



# Chiuri (*Diploknema butyracea* (Roxb.) H.J. Lam): A tree species for improving livelihood of Chepang in Makwanpur, Central Nepal

Roshan Chikanbanjar, Umed Pun, Bhola Bhattarai and Ripu Mardhan Kunwar

## Research

### Abstract

**Background:** Chepang, a semi-nomadic minority group, is dependent on common and private forest resources, Chiuri (*Diploknema butyracea* (Roxb.) H.J. Lam) to be precise, for livelihood. This study was carried out to understand the household economy of Chepang and evaluate the benefit of Chiuri and its by-products such as Chiuri butter, honey or seeds in Raksirang Rural Municipality (RRM), Makwanpur, Nepal.

**Methods:** Primary data were collected through questionnaire surveys, interviews, informal discussions, etc. whereas the secondary data were collected through desk review.

**Results:** Many Chepangs (41 percent) who collect Chiuri earn an average of US\$ 41.43 annually by selling Chiuri seeds, which is very low in the present market value context. People of RRM are still living under poverty with annual income of less than US\$ 414.35 per household (78 percent) and food availability for < nine months (56 percent) in a year. Many of them (55 percent) extract more than 30 kg of butter and surplus butter are sold for US\$ 1.65-2.49 per kg. Normally they produce butter for domestic uses. Butter is applied for muscle spasm.

**Conclusions:** Our result shows that Chiuri is a natural complement to the livelihood of Chepangs. Bee farming in Chiuri growing areas helps generate additional income. Beside local economy, bee and Chiuri products are folkloric for primary healthcare. Hence, Chiuri is a plant with various economic benefits. Proper management of Chepang, Chiuri

and bee is an integrated approach of biodiversity conservation.

**Keywords:** Chepangs, Chiuri, bee farming, livelihood, collection center

### Correspondence

Roshan Chikanbanjar<sup>1\*</sup>, Umed Pun<sup>2</sup>, Bhola Bhattarai<sup>3</sup> and Ripu Mardhan Kunwar<sup>4</sup>

<sup>1</sup>Central Department of Environmental Science, Tribhuvan University, Kirtipur, Kathmandu

<sup>2</sup>Department of Horticulture, Njala University, Sierra Leone

<sup>3</sup>School of Arts, Kathmandu University, Hattiban, Lalitpur

<sup>4</sup>Florida Atlantic University, Boca Raton, Florida

\*Corresponding Author:

roshanchikanbanjar@gmail.com

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### Background

Nepal has approximately 10.8 million mostly naturally growing trees of Chiuri (*Diploknema butyracea* (Roxb.) H.J.Lam). It is geographically distributed in 46 districts of the country and has potential to produce 37,245 metric tons (MTs) Chiuri butter with market value of about NPR five billion (US\$ 41.4 million). The potential production of 17,285 MTs of honey was estimated from these Chiuri trees (MEDEP 2010) and Chiuri honey is one of the most sought honey in the Nepalese market. Various parts of Chiuri plant are used as food and

medicine by diverse ethnic groups in Nepal (Devkota *et al.* 2019). The properly processed packed Chiuri butter can offer strong potential for export market (Devkota *et al.* 2019).

Chepong and Chiuri have a deep relation for their livelihood (Acharya 2015, Dhakal 2014). Chiuri has significantly intrigued with the Chepong culture in Nepal and it has been given as dowry to Chepong daughters (Dhakal 2014). Chepongs do not chop up or fell Chiuri trees because of its multipurpose value (MEDEP 2010). In particular, the Chepong, a minority group of semi-nomadic people, intensively use and conserve Chiuri partly for their cultural and domestic use and partly for barter and sale (Bhattarai 1995, Chhetri *et al.* 1997). Traditionally, beekeeping with native hive bee, *Apis cerana* is very common in areas where Chiuri trees are prevalent (MEDEP 2010). Honeybees maintain biodiversity by providing pollination services and help increase rural income through the production of honey and other bee products (Teshome & Guta 2020). Chiuri butter is locally used mainly for cooking purpose in place of oilseeds crops in Chepong communities (Thapa 2019). The Chiuri butter is also used in soap companies, monasteries and temples, cosmetic companies and exports for cosmetics (GIZ 2014).

The economics of Chiuri trees in the Chepong livelihood has been studied (MEDEP 2010, Devkota *et al.* 2019), however the contribution and economics of Chiuri at Chepong household level is still parsimoniously studied. In this regard, this study was conducted to understand the economic benefits of Chiuri trees at community level of Chepongs of Raksirang Rural Municipality (RRM), Makwanpur, Nepal.

## Materials and Methods

### Study area

The RRM was selected as a study area. RRM lies at the Northwest side of Makwanpur district (Fig. 1 and Fig. 2). The administrative center of RRM that is Chainpur lies at Latitude: 27.54805556°N and Longitude: 84.84388889°E. The total population of this municipality was 30,830 in 2019 (RRM 2019). The total area of the municipality is 226.7 sq. km. and population density is 111.12 per sq. km. The maximum temperature is 35° C in summer and minimum is 5° C in winter. The average annual rainfall of the place is 2200 mm and average annual temperature is 27° C. The altitude of the municipality varies from 300 to 2300 meter above mean sea level (RRM 2019). The forest cover of RRM is 14,941 ha. (66.1 percent) (DFRS 2018). The municipality is mostly inhabited by Chepong who directly or indirectly depend on Chiuri and other forest products for their livelihood and primary health care. Majority

of the local people are farmers who depend on subsistence farming.

### Methods of data collection and analysis

Fieldwork was carried out between June and July 2020. Before conducting field work and household survey, written and oral prior informed consents were obtained respectively from the rural municipality office, community leaders and study participants. The household surveys using semi-structured questionnaires in the villages were carried out with the help of local assistants. Despite the nationwide lockdown imposed by the government of Nepal, there were no travel restrictions inside the villages, resulting in ease access of household survey. Total 100 Chepong households, randomly selected 25 from each ward (Silinge, Damrang, Devitar and Khairang Villages) of RRM took part in the survey. Twenty chairpersons of community-based organizations, such as ward chairpersons, chairpersons of Cooperatives, Forest User groups, Farmers' groups, Women's group, etc., were interviewed as key informants to cross-check the information.

## Results and Discussion

### Ecology: Chiuri and vegetation, bees

Chiuri is largely extended in west to east of Nepal in the south facing slopes. Out of the 77 districts of Nepal, almost 50 districts are known to have Chiuri plants, and 5623130 Chiuri fruiting trees are available (MEDEP, 2010). Chiuri tree is the deciduous but fast growing tree borne oilseed species natively found in Nepal and it's different districts as Accham, Baitadi, Bajhang, Bajura, Dadeldhura, Darchula, Doti, Kailali, Dailekh, Dang, Jajarkot, Pyuthan, Rolpa, Rukum, Salyan, Surkhet, Arghakhachi, Gulmi, Palpa, Nawalparasi, Baglung, Myagdi, Parbat, Kaski, Lamjung, Syangja, Tanahun, Gorkha, Chitwan, Dhading, Dolakha, Kabhre, Makwanpur, Lalitpur, Nuwakot, Ramechhap, Rasuwa, Sindhuli, Bhojpur, Morang, Dhankuta, Ilam, Khotang, Okhaldhunga, Sankhuwasava, Taplejung, Tehrathum, Udayapur, Sunsari districts are the major places where the Chiuri tree is distributed (MEDEP 2010). RRM is rich in natural resources, specifically the Chiuri.

The tree is usually found scattered in wastelands, pastures and cultivated fields near the villages. The tree also occurs separately or in small groups as a natural element of broadleaved forests, especially in association with sal (*Shorea robusta* C.F. Gaertn.), saj (*Terminalia alata* Banks ex G. Don), koiralo (*Bauhinia variegata* var. *candida* Buch.-Ham.), simal (*Bombax ceiba* Burm.f.), amla (*Emblica officinalis* Gaertn.), buddhairo (*Lagerstroemia parviflora* Roxb.), dhayo (*Woodfordia fruticosa* Kurz.), tatari

(*Dillenia pentagyna* Roxb.), barro (*Terminalia bellirica* (Gaertn.) Roxb.), tanki (*Bauhinia purpurea* Wall.), Bhalayo (*Semecarpus anacardium* L. f.) etc.

Other associated species are artillery plant (*Pilea symmeria* Wedd.), Currant (*Ribes takare* D. Don), Mug-wort (*Artemisia indica* Willd.), etc..

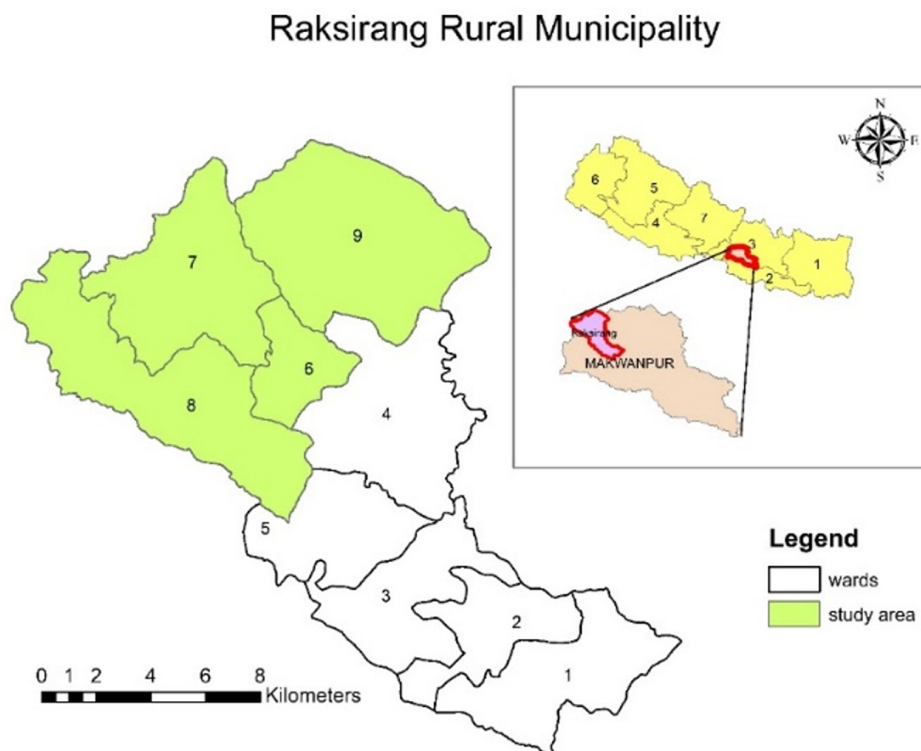


Figure 1. Map of study area

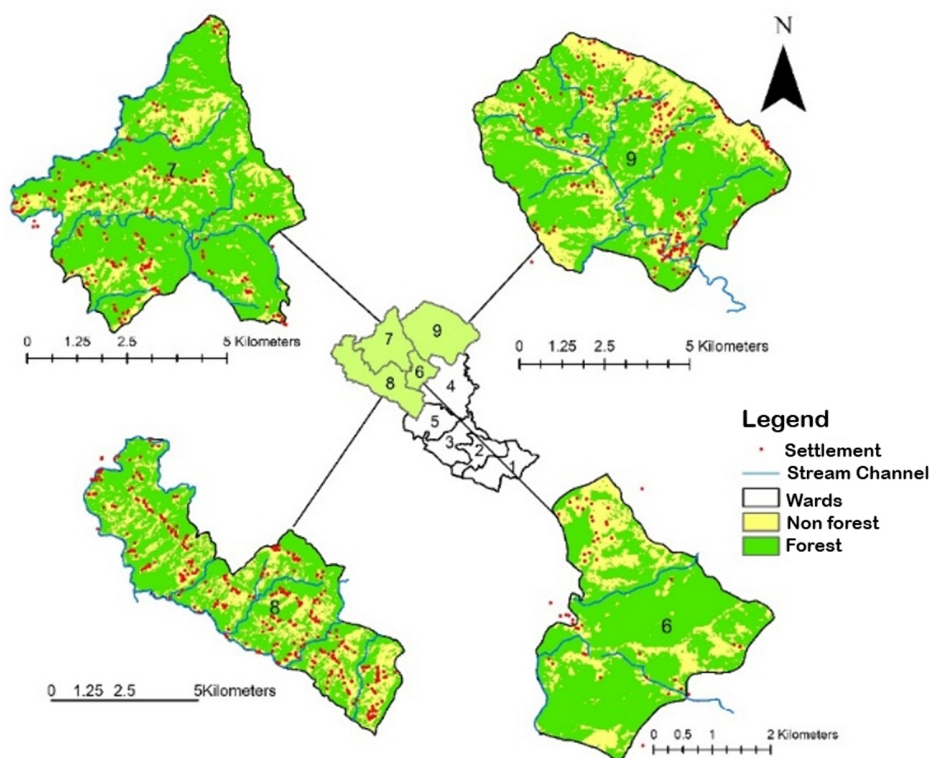


Figure 2. Forest cover map and settlement in study area

Almost half of the respondents (46 percent) had less than 20 Chiuri trees of five years and above and 32 percent had 21-40 trees. Very few people (16 percent) had 41-60 Chiuri trees of more than five years (Fig. 3). It indicated that majority of the

Chepangs have very less potential to produce significant quantity of Chiuri seeds for selling. Selling the Chiuri seed, butter and also keeping the bee in their farm will add extra benefit to them.

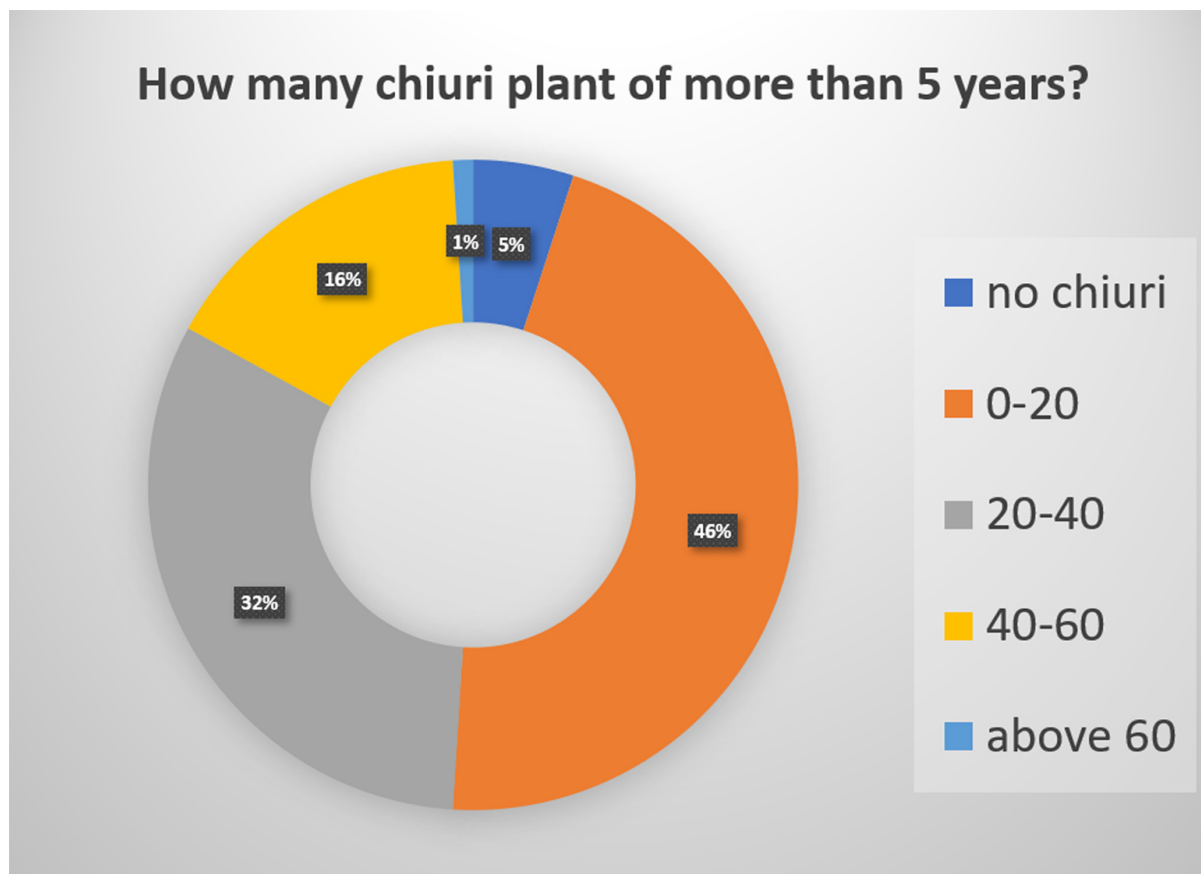


Figure 3. Chiuri trees of more than five years

#### **Economy: Yield of Chiuri seeds and butter**

Twenty two percent of respondents said that a healthy growing single Chiuri tree produces above 75 kg of seeds annually. Forty one percent of the respondents said the healthy matured tree produced 50-75 kg of seed annually. Similarly, 27 percent of the respondents said the Chiuri tree produced 25-50 kg of seeds (Fig. 4). The present study showed that the majority of respondents harvesting 50-75 kg and above Chiuri seeds yield per healthy growing tree. Earlier studies reported the average fruit yield of 67.33 kg/tree (MEDEP 2010), and 240 kg seeds/tree (Bhatt & Adhikari 2003) and 13.7 kg/tree, with minimum of 5 kg/tree to maximum of 155 kg/tree in different girth class sizes (Sundriyal & Sundriyal 2003). There is a wide variation in production potential of Chiuri trees and it may be due to difference in age and size of the trees. A young Chiuri tree of age 5 to 10 years produces comparatively less seeds than that of old Chiuri tree of age 20 years and above (Ram Bahadur Praja, Personnel Communication 30 June 2020). Chiuri trees starts fruiting from seven to 10 years after

plantation and continue to yield up to 50 to 60 years on an alternative year basis (Practical Action 2010). Since the range of production is very high, it is not so easy to make accurate estimation of the quantity of fruits and other Chiuri products in an area. The production of the chiuri seed is high. But most of them are not harvested as it does not provide sufficient income and there is high risk to life during harvesting as farmers have to climb trees. Farmers have not increased the production of Chiuri seeds since people are not making sufficient income from Chiuri seeds. Rather the bee keeping farmers are making much income from the Chiuri.

Fifty five percent of the respondents did not produce butter made of Chiuri seed whereas one percent produced 1-10 kg butter, two percent produced 11-20 kg, nine percent produced 21-30 kg and thirty three percent produced more than 30 kg butter (Table 1). In contrast, twenty six percent of the respondents consumed 1-10 kg Chiuri butter annually, thirteen percent consumed 11-20 kg butter whereas only six percent consumed butter more than

20 kg annually. The farmers of Chitwan district are reported to consume 2-5 kg of Chiuri butter per year per household (Practical Action 2010). According to local respondents the yield of Chiuri butter is 33.5 percent i.e., 50 kg of Chiuri seed produced 16.75 kg of butter on average (Ram Bahadur Praja, Pers. Communication, 30 June 2020). Earlier report suggests that the yield of butter is 42-47 percent of the weight of seeds (MEDEP 2010).

The study revealed that a majority (55 percent) of respondents produce more than 30 kg of the Chiuri butter annually whereas small number of respondents (12 percent) produce less than 30 kg of butter per year and thirty three percent of them do not produce the Chiuri butter (Fig. 5). Other studies showed that the average production of Chiuri butter ranges from 15 to 60 kg per year, of which 3-10 kg

are sold in the market (Practical Action 2010). Bhatta (1996) reported the yield of butter to be 50-125 kg per tree and production potential of gur (jaggery) at 16-37 kg per tree. Bhatt and Adhikari (2003) reported that from a single tree one can get 694 kg of fruits containing 240 kg seeds, which yield 127 kg of butter and 103 kg oil cake. Normally, about three kg of seeds produce one kg of butter that is 100 kg seeds produce 33.3 kg of butter (Ram Bahadur Praja, Personal Communication 30 June 2020). Another study reported the average production of Chiuri butter per 100 kg seed as 39.35 kg (MEDEP 2010). Chiuri butter is the main source of livelihood for many Chepangs as it constitutes the main source of dietary fat. The Chepangs prefer large families since there will be more manpower for the Chiuri fruit/seed harvest.

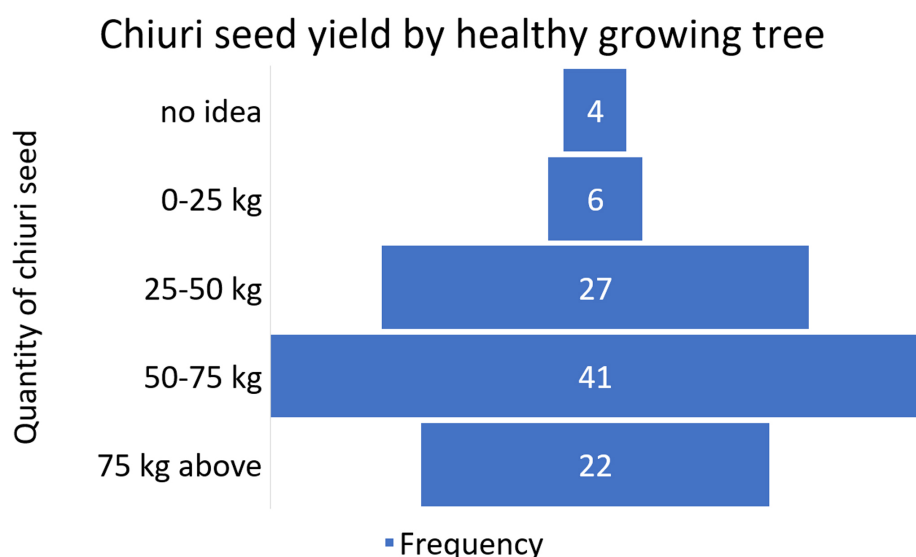


Figure 4. Chiuri seed yield by healthy growing tree

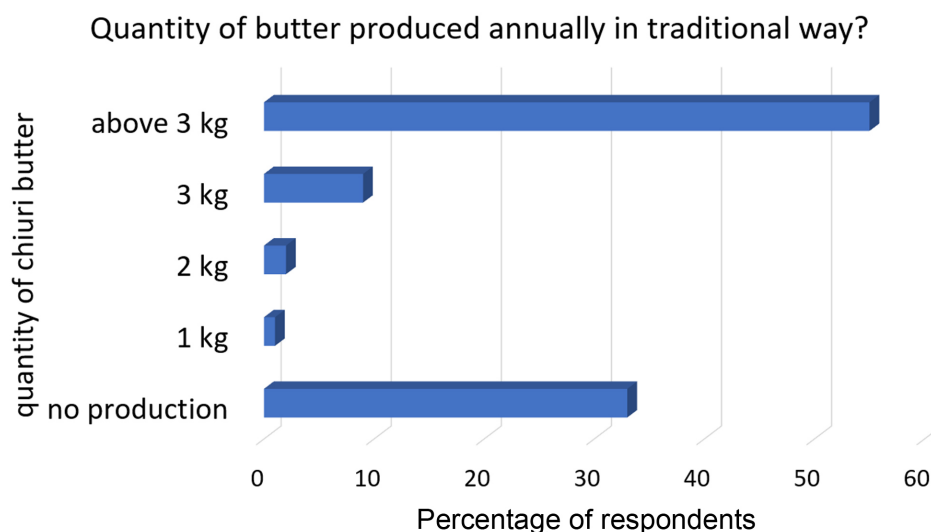


Figure 5. Quantity of butter produced annually in traditional way

Table 1. Production and consumption of Chiuri butter

Production/consumption of chiuri butter	No. of respondents who produces	No. of respondents who consumes
no production no consumption	55	55
1-10 kg	1	26
11-20 kg	2	13
21-30 kg	9	5
above 30 kg	33	1
<b>Total</b>	<b>100</b>	<b>100</b>

(Source: Household survey, 2020)

The survey showed 54 percent of respondents in RRM sold Chiuri seeds but at significantly varying price (Table 2). The price ranged from less than NPR 15-45 per kg of seeds, but 42 percent sold at better price ranging from NPR 31-45. The earlier average market price of Chiuri seeds is about NPR. 30 to 40

per kg (GIZ, 2014) with small increase in the higher side. This shows inconsistency of seed price and that perhaps is because of the lack of group bargaining. The selling price of Chiuri butter per kg in RRM ranged from less than NPR. 100-300 (Table 2) and reflecting same problem as of seeds.

Table 2. Selling price of Chiuri butter and seed

Selling price of Chiuri butter per kg	No. of respondents	Selling price of Chiuri seed per kg (NRS)	No. of respondents
1-100	2	1-15	3
101-200	2	16-30	9
201-300	23	31-45	42
do not sell	73	do not sell	46
<b>Total</b>	<b>100</b>	<b>Total</b>	<b>100</b>

(1 USD = NRs.120.67, 30th June 2020) (Source: Household survey, 2020)

### Chiuri, butter, honey and bee

In the present survey, nearly half (46 percent) respondents did not sell any seeds and 41 percent of them sold seeds for NPR. 1-5000. Few respondents (13 percent) sold seeds for above NPR. 5001-15000 (Table 3). Similarly, about three-fourth (73 percent) of the respondents do not sell Chiuri butter. Some of them (27percent) sell Chiuri butter who earn NPR. 5001 to 15000 annually (Table 3). Likewise, it was found that 80 percent of respondents do not sell honey, 15 percent sell it for NPR. 5001-10000 and only five percent sell it for 30001 and above (Table 3). Almost all (99 %) do not make any money from selling bee-hive. Only one respondent sold bee-hive and earned up to NPR. 10000 (Table 3). Chepangs in RRM normally sell honey for NPR 350-390 amount per kg at field (Ram Bahadur Praja, Personal Communication, 2 July 2020) and retail price of NPR. 450-500 at local market (Dinesh Chepang, Personal Communication, 3 July 2020). Bhandari and Kattel (2020) reported that the mean wholesale rate of honey at site was about NPR 400-450 (US\$ 3.31-3.73) per kg with the retail price rate was NPR 500 (US\$ 4.14) in Pyuthan district of Nepal. People of Pyuthan makes an average income of NPR. 60000 (US\$ 497.22) per annum ranging from NPR 20000 to 120000 by selling honey (Bhandari & Kattel 2020). The income from the Chiuri products is additional income of the Chepangs. They also make

money from selling the agricultural products like lentils and horse gram and through livestock farming. Now farmers are attracted towards the bee farming as it provides more economic benefit.

Only 25 percent of the respondents had bee farming whereas 75 percent did not have bee-farming (Fig. 6). Although people of RRM had sufficient Chiuri tree in their farmland, most of them do not practice bee-farming. Chiuri is among the plant species that have long blooming period and provide abundant nectar to bees. The honey produced by the honeybees after foraging on Chiuri flowers is sold as Chiuri honey by the natives at a good price thus being a good source of income. Chiuri flowers being rich source of nectar, coupled with a long blooming period, it provides enormous opportunity for the production of honey (Joshi & Pechhacker 2002).

The cooperatives in study area are acting as a collection centers of the local products and providing better price to the farmers. Recently cooperatives were able to sell the local products like honey, lentils, horse gram, etc. in the market and provide better price than before to the farmers. In the past, most of the farmers used to sell products through brokers due to which farmers used to get low price. The cooperatives are planning to start collection of Chiuri seeds to make Chiuri butter using modern tools.

Table 3. Annual income of respondents from chiuri seed, butter, honey and beehive

Annual income (NRS.)	Number of respondents with income from			
	seeds	butter	honey	bee-hive
no income	46	73	80	99
1-5000	41	15	0	0
5001-10000	3	1	15	1
10001-15000	10	11	0	0
15001-20000	0	0	0	0
20001-25000	0	0	0	0
25001-30000	0	0	0	0
30001 and above	0	0	5	0
Total	100	100	100	100

(1USD = NRs.120.67, 30th June 2020) (Source: Household survey 2020)

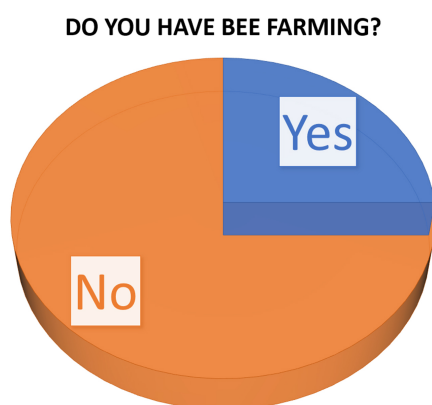


Figure 6. Status of bee farming in RRM

### Socio-culture

About 90 percent of the respondents use flower, leaves and wood whereas only 70 percent of them make application of seeds of Chiuri (Fig. 7). People of RRM mostly use flower, leaves, seed and wood of Chiuri tree for different purposes. From the survey, respondents said that flowers are specially used by the bee keeping farmer to produce honey whereas leaves are used to make plates (duna tapari) which can be utilized for keeping food to eat. Leaves are also used as a fodder for animals. Similarly, wood part of the tree is used as fuelwood and for making houses. Respondents say that wood is also used for making handles of tools, sheds of animals and construction of fences. The fruits are eaten raw, while working in the field or forest. The fatty juice from the fruit is used for making sweets or brewed for making alcohol. The residues after juice extraction are used for washing clothes and also as insecticides. The respondents use Chiuri butter for as edible oil for cooking purpose and lighting purpose in remote area. Chiuri butter is also used to cure the cracked skins in hands and toes. Also, the oilseed cake after extraction of oil is used as a fertilizer in the field. It not only corresponds to yield but also suppresses the insect pest incidence in the field and fungal contamination. Oil seed cakes of Chiuri are also used as fish poisons for fishing which is not as harmful as chemical poisons.

Chiuri has various uses depending upon the people and places where its parts are used. The bark of the tree is used in the treatment of rheumatism, ulcers, itching and hemorrhage, inflammation of the tonsils, leprosy and diabetes (Thapa 2019). It is one of the rare plants in the world from which nectar can be collected without aid of honeybees for making juice, jam or gur. The nectar from the flowers is also harvested directly to produce jaggery, which is highly prized in Uttarakhand (Khanka *et al.* 2009). The roots are cleaned and messed and dipped in water and kept for the whole night or day and thereafter the juice thus prepared is taken as a tonic. Chiuri oilcake has been used as feed in poultry farming in Rolpa district after detoxification (Koirala 2009).

The indigenous Chepang community regards Chiuri as their property, which is even given as a dowry during marriage of their daughters (Bhattarai *et al.*, 2021). Thus, this plant is used as ritual however the use of this plant leaves for religious purpose was not reported in study area. Use of plants for fodder, fuelwood and religious purposes is common in western Nepal (Kunwar & Adhikari 2007). Chepangs are known to have special role in protection of Chiuri trees from their ancestors. The traditionally produced butter by Chepang community is mostly consumed by themselves. Surplus butter is sold to generate income by some families, but the income is very low.

### Livelihood

More than half (56 percent) of the respondents from Chepang communities produced food that subsistence for less than 9 months. In contrast, only 39 percent of respondents produced food enough for 9-12 months (Fig. 8) with average months being 8.82. This data clearly shows that the majority of the community has food deficit. They manage food for their household by doing labor work, taking loan and collecting food, such as Githa (*Dioscorea bulbifera*), Bhyakur (*Dioscorea pentaphylla*), etc. from the forest. An earlier study in Chepang community in Chitwan and Makwanpur districts found that the

average food self-sufficiency of the community was 7.3 months (Piya *et al.* 2011) which is similar to this finding.

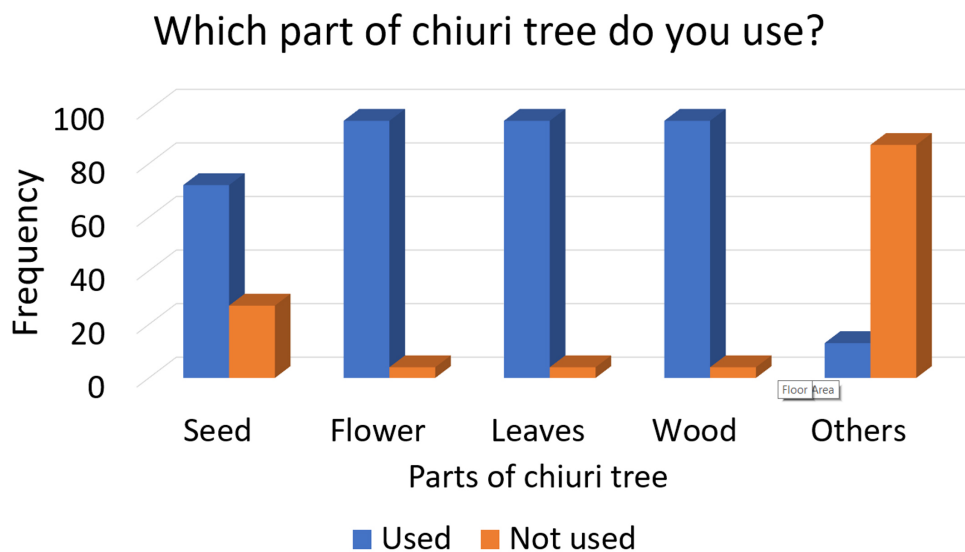


Figure 7. Use of different parts of Chiuri tree

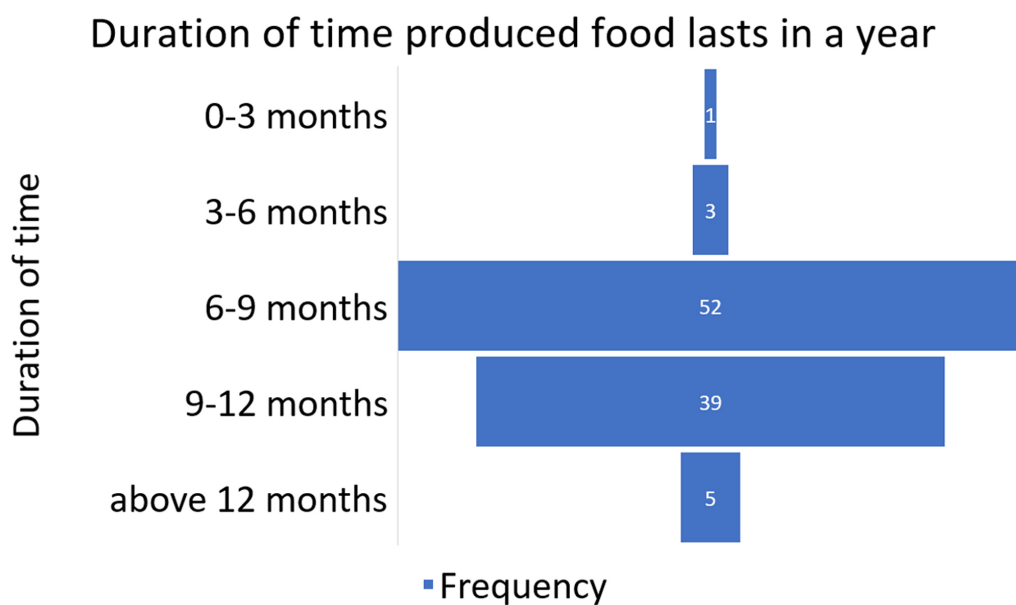


Figure 8. Food available in a year in study area

Eighty eight percent of the respondents had annual income of less than NPR 50,000 (NPR. 136=1.13 \$ per day, 1\$=NPR. 120.67) which is very low to run a family (Fig. 9). If we use international poverty line of \$1.90 per day, majority of the population are below poverty line based on recent data (UN 2020). Only few respondents (12 percent) earn more than NPR 50000 annually. It indicates that many Chepangs are still in poverty. Although the people under poverty line is declining in Nepal, the Chepang of RRM are not able to come up above poverty line. People still live miserable life in those area with poor access to health, education, transportation and communication

facility. They earn additional money from selling goat, chickens, lentils, horse gram, tarul, etc.

#### Primary health care

Chiuri butter is used for the treatment of headaches, rheumatism boils, pimples, burns, and used as emollient for chapped hands and feet during winter (Manandhar 2002; Adhikari *et al.* 2007; Watanabe *et al.* 2013). Fruits are used as a dietary supplement for the Chepang people. Chepangs use bark and oil cake as fish poison. Oil cake is also used as fertilizer to protect crops from pests and worms (Shakya 2000). The stem has been used as a toothbrush to



remove the foul smell, a decoction prepared by the inner bark is used to treat amenorrhea and diarrhea in Maharashtra, India. Leaves have been used to treat mouth ulcers and to relieve muscular pain. The dried petals have been used against dysuria, cold, and

cough. Moreover, the wine has been prepared by the local tribal from the petal and sometimes used during child delivery. Likewise, the seed juice is applied against headache whereas the seed powder is used for curing constipation (Kunwar & Bussmann 2009).

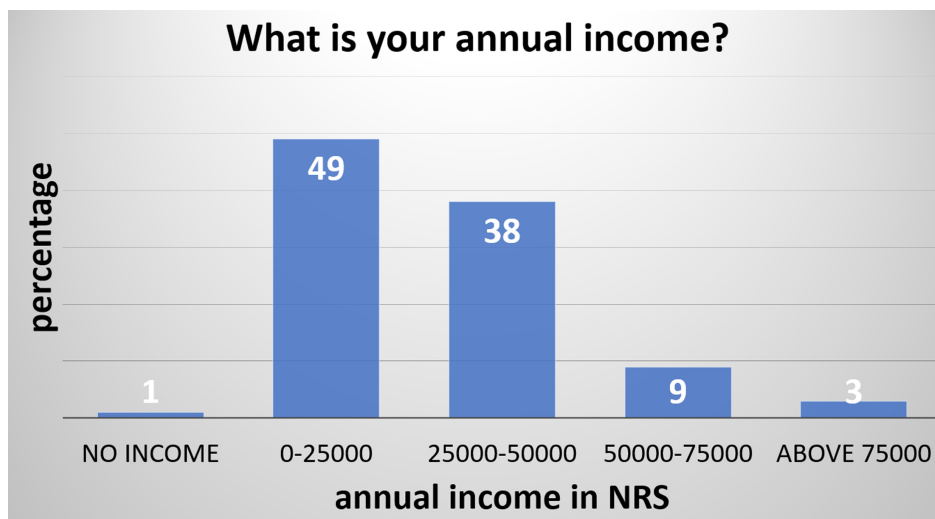


Figure 9. Annual income of the respondents

### Conservation and Management

*D. butyracea* tree plays important role in soil conservation because it is considered to be a good soil binder. It grows well on poor rocky ridges wherever the roots lead into the clefts. It grows higher on southwest-facing slopes. Chiuri seedlings grow best in shaded sites. Seeds from the fruits eaten up by jackals, bats, wolves, etc. conjointly germinate well. The large number of animals and insects depend on Chiuri trees for food and shelter. Children, monkeys, and langur shake the flowers

and collect nectar for drinking. A large number of honeybees, wasps, hornets and other insects are found collecting nectar. Thus, plantation and afforestation of Chiuri is imperative for wildlife (Table 4). NAFAN distributed more than 3,000 Chiuri seedlings to the local people in RRM for plantation and conservation (NAFAN 2020). Engaging the Chepangs in income generating activities such as producing butter, bee farming and goat farming, which are directly linked with Chiuri tree will support in reduction of poverty in Chepang communities.

Table 4. Number of chiuri seedlings planted in 2020 and estimated plantation in 2021

Number of trees	Number of respondents	
	trees planted in 2020	Estimated plantation in 2021
no plantation	62	5
1-50	17	40
51-100	5	20
101-150	15	31
above 150	1	4
<b>Total</b>	<b>100</b>	<b>100</b>

Source: Household Survey, 2020

### Conclusions

*D. butyracea*, Chiuri is a plant with various benefits to local livelihood. However, Chepangs are not getting optimum benefits from the Chiuri trees. Chepangs in Raksirang rural municipality are living below poverty line despite the livelihood support programs are in place. The majority of Chepang households are earning just around NPR. 5000 (US\$ 42) annually from the Chiuri seeds. Honey is another

portfolio for household economy. Therefore, Chepang prioritize conservation of Chiuri trees for generation. Inventory and sustainable harvesting of Chiuri trees should be carried out to predict yield of seeds and plan future productivity. Existing cooperatives can work as a bridge between locals and municipality to support local agribusiness such as bee-farming, better price for honey and butter and livelihood support.

## Declarations

**List of Abbreviations:** DFRS: Department of Forest Research and Survey, Fig.: Figure, GIS: Geographical Information System, GIZ: Deutsche Gesellschaft für Internationale Zusammenarbeit, Kg: kilogram, MEDEP: Micro-Enterprise Development Programme, MTs: Metric Tons, NAFAN: National Forum for Advocacy, Nepal, NPR: Nepali Rupees, RRM: Raksirang Rural Municipality, US\$: United States Dollar.

**Ethics approval and consent to participate:** The data were collected with full confidentiality and consent of the respondents. Written and oral prior informed consents were obtained respectively from the rural municipality office, community leaders and study participants. Permission of data collection was obtained from Executive Director of NAFAN in the project area and all respondents were informed about the aim of the study.

**Consent for publication:** Not applicable

**Availability of data and materials:** The data are available from the authors upon request.

**Competing interests:** The authors declare that they have no competing interest among them.

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**Authors' contribution:** Roshan Chikanbanjar collected data and prepared draft manuscript. Umed Pun developed the overall research concept. Bhola Bhattarai and Ripu Kunwar were involved in reviewing and providing feedback for finalizing manuscript. All the authors participated in writing and giving feedback on the manuscript and approved the final version of the manuscript.

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