

Local plant use for *Natto* production in mainland Southeast Asia and Himalayas

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Abstract

Natto is a traditional Japanese soyfood by fermenting with a bacterium called *Bacillus subtilis*. Like *natto* in Japan are also found in East Asia, mainland Southeast Asia and the Himalayas. *Natto* in these areas has a long history as a traditional food, and it is widely used by locals as a seasoning. In order to produce *natto*, *Bacillus subtilis* for fermenting soybeans is necessary, and it is usually supplied from plant leaves gathered from the forest around the village. Therefore, it is possible to clarify the relationship between local food culture and plant use by implementing the field survey on local *natto*. Although there are countless research outcomes on plant uses, so far little research focused on plant use for traditional food production is implemented. In this study, I would like to introduce traditional *Natto* production by use of local plants and clarify the changes in its production and local plant use in mainland Southeast Asia and the Himalayas.

Introduction

In Japan, *natto* is usually consumed at breakfast tables together with rice. People have strong feelings towards *natto*: it makes a difference with persons who love it and hate it because of that smell and stringy texture. *Natto* is made by soaking whole soybeans, then steaming or boiling them, and afterwards adding the bacteria *Bacillus subtilis* to the mixture. It is then allowed to ferment over time. Japanese *natto* producers used to inoculate *Bacillus subtilis* from rice straw before 1930s, but now we use cultivated bacteria for its production.

In general, *natto* is thought to have a stringy texture, but depending on a variety of *Bacillus subtilis*, there are *natto* that does not have a stringy texture. Moreover, many Japanese think it is a traditional Japanese food. *Natto* is undeniably the traditional Japanese food, but it is not a unique Japanese food. According to “The Lucidophyllous Forest Culture (*Syoyo-jyurin Bunka*)” proposed by Ueyama, Sasaki and Nakao (1976), fermented soyfoods such as *Miso* and *Natto* are produced in lucidophyllous forest zone extending into Southeast Asia and the Himalayas. In fact, *natto* is widely seen not only Japan but also Southeast Asia and the Himalayas (Fig. 1), and these are used the same bacteria *Bacillus subtilis* for fermentation (Yokoyama 2014).



Fig. 1 *Natto* in mainland Southeast Asia and the Himalayas
 (Source: Yokoyama 2014, p.56)



Fig. 2 Study Sites

Regarding the distribution of *natto*, Sasuke Nakao, an advocate of the lucidophyllous forest culture theory, proposed the “Great *Natto* Triangle,” a triangular region in which *natto* is distributed, bound by the fermented soybean products *tempe* in Java, *kinema* in the Himalayas, and Japanese *natto* (Nakao 1972). However, it was later learned that the fermenting agent of *kinema* and Japanese *natto*, *Bacillus subtilis*, differs from that of *tempe*, *Rhizopus* spp., a fungus. Even though they are all non-salted fermented soyfoods, *tempe*’s fermenting agent differs from that of *kinema* and *natto*.

Natto in Japan was produced by using rice straw as a source of *Bacillus subtilis*, but little is discussed about *natto* production method other than Japan. Therefore, this research aims to clarify how *natto* in mainland Southeast Asia and the Himalayas are produced by paying attention to using local plant to inoculate *Bacillus subtilis*.

Study areas for this research are mainly in lucidophyllous forest zone including

northern Vietnam, northern Laos, northern Thailand, northern Myanmar, Arunachal Pradesh and Sikkim states of India, Bhutan and eastern Nepal. Among these study areas, I have so far recorded about 70 *natto* production sites. In this paper, I selected nine study sites for the cases studies of *natto* production to accomplish a purpose of the study (Fig. 2).

Local Plant Use for *Natto* Production

A various method to produce *natto* could be found in mainland Southeast Asia and the Himalayas. The method of fermentation in *natto* production is roughly classified into three types: 1) a method that soybeans are wrapped in leaves, 2) a method that soybeans are placed into the basket with leaves on the inside, and 3) a method that no plants are used as the source of bacteria for fermentation. The variety of *natto* production seen in each area represents the diversity of the food culture of each ethnic group. In this chapter, we would like to introduce various *natto* production in mainland Southeast Asia and the Himalayas.

Wrapping soybeans with leaf

The method that boiled soybeans are wrapped in leaves is adopted in Kachin State of Myanmar. Burmese *natto* called *pebouk* found in the market of Bhamo and Myitkyina has stringy texture produced by Shan people and Zaiwa people. Producers wrap small amount of soybeans with leaf of *Ficus* spp. for fermentation (Fig. 3). Taste of *Pebouk* in Kachin State was almost the same as Japanese *natto*. The seller who had been selling *natto* at the market said "*pebouk* with strong stringy texture is more delicious." In addition to the survey at local markets, we visited a house of Zaiwa people to survey how to ferment soybeans. The leaves used for fermentation were leaves from fig tree



Fig. 3 *Pebouk* with stringy texture (Bhamo market, Kachin State, Myanmar, August 2009)



Fig. 4 Fig tree used for fermentation (Myitkyina, Kachin State, Myanmar, August 2009)



Fig. 5 Wrapping large amount of soybeans overlapping two kinds of different leaves (Phutao, Kachin State, Myanmar, March 2014)

(*Ficus* spp.) planted by the producer in the garden (Fig. 4).

In *pebouk* production by Gimpo people in Phutao, Khachin State, the method of wrapping soybean with leaves is the same as Myitkyina area, but they wrapped large amount of soybeans overlapping two kinds of different leaves. Leaves of the Moraceae family (*Artocarpus* spp.) are put on two leaves of the Marantaceae family (*Phrynium pubinerve* Blume) in a cross shape, and boiled soybeans were firmly tied (Fig. 5). These are left on a warm fireplace for 3-4 days to ferment. This *pebouk* has strong stringy texture and similar taste with Japanese *natto*.

Pebouk with stringy texture, similar to Japanese *natto*, is also produced in Dehong Dai and Jingpo Autonomous Prefecture, Yunnan Province of China where many Shan and Gimpo people live.

Placing soybeans into the basket with leaves on the inside

The method that soybeans are placed into the basket with leaves on the inside is adopted in many regions including Shan State, Chin State and Magway Region of Myanmar, Northern Thailand, Sikkim of India, and Eastern Nepal.

Tai Yai and Kon Muang people in Northern Thailand produce *natto* called *thua-nao*. To ferment soybeans, they line with Teak (*Tectona grandis*) leaves in the interior of bamboo baskets, then boiled soybeans are placed into the basket for three days (Fig. 6). In case of Shan people in Shan State of Myanmar, the same ethnic group as Tai Yai in Thailand, producers use rice straw which stores up for cattle feeds to supply bacteria for fermentation (Fig. 7). Although rice straw is being used to inoculate *Bacillus subtilis* like the same as former Japanese *natto* production, this type of *pebouk* has little stringy texture. When we heard that *pebouk* is fermented by rice straw, many Japanese want to search the relationship with Japanese *natto*. Perhaps they were not related to each other because it is hardly to find commonality of food culture between Japan and Shan State. Moreover, a woman who produces *pebouk* in rainy season said that



Fig. 6 Teak (*Tectona grandis*) leaves in the interior of bamboo baskets (Mae Taeng District, Chiang Mai Province, Thailand, September 2009)



Fig. 7 Rice straw in the interior of bamboo baskets (Loilen District, Shan State, Myanmar, September 2014)

“pebouk produced by rice straw is not tasty.” According to her, fern is the best plant for pebouk production. She preserves a lot of fern in the dry season because it is difficult to enter the forest in the rainy season. The producers who do not have any fern in the rainy season have no choice but to use rice straw. It can be said that producers use the plants by evaluating the taste of *natto*.

In case of Limbu people in Sikkim State of India, the interior of bamboo basket is lined with young fern called *unyu* to produce Himalayan *natto* called *kinema* (Fig. 8). A producer lightly cracked boiled soybeans by using a mortar and then placed into the basket for fermentation. It is surprising that ferns were also used in both Myanmar and Sikkim. Both regions are about a thousand kilometers away, and there is almost no cultural exchange between each other. Therefore, it is not due to diffusion from either side, but it is considered to be a coincidence. In addition to this, although parents' generation of the producer used to use leaves from fig tree (*Ficus* spp.) called *nebara* for fermentation, she uses only *unyu* to produce *kinema* because customers prefer to *kinema* produced by *unyu* than *nebara*.

No plant use for fermentation.

The method that no plants are used as the source of bacteria for fermentation was widely confirmed in mainland Southeast Asia and the Himalayas including Shan State of Myanmar, Northern Thailand, Northern Laos, Northern Vietnam, Arunachal Pradesh of India, Eastern Bhutan, and Eastern Nepal. This *natto's* method of production is extremely simple. First, soybeans are usually sun-dried. Second, dried soybeans are placed in into large pots and boiled for about half a day. Next, they are placed in plastic bags, commonly used for the transportation of rice. These plastic bags have usually highly breathable structure, but sealed bags were employed in Bhutan.

In case of Shan people in Shan State of Myanmar, commercial *pebouk* producers use



Fig. 8 Young fern in the interior of bamboo baskets (East Sikkim District, Sikkim State, India, September 2012)



Fig. 9 Fermenting soybeans using plastic Bags (Namkham District, Shan State, Myanmar, August 2009)

highly breathable plastic bag for fermentation. Some producers put plant leaves such as *Dipterocarpus tuberculatus* or *Tectona grandis* into the plastic bags as a source of bacteria, but in general they do not put anything into plastic bags (Fig. 9). According to interview with *pebouk* producer in Namkam of Shan State, some producers used to have fermented using fern. However, it is unsuitable to use fern for mass production, because collecting wild plants takes considerable time.

Rai people in Eastern Nepal produce *kinema* which is generally dried after fermentation, and put it into curry. They use cardboard box and newspaper for *kinema* production (Fig. 10). The ultimate simplified fermentation method without using leaves has been adopted to *kinema* production in Eastern Nepal. In and around Eastern Nepal and Sikkim, mainly Rai and Limbu people are producing *kinema*. On the one hand Rai people adopt a simple production method using cardboard box, on the other hand Limbu people always use plant leaves. It can be said that the production method depends on the characteristics of ethnicity, rather than regional differences.



Fig. 10 Fermenting soybeans using cardboard box and newspaper (Sunsari District, Kosi Zone, Nepal, August 2014)

Changes in the method of *Natto* Production

From handicraft production to mass-production

In mainland Southeast Asia and the Himalayas, households that mass-produce commercially do not use plant leaves for fermentation of soybeans. Instead, boiled soybeans are simply left in plastic bags or cardboard box for two to three days. Plants served as the source of bacteria are also not used, but the atmosphere containing *bacillus subtilis* ferments soybean. The Japanese have a tendency to consider their *natto's* stringy texture as an essential feature of *natto*. However, because most of *natto* in mainland Southeast Asia and the Himalayas are fried, grilled, or mixed with other ingredients, stickiness in *natto* so as to produce "pulling strings" is unnecessary. This is probably the reason that the fermentation process became simplified and did not require ingredients like plants during fermentation.

Commercially mass-produced *natto* come in ground form and dried cracker form, which is sold in mass quantity wholesale to markets, or supplied to intermediaries, also in mass quantity. As producers become more oriented towards mass-production, "simplification" such as methods of fermentation without plants is advanced.

Competition between *Natto* and fermented fish products

A *natto* producer in Mindat, Chin State of Myanmar said the frequency of *natto*

production is decreasing, because fermented shrimp seasoning called *Ngapi* can be easily obtained even in mountainous region. In contrast with Japanese *natto*, which is placed on rice and eaten as-is, many of the *natto* in mainland Southeast Asia and the Himalayas are used as seasoning. In the case of Southeast Asia, *natto* has been used in mountainous regions, and fermented fish products have been used in the lowlands as main seasoning for locals. As a result of the advance of commercial distribution, fermented fish products are seen even in mountainous regions, and then these are replacing *natto*.

Conclusion

People in Southeast Asia and the Himalayas have long continued to produce *natto* by using familiar plants, and the method of producing *natto* was varied for each region. As a result, to produce *natto* which is regarded as a traditional seasoning, producers' diversified plant utilization was seen in various places. However, producers are not aware of bacteria. They pursue the taste of *natto* by selecting the kind of plant.

Dr. Nakao Sasuke said that *natto* is a complex of plant cultures of soybeans, plants and bacteria attached to them (Nakao 1992). Diversity of plants to be used as a source of the bacteria would represent the diversity of different *natto* tastes by region. As for the change of traditional food like *natto*, we should study not only from the viewpoint of changes in food culture but also from the relationship between people and plant resources. In the study on traditional fermented food, therefore, the plant uses as a source of bacteria are needed to pay more attention.

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