food system as rice was introduced and was being widely cultivated, leading to a decline in the cultivation of colacasia crops. This decline in cultivation was the primary reason for the decrease in the number of users relying on colacasia as a food source and animal feed.

Late sowing of crops was followed by 8 respondents. From which 62.50 per cent of the respondents perceived it to be up to 75.00 per cent effective while 37.50 per cent perceived it to be up to 50.00 per cent effective respectively. The farmers in the village areas were mostly older peoples, and they mostly rely on traditional farming methods and their agricultural practices are often closely aligned with the local climate and weather pattern. Therefore, it was revealed that late sowing may result in crops to escape adverse weather conditions and pest infestations. Therefore, planting time has a major role in reducing incidence of pest and diseases. As reported by Chaudhari *et al.* (2018) low incidence of leaf folder, brown plant hopper, white backed plant hopper and green leaf hopper were recorded in different plantings.

The practice of cultivating crops in larger area than required area was followed by none of the respondents. Over time, farmers began shifting towards horticultural crops, resulting in reduced areas being managed for agricultural crops. This shift limited the opportunities for practicing traditional agricultural methods in the field. Therefore, it is reasonable to assume that the traditional practice is no longer followed.

Biyomai/*Byume* was used by 173 respondents. Among which 27.74 per cent of the respondents perceived it to be up to 50.00 per cent effective while 72.25 per cent of respondents perceived it to be up to 25.00 per cent effective respectively. *Biyomai*/*Byume* is a scare crow made using straw which resembles human being structure dressed with human cloths.

Hakap/*Kapo* was used by 5 respondents. All of the respondents perceived it to be up to 75.00 per cent effective. *Hakap*/*Kapo* is prepared using bamboo which acts as clapper device to scare birds away.

Hambrung/*Tadap* was used by 47 respondents. Among the respondents, 38.29 per cent of respondents perceived *Hambrung*/*Tadap* to be up to 50.00 per cent effective, while 61.70 per cent perceived it to be up to 25.00 per cent effective. *Hambrung*/*Tadap* is created by hanging empty tin cans on bamboo sticks. When the wind blows, it produces sound which scares away birds.

Taiphungg/*Halyanggara* was used by none of the respondents. Most of the respondents were aware about the *Taiphungg*/*Halyanggara*. *Taiphungg*/*Halyanggara* is a dried wooden log, typically small to medium-sized, made from specific tree species such as *Makaranga sp.* and *Tahar-shung*/*Hülyang-ashang*. It was used as an instrument to produce sound when beaten, effectively scaring away birds and animals. Additionally, *Taiphungg*/*Halyanggara* served as a source of entertainment for people staying in fields far away from the village. However, as the time has passed and areas under agricultural crops have decreased, along with the availability of alternative media sources, the traditional use of *Taiphungg*/*Halyanggara* had been replaced by more versatile options.

Table 3 represents the extent of adoption and perceived effectiveness on mechanical methods of crop protection practised by *mishmi* tribe of Arunachal Pradesh.

Atiphang/*Machikkapo* was used by 13 respondents. *Atiphang*/*Machikkapo* is a device made by bamboo specifically designed to deter animals that pose a threat to agricultural fields, typically installed near fields with water streams. Similarly Miyazaki and Yamada (2016) also mentioned about the use of such device to scare birds and animals away by the sound produced.Among the respondents, 92.30 per cent of respondents perceived it to be up to 75.00 per cent effective while 7.69 per cent of respondents perceived it to be up to 50.00 per cent effective. Since these devices were installed near river streams, a single *Atiphang*/*Machikkapo* can cover a considerable area within its effective range in the vicinity. As a result, many others also benefit from a single installation. However, not everyone's field is located near a river stream, which limits the application of *Atiphang*/*Machikkapo* in those areas. Furthermore, once the application of *Atiphang*/*Machikkapo* is stopped, it may discourage farmers from future installations. Additionally, the lack of skilled individuals for proper installation in the study area may have discouraged people from using the device. These factors were the reasons why every farmer in the study area did not adopt the use of *Atiphang*/*Machikkapo*.

Handam/*Düye* was used by 127 respondents. Among which 31.49 per cent of respondents perceived it to

be up to 75.00 per cent effective while 64.56 per cent of respondents perceived it to be up to 50.00 per cent effective and 3.93 per cent of respondents perceived it to be up to 25.00 per cent effective respectively. *Handam*/*Düye* is a simple trap made using easily accessible stones commonly found in the nearby fields.Similar trap was identified by Talisosang, (2012). The use of *Handam*/*Düye* was reported in every block of the study area.

Tawan/*Taku*was used by 105 respondents. *Tawan*/*Taku* is a triangular trap made using fence wires and bamboo. The use of *Tawan*/*Taku* was reported in every block of the study area, indicating its widespread adoption. Among the respondents, 28.57 per cent of respondents perceived it to be up to 100.00 per cent effective while 68.57 per cent of the respondents perceived it to be up to 75.00 per cent effective and 2.85 per cent of the respondents perceived it to be up to 50.00 per cent effective respectively.

Kaiwoh was used by 8 respondents. *Kaiwoh* is a trap that utilizes a stone as a weight to entrap rodents while they are feeding on the bait.

Dhiawoh/*Thu* was used by 73 respondents. *Dhiawoh*/*Thu* is a snare trap made using a j-shaped stick and wire. Among the respondents, 1.36 per cent of respondents perceived it to be up to 100.00 per cent effective while 83.56 per cent of respondents perceived it to be up to 75.00 per cent effective and 15.06 per cent of the respondents perceived it as up to 50.00 per cent effective respectively.

Hakapp/*Kapoh* was used by 88 respondents. *Hakapp*/*Kapoh* is a split bamboo trap. Similar trap was identified by Talisosang (2012).Among the respondents, 1.13 per cent of respondents perceived it as up to 100.00 per cent effective while 72.72 per cent of respomdents perceived it to be up to 75.00 per cent effective and 26.13 per cent of respondents perceived it to be up to 50.00 per cent effective respectively.

Khyet/*Takhrek* was used by 66 respondents. *Khyet*/*Takhrek* is trap made using strong steel wires with a noose made in the wire. The trap is used mainly against large animals. The use of this trap was reported from every block in the study area. Among the respondents, 83.33 per cent of respondents perceived it to be up to 75.00 per cent effective while 16.66 per cent of respondents perceived it to be up to 50.00 per cent effective respectively.

Bappaih/*Talu*was used by 28 respondents. *Bappaih*/*Talu* is a type of spring pull snare that is strategically placed around fields against rodents and birds. It was reported from every block in the study area. Among the respondents, 64.28 per cent of respondents perceived it to be up to 75.00 per cent effective while 35.71 per cent of respondents perceived it to be up to 50.00 per cent effective respectively.

A total of 18 ITK on crop protection were identified. A magico-cultural practice known as *Neongkshatotowat/Kalyuõkabigoya* was reported in rice *jhum* fields to control pest and disease infestations. Botanicals were also used for pest control, although the efficacy of this practice in the current situation remains questionable. *Tahmah-shung/Lükap-ashang* (*Gynocardia odorata*) and the root of *Chapukk/Chikãpum* (*Stephania japonica*) were reported to be used against locusts. The utilization of *Kasak/Maku* or carbon soot was also reported. Other cultural practices included late sowing of crops and cultivating crops in larger areas than required.

Seven traps for rodents and other animals were identified: *Handam/Düye*, *Tawan/Taku*, *Kaiwoh*, *Dhiawoh/Thu*, *Hakapp/Kapoh*, *Khyet/Takhrek*, and *Bappaih/Talu*. Additionally, five different types of scarecrows and other devices were also used to deter birds and animals: *Biyomai/Byume*, *Hakap/Kapo*, *Hambrung/Tadap*, *Taiphungg/Halyanggara*, and *Atiphang/Machikkapo*. Most of the traps and other devices had a touch of bamboo (Nagi *et al.,* 2023).

Indigenous technical knowledge has been found to have strong roots in rural culture which offers a unique perspective and alternative approach to solving practical problems, often based on resourcefulness, adaptability, and a deep understanding of local ecosystems. One significant advantage of ITK is its focus on low-cost technologies and sustainability, which are often suitable for resource-constrained communities and have minimal environmental impact which can serve as an alternative to contemporary technologies.

Neongkshatotowat/
Kalyuõkabigoya

Tahmah-shung/Lükap-ashang
(Gynocardia odorata)

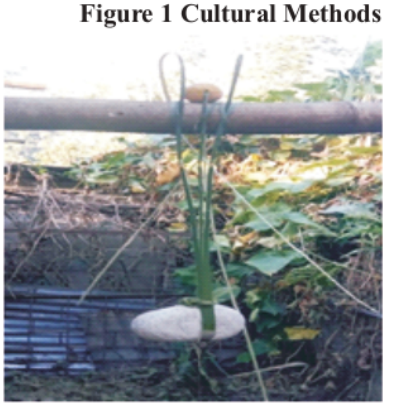
Kasak/Maku
(Carbon soot)

Chapukk/Chikãpum
(Stephania japonica)

Hambrung/Tadap

Figure 1 Cultural Methods

Handam/Düye



Kaiwoh

Tawan/Taku

Dhiawoh/Thu

Hakapp/Kapoh

Atiphang/Machikkapo

Figure 2 Mechanical Methods

1. Identification and documentation of Indigenous Technical Knowledge

Table 1. Indigenous Technical knowledge (ITK) on crop protection

ITK	Purpose
A) **Cultural Methods***i.*	
i. *Neongkshatotowat/Kalyuõkabigoya* is a traditional magico-cultural practice.	It is believed that this practice prevents further spread of blight like symptoms in leaves and dead heart symptoms in paddy field. It is also believed that this practice controls the spread of brown leaf spot in paddy field.
ii. *Tahmah-sit/Lükap-sik* application.	It is used against the locust which acts as an insecticide.
iii. *Kasak*/*Maku* is carbon soot applied in the leaves of paddy plants around the fields.	Due to the bitterness in taste & smell of *kasak*/*maku*, it was used as repellent against the herbivorous animals and wild boars which may damage the field.
iv. *Kasak*/*Maku* is carbon soot applied along with ash & tobacco used against borers in colacasia.	It kills the borer.
v. Late sowing of seeds.	It helps to prevent major damage to crops from pest infestation.
vi. Cultivating crops in larger area than the required one.	This additional area under cultivation creates a buffer zone that can absorb the impact of uncertainties.
vii. Restriction to carry freshly harvested *Shukrah/ Taraw hagrã* through the paddy field during flowering stage.	It is believed that strong smell from freshly harvested *shukrah*/*tarawhagrã* damages flower and leads to production of chaffy grains in rice.
viii. *Biyomai/Byime* scarecrow resembling human, made using the plant straw and cloths.	It is used to scare the monkeys and birds away.
ix. *Hakap*/*Kapo* is bamboo clapper device made using bamboos.	It is used to scare birds away.
x. *Hambrung*/*Tadap* is a type of scarecrow made using tin cans.	It is used to scare birds away.
xi. *Taiphungg/Halyanggara* a light weight dry wooden piece, which produces sound when beating using sticks.	It is used to scare animals and birds away.
B) Mechanical Methods	
i. *Atiphang*/*Machikkapo* is a sound making device made by using bamboo and placed near river streams.	To scare animals away from the field.
ii. *Handam*/*Düye* is a trap made using stone and bamboo.	This trap is used against rodents in the field.
iii. *Tawann/Taku* is a triangular trap made using fence wires and bamboo. It is strategically positioned along the paths frequently followed by rodents, such as stream crossings or tree branches near the field.	This trap is used against rodents.
iv. *Kaiwoh* is a trap that utilizes a stone as a weight to trap rodents while they are feeding on the bait.	This trap is used against rodents.
v. *Dhiawoh*/*Thu* is a snare trap constructed using a j-shaped stick and wire.	This trap is used against rodents and birds around the field.
vi. *Hakapp*/*Kapoh* is a trap made using split bamboo.	This trap is used against birds and rodents.
vii. *Khyet*/*Takhrek* is a trap where steel wire is used to make noose.	This trap is used against herbivore animals and wild boars which damage the field.
viii. *Bappaih/Talu* is trap similar to *Dhiawoh*/*Thu* as mentioned above. The difference can be observed the way the trap is placed.	This trap is used against birds.

2. Extent of adoption and perceived effectiveness towards crop protection

Table 2. Distribution of respondents based on extent of adoption and perceived effectiveness towards crop protection (Cultural method) N=220

Sl. No.	Cultural methods	No. of users		Effectiveness									
				No success		Up to 25 %		Up to 50 %		Up to 75 %		Up to 100 %	
		F	%	F	%	F	%	F	%	F	%	F	%
1	*NeongkshaTotowat / Kalyuõkabigoya*	89	40.46	-	-	-	-	14	15.73	58	65.16	17	19.10
2	*Tahmah-sit / Lükap-sik* application	-	-	-	-	-	-	-	-	-	-	-	-
3	*Kasak / Maku* application	-	-	-	-	-	-	-	-	-	-	-	-
4	*Kasak / Maku* application with ash and tobacco	8	3.63	-	-	-	-	-	-	8	100.00	-	-
5	Late sowing of crops	8	3.63	-	-	-	-	3	37.50	5	62.50	-	-
6	Cultivating crops in larger area than required area	-	-	-	-	-	-	-	-	-	-	-	-
7	*Biyomai/ Byime*	173	78.63	-	-	125	72.25	48	27.74	-	-	-	-
8	*Hakap / Kapo*	5	2.27	-	-	-	-	-	-	5	100.00	-	-
9	*Hambrung/ Tadap*	47	21.36	-	-	29	61.70	18	38.29	-	-	-	-
10	*Taiphungg/ Halyanggarã*	-	-	-	-	-	-	-	-	-	-	-	-

Table 3. Distribution of respondents based on Extent of adoption and perceived effectiveness towards crop protection (Mechanical method) N=220

Sl. No.	Mechanical methods	No. of users		Effectiveness									
				No success		Up to 25 %		Up to 50 %		Up to 75 %		Up to 100 %	
		F	%	F	%	F	%	F	%	F	%	F	%
1	*Atiphang/Machikkapo*	13	5.90	-	-	-	-	1	7.69	12	92.30	-	-
2	*Handam /Düye*	127	57.73	-	-	5	3.93	82	64.56	40	31.49	-	-
3	*Tawan /Takü*	105	47.73	-	-	-	-	3	2.85	72	68.57	30	28.57
4	*Kaiwoh*	8	3.63	-	-	-	-	-	-	7	87.50	1	12.50
5	*Dhiawoh/ Thu*	73	33.18	-	-	-	-	11	15.06	61	83.56	1	1.36
6	*Hakapp/ Kapo*	88	40.00	-	-	-	-	23	26.13	64	72.72	1	1.13
7	*Khyet/Takhrek*	66	30.00	-	-	-	-	11	16.66	55	83.33	-	-
8	*Bappaih/ Tali*	28	12.73	-	-	-	-	10	35.71	18	64.28	-	-

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