

3. Investigation

Farming Culture and the Origin and History of the Traditional Fermented Keeper Foods in Southeast Asia

Iichiroh Ohhira, Izumi Iwama, Tatsuo Ogoh
Taku Miyamoto and Kei Kataoka

*Division of Applied Production Technology,
Graduate School of Natural Science and Technology,
Okayama University, Okayama, 700 Japan*

Summary

In ancient times it was very difficult to secure foods in the laurilignosa (Temperate Rain Forest) zone which ranges from the southern areas of the Tibetan mountains, Nepal, Bhutan, Assam over to such Chinese provinces as Yunnan, Guizhou and Hunnan.

This was in sharp contrast with southern areas where the groups of tribes living there were favored with better natural environments of the Tropical Rain Forest climate.

In the northern Temperate Rain Forest climate, however, foods were extremely difficult to secure because the rainy season here is limited within a half of the year. The people here must have made desperate efforts for getting foods.

After they made repeated trials and errors in using their wisdom, experience and knowledge in order to survive the dry season, they came to invent a method of extracting starch through such ways as soaking-in-water and heat-treating. This invention was indeed one of the first steps to civilization and culture, but not a cure-all for unstable supplies of foods.

They continued to seek fresh foods (perishables) in all directions, until they succeeded in introducing arum. After many failures they could find such kinds as were suitable to their soils and climate, which they began earnestly to cultivate and raise. They afterwards learned how to grow miscellaneous cereals for their slash-and-burn farming in conjunction with their introduction of some kinds of pulses. Thus they began to enjoy some extent of stable supplies of foods. The people's efforts and wisdom, accumulated through their long history, led them to succeed in finding rice and growing it in their climate of the Temperate Rain Forest.

Here we can trace the process of their efforts and knowledge as follows: <Hunting - Gathering> → <Hunting - Gathering plus Root Crop> → <Hunting - Gathering plus Root Crop plus Miscellaneous Cereal> → <Hunting - Gathering plus Root Crop plus Miscellaneous Cereal plus Pulse> → <Hunting - Gathering plus Root Crop plus Miscellaneous Cereal plus Pulse plus Rice>

In this process we see one form of systematization the people aimed at multi-kind and good-harvest farming. But it did not solve all their problems, that generally, they could not help working and harvesting in a relatively short term. This meant that they could enjoy their harvest in a rather limited term of the year. Consequently they came up to face another problem: how to keep their good amount of harvest. We infer that this was the first step of implementing food-preserve.

The Temperate Summer Rain, providing a good natural condition for preserving foods, enabled some kinds of foods to be preserved by drying. But other kinds, such as animal protein, were not easy to be preserved.

In the course of history, however, the people finally, though accidentally, found a way of preserving

big animals or a large quantity of fishes and shells they have caught. The way was also excellent for increasing the tastes and flavors of these foods.

This was a way of fermenting foods by using microbes in the air or on the surface of the foods.

Fermented foods, with a high degree of preservation and their particular tastes and flavors in addition to their glutinosity, were enjoyed by the Temperate Rain Forest tribes, and later were gradually spread to their southern and eastern neighbors.

It was true that many kinds of fermented foods were developed in the Temperate Rain Forest culture and spread all over to Southeast Asia. But here remains a question: why is it that there are so many kinds of them even now in those regions?

The decisive reason is that those regions have a climate of high temperature and humidity which is most suitable for microbial activities indispensable for fermentation.

Aside from those by high-technology fermentation, it is possible to produce all fermented foods by natural process of fermentation or by using some kinds of *Aspergillus* as a starter.

Almost all of fermented-preserve foods are originated in the Temperate Rain Forest culture except some others which were introduced by land or sea from Babylonian and Indian cultures. At any rate, they are now spread widely in Southeast Asia.

It is the accepted view that the original home of rice farming is the Temperate Rain Forest zone. And rice culture has been spread through Assam, Yunnan, Guizhou and Hunnan over to Japan on the one hand. And on the other hand, it went down to the whole region of Southeast Asia.

We conclude that fermented foods were developed as a kind of fermented preserve by the people in that region, along with rice culture, to be spread all over Southeast Asia and have been handed down to the present as a form of traditional fermented foods there.

INTRODUCTION

Currently, in Southeastern Asian area, many kinds of traditional fermented foods are distributed. The number of their species in the area is said to be a few hundred.

Why do a variety of traditionally fermented foods groups exist especially in this area? Why were they inherited in a long history?

Southeast Asian area is under monsoon climate. Their northern region and southern region have different climatic characteristics. Northern region belongs to the mild zone with appropriate rainy season and dry season, while southern region belongs to the Tropical Rain Forest zone with high temperature and high moisture where they have a great volume of rainfall. As shown above, in the same area, they have a characteristic that roughly two different climatic forms exist in the same area. The climate of southern region is suited to farming under rich water source and fertile soil. The high temperature in connection to water always brings rich harvest. They are appropriate in farming and under the circumstance that is full of godsend throughout the year.

When we compare northern and southern regions historically, in the age of low production, it is clear that the northern region is "poor" and the southern region is rich. For tribal people living in the northern region, the issue to survive in the dry

season or non-harvest season, must have been an extremely important matter of life or death. That is, in ancient days, at least in the era of collecting and hunting, tribal people in the south could obtain fresh foods easily but tribal people in the north could obtain fresh foods only in the rainy season which is only half a year. To be more concrete, although they could obtain fresh foods relatively easy in the rainy season, the issue of the dry season on how to obtain food in the rest of the half a year when it was not easy to get fresh foods was their fate on account of the natural environment.

In the era of hunting with low productivity, tribal people living in the southern region could obtain foods throughout the year such as bananas (蕉) or a variety of arum. On the contrary, tribal people living in the northern region or mountain or highlands area, must have been demanded a variety of imaginative invention to survive in the circumstance of the natural environment. They were assumed that obtaining food in the dry season is the biggest issue for them to survive in such regions.

It is determined that it was the fate for inhabitants in the northern region to involve and solve the problem of how much, long, safe and secure they would preserve foods that had grown and harvested during the rainy season.

Inhabitants basically engaged in hunting and gathering in this area of laurel forest invented a

method of extracting starch through such ways as soaking - in - water and heat - treating. It is then considered that they succeeded in surviving the dry season with this method.

In the era labor when conditions were totally underdeveloping, soaking-in-water and heat-treating methods are to crush woods, grass roots or arum with stone implement from arrowroot, bracken and arum, soak them in water and extract starch. It is truly incredible that such method of extracting starch was invented in thousands of years before Christ.

It then would better be understood that it was the fruit of instinct of "hope to survive" in harsh environment, co-work with "human wisdom" and great cultural technique.

Anyhow, it must never be a rich living environment for inhabitants in the laurel forest where fresh foods are gathered in a period of half a year and the harvest was once a year with only a species.

In the next step, to ensure their survival more, they utilized their wisdom to step up from gathering foods from the nature to the step wishing and starting to feel their need to preserve rich foods around their household. This way of thinking is a tremendous development for human in a life of simply gathering fresh foods. This attitude of thinking led toward "managed production" of obtaining foods by "cultivation" in the next step.

Their endeavor of surviving must have been desperate. They must have kept searching for not to say hunting but also gathering and something new to eat. On the contrary, they must have wished to keep what they gathered as near as possible to their living space.

After a harsh strive of long gathering and hunting era, they invented soaking-in-water and heat-treating methods with wisdom they have learned in their living environment, put their ideas to shape the method appropriate to this area with the introduction of plantation in the next step, and established the results to form of cultivating plants.

Those inhabitants in the laurel forest who found out the starch extracting method successfully by their wisdom with their motivation to get away from long "starving" period as half a year and thought out the cultivation rationally appropriate to their region first succeeded in the extract of starch from oak, nuts of pasania, acorns in highlands those that bring us mercy with the visit of fall in their living environment. The laurel forest is a treasury of oak, pasania and acorns. Therefore, exercising the starch extracts from nuts helped them stabilize

more their obtaining foods.

Their attitude to search for foods and obtain them never stopped. Their interest to their neighbor in contact such as the western, southern eastern region and to eating should have been immense.

From the southern part, they received arum, from the western part, cereals such as millet or *Setaria italica* (2), barnyard grass or *Echinochloa* (3), *Eleusine* (4), *Sorghum bicolor* (5) or rice grown in a dry field (6). In the burned field to gather roots of arrowroot or bracken, they enthusiastically conducted cultivation. This process established as the years pass by and developed to the unique method of "slash-and-burn" method.

Nothing but his unique slash-and-burn method is the representative cultural inheritance of the laurel forest.

The aptitude of cereals introduced from each region within the laurel forest was categorized though experiments as cultivation that only those suited managed to stay.

It is natural that native people in the laurel forest who were engaging in hunting and gathering attained the habit of great "accumulation of wisdom" and "not to waste food" from their harsh living environment and long living experience. This invented extracts of starch and preservation of starch. Next, they started to cultivate cereals and attain their preservation as crops with their wisdom.

Also, fishes hunted for protein rely on seasons. Because there is deep relationship between the time of laying eggs and the time of gathering. The issue here is that it must have been a very important issue for them to preserve for a long time those caught a big amount.

Therefore, we can imagine how profound they had to think of their needs to keep and preserve, so to say, the necessity of preservation of those hunted a big amount including crops and fishes.

In the era of poor gathering and hunting, they succeeded in obtaining starch by inventing soaking-in-water method in results from their wisdom and endeavor. Next, they cultivated cereals in burnt field from the southern part and raised arum introduced from the southern part. Then, with rice cultivation produced in the laurel forest, the laurel forest changed to a richer living environment and revolutionized to the era people need to preserve those produced or hunt.

On the other word, on keeping the cultivation in the rainy season with high temperature and rainfall and the farm production in the dry season with low temperature and rainfall, we imagine that the

laurel forest had gone away with the decrease of soil power. That is, it was the area with the issue of how to keep high production in the appropriate season and how well they were to preserve them.

In this research, not only the investigation of rich distribution of traditional fermented foods in Southeast Asia but also, we investigated the whereabouts of the original point of present traditional fermented foods in Southeast Asia looking back the ancient days, the reason why the fermented preserved foods were created and for what reason they developed and distributed widely in the Southeast Asia.

Section 1

The geographical place, climate and cultivation character of Southeast Asia

In Southeast Asia, climatically speaking, the northern part belongs to the Temperate Zone of highlands moderate type while the southern part belongs to the Tropical Zone of high temperature and rainfall type. Also, it is the special area on the earth with contrastive properties that the northern part is extremely similar to the continental climate and the southern part belongs to the marine climate. On the other hand, ecologically, the northern part belongs to the laurel forest and the southern part belongs to tropical rain forest.

1) Southeast Asia in geographic term

To start with this research, we need to set the exact place of Southeast Asia and the detail of the region. Because we need to describe where the inhabitants were, where the cultivation began, and where fermented preservation foods were born on the map.

Nagazumi (ノ) says, "Southeast Asia is, needless to say, the name for peninsula with complicated shape jutting out in southeast of the Eurasian Continent and islands scattered in the area. To define in country names, Southeast Asia includes Burma, Thailand, Vietnam, Laos, Cambodia, Malaysia, Singapore, Indonesia, Brunei and the Philippines. Some scholars count Sri Lanka (Ceylon), Taiwan and others as Southeast countries but it is common to exclude these nowadays. Also, although many people in Japan include Bangladesh, India, Pakistan and others to Southeast Asia, it is correct to call them South Asia.

And Delvert (デル) determines this Southeast Asia as the following. "The name Southeast Asia is a military expression by recent Anglo-Saxon people. That is, to recapture Indochina peninsula and Malaya Islands from Japanese army in the World War II, the

name was used first when 'the right of command' of Southeast Asia was transferred to admiral Mountbatten in 1943. Officially, Southeast Asia is usually divided in the area of Burma, Thailand, Laos, Cambodia, Vietnam and Malaysia and the area including Indonesia and the Philippines."

The frame that each author stated for Southeast Asia has a common definition and it is clear that the expression of 'Southeast Asia' has a very short history.

2) Climate and characteristic of Southeast Asia

In the introduction, we categorized the climate of Southeast Asia in two regions: roughly Temperate Zone and Tropical Zone. Here we will divide the area more in detail.

When we categorize the whole area meteorologically, there are five regions: Temperate Summer Rain climate, Temperate Seasonal Wind climate, Tropical Rain Forest climate, Tropical Seasonal Wind climate and Tropical Wild Plain climate.

First, climate belonging to Temperate Summer Rain and Seasonal Wind region has its monthly rainfall of summer, with much rain as several fold than that in winter. And in winter, it is extremely dry with poor rainfall. As for region applying the above region, highlands zone near low latitude and temperate mid latitude zone. A part of Bhutan, north part of Burma, Yunnan province of China, north part of Thailand, north part of Laos and a part of Annamese Mountains apply to this climate.

Second, the climate that Tropical Rain Forest and Seasonal Wind belong has the biggest amount of rain forest in the world that even the least month has more than 50 to 60 mm. In both regions, since they have extremely high amount of rainfall through the year, the terrestrial surface rarely dries even there is a dry season, that is, it is always moist. The number of species of trees is also extremely big that trees grow thick with rainfall and high temperature forming jungles. As for the living environment for human, it is never considered comfortable since it is humid and the effective temperature is always high. Because they have poor ventilation and strong sun beam, they produce high temperature and moisture living environment. They have a tendency of clear sky relatively in morning and rain with thunder in the afternoon. Namely, they are the coastal line as Kuala Lumpur or Singapore and small islands as Jakarta or Surabaya.

The climate of Tropical Wild Plain has 30% to 35% less annual rainfall than Tropical Rain Forest or Tropical Seasonal Wind region. In winter, the

monthly average rainfall in winter is less than 50mm to 60mm that they have difference in rainfall volume according to seasons. There is a tendency that the beginning of thunder is a notice of rainy season, heavy or extremely heavy rainy days then continue and that rainy season ends with the beginning of thunder again. Then comes the dry season which is a climate tremendously desert-like. In this reason, it is popular to have dwarf plants or grass and tropical trees grow together, while partially seen vegetation near savanna. To be more concrete, a part of Burma and a part of Vietnam apply to the above.

On the contrary, regarding which climatic zone the laurel forest zone belongs, it would be appropriate to think that they are categorized mainly in Temperate Summer Rain climate and Temperate Seasonal Wind climate.

Section 2

Ancient inhabitants tribes in the laurel forest zone and their mode of life

The geographical place, plants ecology and climatic characteristics were mentioned as above. Here we would like to investigate on tribes inhabited from ancient days and their mode of life in so called the laurel forest, especially Tropical Summer Rain or Temperate Seasonal Wind climate.

We can imagine that collection of vegetable foods (especially fresh foods) was under difficult circumstances since the laurel forest zone has small rain fall in winter and low air temperature that plants stop their growth although the zone have appropriate rain fall in the summer making collection of vegetable foods easier with rich sun beam.

Then, what type of tribes was living in this region?

It is believed that a great number of tribes were inhabiting from early days in the laurel forest zone, that is from Assam region to Yunnan highlands, a series of belt zone from Guizhou and Hunnan of China. The representative tribes are Kachin, Naga, Hani, Rai, Limbu and Lolo. Other main tribes distributed are small tribes of Tibet Burmese, Bhutanese natives and Himalayan natives. They were said to live in respective points.

Also, in the northern part of Southeast Asia, those tribes include the tribe of Austroasia from ancient days, Ahom, Khasi, Zhuang and Lao were living permanently.

Except for a part of nomadic grazing tribes, it is believed that collection of food including fresh foods was difficult for the tribal people living in the zone over Yunnan highlands from Assam region

to Hunnan of China in the dry season, that is with low rainfall and poor sun light although they were mainly engaging in hunting and gathering in the early stage (ancient days) they were living in.

However, surviving is a very important issue. We can well imagine that the issue of obtaining food was their hasting theme even it was impossible for them to have fresh foods.

The harsh environment gave "wisdom of ideas" to their living. From those ideas, they invented so-called "soaking-in-water" and "heat-treatment" methods to collect starch.

It resulted those roots of trees or grasses which were abandoned since then to change into starch as their food.

On this matter, Nakao (♂) remarks the advance of life environment with the invention of soaking-in-water method as the followings: "On even this simple preparation method the natives had to solve uneasy problems. First, crushing arum must be relatively done easily with stones, but, they needed badly some pails to collect starch after rinsing and precipitating starch. Also, because they needed a great volume of water, it was convenient for people who were leading such life style to live nearby water.

In the laurel forest zone, since water is not rich enough as in the tropical rain forest zone, such technique using a lot of water produces a tendency to limit the place people were living in. However, with this technique, it made people to obtain food easily in the laurel forest.

In the fall, extreme amount of food fall in the forest mainly with acorns. Similar to nuts of horse chestnut, these could be changed into food easily only with water. It is capable to have them easier as wild bulbs or arum. Also, it is easy to gain starch excellent for eating as dogtooth violet, arrowroot and bracken. Soaking-in-water method stabilized human life for primitive men to gain food easily.

This invention of soaking-in-water method to collect starch in the laurel forest dramatically enabled dietary style with starch food from the pattern they survive gathering fresh foods in the half a year rainy season. The production of starch sprouted in people's mind to consciousness and wisdom for so-called food preservation gradually for starch preservation.

Section 3

Establishment of slash-and-burn cultivation and cultivation plants

We mentioned in the previous section that there were many tribes living in the area from Assam to Yunnan highlands in China and the laurel forest of Guizhou and Hunnan. The cultivation method those tribal people were engaging respectively has a similarity. In fact, that is slash-and-burn method.

The soaking-in-water method described previously was the method gathered and extracted so-called vegetable starch from root crops as arrowroot, bracken and *Arisaema serratum*. Then it is the problem why these roots and burning farm combine.

It is believed that ancient primitive men produce fire for any reason in the primitive forest and that root crops such as arrow root, bracken and *Arisaema serratum* would grow thick on the next year of fire. It is sure that they have learned it fully from their life experiences.

Here we would like to make it clear that we can assume that "burnt field" in the early stage they easily found wild roots and take as that to collect, in later years, after they received millets from the west or arum from the south, then they sowed seeds of crops newly invited on the place wild root crops were collected. That is, we can well infer that they started sowing or cultivating incoming cultivation crops on the place wild root crops were collected and developed up to "slash-and-burn" method.

To our experiences, the year after the year of mountain fire, bracken, flowering fern or others grow very thick. We may say that the ancient people well knew this phenomenon.

We assume that on the field once burned, the place wild root crops were harvested the ancient native inhabitants cultivated arum from the south and crops from the west enthusiastically by determining the suitability of the land.

There is even no need to explain that the burnt field is ideal for primitive cultivation method that it is the ideal place for cultivating root crops or cereals after burning the mountain.

It is definite that obtaining the necessary volume of food to defense life of the inhabitants themselves and naturally increasing ancestors expanded gradually. With this, it made gradually capable to obtain food around them.

However, the most of arum were in the species of Tropical Rain Forest, that not all introduced arum was suitable to burnt field in the laurel forest. We may rather say that only a limited species were determined

suitable to burnt field in the laurel forest.

On this point, Sasaki (10) said, "the Temperate Zone Arum (yam, Chinese yam, vegetable of taro to young taros) which are relatively strong against low temperature are assumed to be cultivated in the area of the southern edge of "East Asian Crescent" shown in Figure 1. Then, the cultivation of this arum family was expanded in the laurel forest that they expanded as a part of important field crops. However taros or yams are originally arum of Tropical Zone." This shows that they struggled in the cultivation by communicating with the South, aggressively looking for plants to cultivate from those growing in their area and the area around. (Figure 2).

Also, Sasaki (11) points out, "the Temperate Zone of East Asia, that is, the laurel forest, has a totally different situation. Arum cultivated there have different characteristic to those cultivated in the Tropical Zone and the production is not as big as that of the Tropical Zone. For such reason, it is assumed that although Chinese yams and Japanese yams were treated as some of their main crops, it is difficult to believe that a life depending on Chinese yams and Japanese yams in great amount of food was carried on in the laurel forest.

It is rather assumed that cereals were holding an important function from relatively early stage of cultivation that arum were combined in the complex cultivation with these cereals." Anyhow, it is determined that in the laurel forest, obtaining food was the most important issue in their life all the time. For stabilizing more their life, arum and cereals were introduced, not just one, they formed a complex productive life style in burnt-field cultivation.

In this stage, in the laurel forest, a tendency was seen having complex cultivation style was stayed in the laurel forest and introducing other wheat and pulse from the west and Indian cultivation crops.

The roots of crops were said to be from the southern north of India to the central south of Indian Peninsula, from the south edge of Sahara desert in Africa to Great Savanna Area (Ethiopia and Uganda). In both savanna zones, each communicated in very ancient days and it is said that they also had exchanges of cultivation crops.

On this matter, Sasaki (12) reports about a cultivation culture unique in savanna area, "it is well known that in Great Savanna Area, from the south edge of the Sahara desert to Ethiopia and Uganda of Africa, numbers of millet (cereals) were selected from annual true grasses growing wild widely in the plain and cultivated in the ancient days.

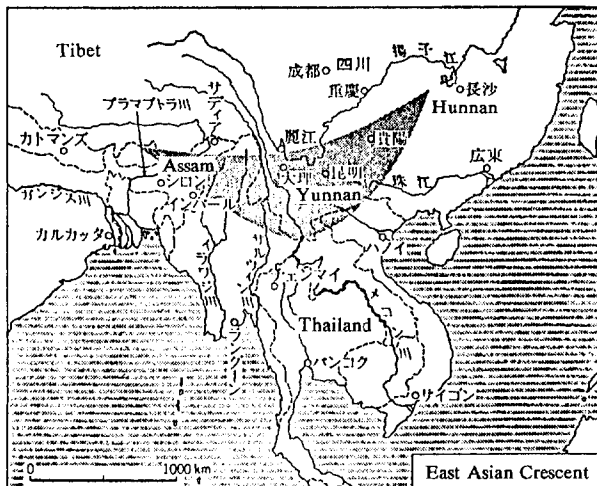


Fig. 1 Ueyama, S., Sasaki, K. and Nakao, S.: Laurel Forest Culture (Second Volume), Chukou Shinsho, p.201, Tokyo (1976)

The main true grasses (cereals) of quite many species in the summer cultivated are: *Sorghum bicolor*, *Pennisetum typhoides*, *Eleusine coracana*, *Digitaria exilis* and *Eragrostis tef* such almost unknown to Japan, and African rice called *Oryza glaberrima*...

Then, 'a complex of crops mainly with summer crops' suited to climate of savanna was formed and settled unique cultivation culture based on such in African savanna.

On the other hand, in the climate of savanna from Indian western part to central south part of Indian Peninsula, it is considered that several crops such as *Panicum miliaceum*, *Setaria italica*, *Paspalum scrobiculatum* and *Panicum miliare* were cultivated.

Moreover, it is known that a variety of pulses such as *Cajanus cajan*, *Phaseolus* spp. chickpeas or *Cicer arietetum* and vegetables such as egg plant or cucumber were developed, while a totally similar cultivation culture to African savanna was formed."

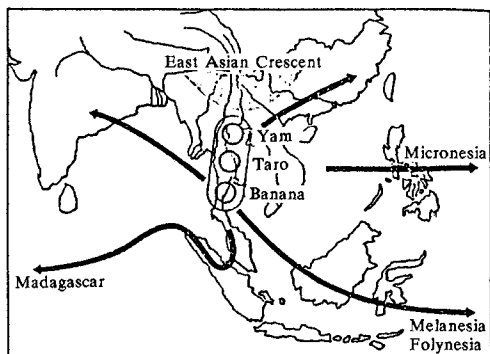
The point we should focus here is that in the laurel forest area close to Indian savanna cultivation continuously looked for the cultivation plants suited to their climate because of their peculiarity in the natural environment. Moreover, since the savanna cultivation culture is "a Crop Complex mainly with summer crops", it is the characteristic extremely suitable for the Temperate climate of the laurel forest. The millet cultivation then succeeded its development in the laurel forest under the condition that holding a space ideal as burnt field.

As a result, in the laurel forest, people became capable to obtain a variety of food other than by only gathering fresh foods in the rainy season but also by cultivating arum, cereals and pulse in the burnt field, harvesting these in the dry season and gathering acoms. This enriched the profundity in the stabilization of food resources.

By the beginning of the dry season, the fall, a lot of fruits enrich the land. Some are changed to starch and others are preserved dry.

In consideration of time, it is believed that the drying technology was born from this era. Drying is needed to preserve cereals or pulses, and with other condition, the laurel forest had its climate under an ideal condition for drying.

A harsh living environment invented "soaking-



Origins of crop cultivation (Yam, Taro, Banana)

Fig. 2 Ueyama, S., Sasaki, K. and Nakao, S.: Laurel Forest Culture (Second Volume), Chukou Shinsho, p.27, Tokyo (1976)

in-water” in extracting starch. The accumulation of persistent wisdom to secure any food in poverty led the introduction of arum, cereals and pulses to the burned field. Finally, with the mass of wisdom produced by the inhabitant tribes, the laurel forest transferred to a cultural zone different from the past.

At the same time, rice cultivation started in a part of the laurel forest assumedly around 2000 B.C. On the origin of rice, there is no definite academic thesis up to now. A hypothesis stating it was around Assam region to Yunnan highlands is believed to be true.

Watabe (13) notes on the production and distribution of rice (shown in Figure 3) as “it became relatively clear that all the rice roads running up and down complicatedly, to the south, east or west in Asian Continent, at least countries in the Tropical Zone, have their origin in Assam region and Yunnan.” suggesting that the roots of rice as Assam region and Yunnan highlands in China.

We would like to understand this as a detailed case already established that the inhabitants of those days living in the laurel forest had their intelligent basics to try systemizing by cultivation as filtering the possibility in making every vegetable edible.

Also, on the location condition rice used to be cultivated, Watabe (14) points out that “All the condition of location, those ruins where rice of the prehistoric age was excavated is not the low plain area as the major rice field zone today. This infers that rice might have been cultivated

extremely in a primitive way in mountain area or slopes of the hillside in a very old era when rice crops cultivation started in Thailand.

The rice cultivation under the condition depending on the rain of the rainy season establishes relatively steady on the lowest technology nevertheless its low amount of harvest. It would be rare Thailand belonging to Monsoon Asia receive a devastating damage even a disaster by a drought happened at times.” He comments that a crop like rice had suitability in natural environment and stability well in this area as cultivation plant.

Also, Watabe (15) describes about the species of rice as “during thousands of years vacant from the era of Non Nok Tha or Ban Chiang to 1500 A.D., at least in the first half period, it is assumed that these upland rice were cultivated superiorly.” suggesting that upland rice was in main those days rather than paddy rice currently popular to cultivate.

This describes that it is not only the issue of rice cultivation type but the basic of cultivation type is on “burnt field” that upland rice was dominated because upland rice suited well to the cultivation method of complex of pulses and cereals.

What is important and cannot be forgotten here is that to manage a complex cultivation systematized in their living area, the burnt field was the base of total production of pulses, cereals and rice including all fresh foods.

Watabe (16) notices about the location aimed to cultivate ancient rice as “in the stage without any water facility as of today, there is no other chance than cultivating species of upland rice field. That is, these species of upland rice was a popular crop in the field. It was not the kind cultivated in only peculiar situation as burnt field.”

However, we imagine that almost all the cultivation crops or plant were done on the place once was a burnt field, considering the cultivation technique of that time at the time upland rice was selected as cultivation crop although they might have grown wild other than burnt field. We want to point out its reason that the burnt field had soil of high quality and easy to divide from other plants at harvest time. Also, from the fact of cultivation experience of plants introduced and received from other regions, we assumed that they were gifted with “great intellectual discretion through experience” to evaluate systemization and cultivation achievement mainly on burnt field.

Also, Watabe (17) assumes on the process of time when upland rice was transferred to paddy rice

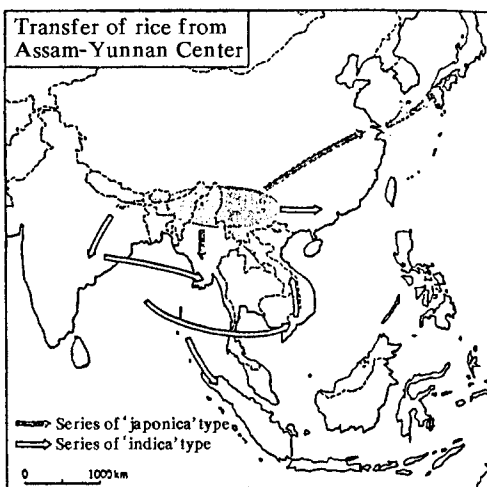


Fig. 3 Ueyama, S., Sasaki, K. and Nakao, S.: Laurel Forest Culture (Second Volume), Chukou Shinsho, p.55, Tokyo (1976)

cultivation as "in short, in Indochina Peninsula, an age upland rice cultivation was superior existed long in the ancient days. Such age must have been longer than an age paddy rice excelled until today. As shown clearly in the example of Thailand, it is determined that the transfer from upland rice to paddy rice progressed gradually even after the Christ."

This indicates that in the laurel forest, "an agricultural system applying to the nature" with accumulated wisdom from long living experience was already established due to secure their lives coping with their living environment in their living zone even they had a notable increase of inhabitants' population.

As mentioned above, it was quite difficult for inhabitants environmentally to obtain fresh and other foods in the early age of the laurel forest with temperate rainy season and cold dry season with less rainfall. However, their "poverty" and "persistent desire for life" acquired from the harshness of the environment won in learning starch extracting method as "soaking-in-water" and "heat-treating" method with wisdom to study the habit of coping with natural environment.

However, the inhabitants could never be freed themselves from "starvation". Their "persistent desire for life" never stopped searching for fresh foods or other food capable for preservation. In the communication with neighboring tribes, they introduced those foods not capable to obtain in their area such as cereals and pulses from Indian savanna culture applying to burnt field as traditional food production base and finally succeeded. Their "endless persistence to food" learned and gained through a long history succeeded in maturing food by receiving rice agriculture gradually in to their life in the laurel forest, systematized everything significantly along by desiring fresh foods. Establishing this great system of agriculture, the inhabitants of the laurel forest became independent for about 30 centuries.

Although people in the north of the Southeast Asia were poor in contrast to the richness of the south even though they were located in the same Southeast Asia region, they learned to cope with great nature in their long history and also mastered something precious to utilize it. It is not too much to say that this preciousness is the one which brought us power and habit to progress science by surviving and being developed until today of the 20th Century.

Section 4

Hypothesis on establishment of malted rice, liquor, *natto*, *narezushi* and *hishio*

It is nothing but a miracle that the tribal people in the laurel forest, where is extremely in a severe environment, learned and established a technique to obtain food over 30 centuries to survive in consideration of a long historical study. The systematized agriculture in the laurel forest must have increased gradually its volume of harvest. However, we cannot forget that there occurred problems to preserve those harvested in a great amount as fresh foods or their value as food only.

The laurel forest belongs to the area of 2000 to 3000m above sea level such as Tibet, Nepal, Bhutan, from Assam region to provinces Yunnan and Kunan of China. This region is in location with less oxygen in the air and relatively dry even with some rainfall. Perhaps, in term of natural condition on the earth, it is the area capable to preserve food in the most ideal way.

Therefore, we imagine that the preservation of cereals, pulses and rice harvested was such in a simple way as natural drying. Also, they might have dried birds or animals they hunt ed easily in the air.

The issue here is there existed many kinds of fermented foods in quite old days in this laurel forest. For example, those representatives are malted rice as starter fermented food, liquor, *natto*, *narezushi* and *hishio*.

To solve this problem, we settled hypotheses for each malted rice, liquor, *natto*, *narezushi* and *hishio* and discussed their production and stages to be established.

First of all, we would like to describe about "lifestyle" and "living philosophy" of the inhabitants in the laurel forest before we state hypotheses for each fermented foods.

As we mentioned many times in this report, those ancient inhabitants of the laurel forest were extremely "hungry". This is a common spirit in these tribes and we want to make it clear that everything happened from this origin.

We acknowledge that their "hungry" spirit is "to knead", "to cherish those would deserve to spirit of thanks" and "achievement".

Settling our next hypothesis, we are introducing that the following idea is based on it beforehand.

We assume the production of malted rice as the followings:

Those inhabitants of the laurel forest who received the influence of neighboring Indian Savanna

cultivation culture systematized organically in the half a year of rainy season mainly summer Crop Complex such as foxtail millet, millet, *Eleusine, cajanus cajan*, *Phaseolus* spp. and chick pea or *Cicer arietetum* and decided to cultivate them.

With the introduction of cereals, they not only learned the cultivation method but also eating method. It includes all steps from cultivating, growing, producing and eating after the harvest. These cereals must have been eaten powdered in a mill or steamed. Mills must have been introduced at the same time as the coming of cereals and steaming technology already existed in the laurel forest culture.

Those *Eleusine* the most popular in this area were threshed after the harvest, dried and powdered in a mill. They were then mixed with water, solidified and eaten after steamed. At cooking, sometimes only necessary amount should be prepared but we believe they were prepared exceedingly in daily life.

Those people who had been living in a life zone poor in food historically have a habit of not wasting the leftover food in general. They keep the leftover in an appropriate place to eat afterward thinking back the number of months they spent over this meal, the number of hands helped to make this meal or they were not deserved to throw the food away.

When the solid of *Eleusine* stuck to the steaming apparatus preserved were happened to be left for some days, it is natural that some microbes in the air or other kind of microbes attached to the surface of the solid would start activating. So-called the genus *Rhizopus*, the genus *Mucor* and the genus *Aspergillus*, for instance, would fully attach and start activating because they are wet appropriately. This becomes the malted rice.

We presume that they could not throw these molded malted rice away. Because of there must be a "spirit to take good care of food". We assume that they melt the molded solid of *Eleusine* and eat them as making it to rice gruel form. When the above microbes activate, the taste should become surely "sweet" and "sour" according to how far the solid was fermented.

It is believed that those tribal inhabitants in the laurel forest already had wisdom to think matters scientifically that they were capable with the tracking ability of this sweet-and-sour food reversibly. (They even had wisdom to settle complex cultivation method.)

Being such the case, if they felt the food was tasty and little drunk, for instance, it should not be a difficult task for them to reproduce this tasty food

(drink). This led the birth of so-called "rice wine".

Another hypothesis on production of liquor is that even a certain amount of food was obtained and their living are was stabilized, we think that raising children is a big issue. Even in modern days, only a several tens percent of mothers in childbed are gifted with milk to breast-feed children fully. In such case, it is assumed that food situation of ancient people is far worse than that of modern people even they managed to make it better than before.

Perhaps more than half number of mothers in childbed is lacked with breast milk. The lack of mother's milk leads precious babies to death. The mothers must have fed some food to take over breast milk. In the laurel forest, excluding a part of tribes, they could rarely utilize livestock's milk to take over human milk because they were not nomadic grazing tribes.

Then, we could imagine fully that those mothers gave babies pasted food for any method, which mothers digested physically especially the cereal processed food that they were taking in their human daily life in the mouth to take over breast milk.

In mouths, it is clear that the genus *Amylase* and *Streptococcus* exist. These enzyme and lactic acid bacteria are included easily in the paste-form food physically digested.

If mothers made a lot of those food for breast milk at a time, there is no question that they are fermented naturally and changed into alcohol gradually. This shows the birth of "liquor" that those leftover of alternative food for breast milk crunched became liquor.

To back this hypothesis, Shinoda (18) describes that there were liquor already in the age of civil war in China, "however, it is noticeable that women were employed in the department limited in relation to brewery of liquor, fish sauce, salted meat and vinegar under the command of liquor master (the position to advice)." We can assume that the roots of our hypothesis become unified since women were engaging especially in such job as they were deeply related to liquor and brewing.

Next we would like to talk on natto production. The above mentioned "steaming" was supposed to be one of the tasks in the laurel forest culture. Ishige (19) describes "there is a possibility that there was a steaming method in very old age in Southeast Asia but we cannot assure that." but we can well imagine such possibility. Then there is also a possibility they steamed pulses and other food since they already steamed cereals.

At the same time as they received cereal culture from the west, the laurel forest people received pulses especially from Indian Savanna Civilization. Sasaki (20) reports that tribes of Koniyaku, Nagayama and Naga of Assam mountains cultivated cereals, Kachin of North Burma cultivated pulses, Yao of Guandong, Huannan or southern area of China cultivated pulses as side crops and Yao cultivated pulses as main crop on "slash-and-burn field".

Those tribes living in the laurel forest are believed to be eating pulses as cereals process food steamed with so-called "steamer" mentioned above.

For something interesting, people in the laurel forest who were supposed to be influenced from Indian Civilization became utilizing a mortar less and less regarding pulses.

It is not usual to steam only necessary amount of these pulses to eat. Sometimes, only needed, other times, they may have steamed much. The leftover was then preserved just leaving them alone or spreading them over reeds or straws. Of course, it was done to eat afterward when needed (at least inside the house).

On those steamed pulses (especially soybeans) preserved, microbe attached to reeds or straws and microbes existed in the air gather to the surface of the pulses and start fermentation.

Especially, those *Bacillus natto*, *B. subtilis* and such are existing so many in straws or other similar plants. The "steamed beans preserved" in fermentation progressed as time passes already changed to natto.

We want to note here that we think those tribes living in the laurel forest loved so-called "stickysense" in the mouth and they were a kind of "familiar" with it

Those tongue feelings natto had must be suited to the favor of taste in people in this laurel forest. Then they just went back the track as founding malted rice and liquor, there established natto.

Figure 4, then, shows establishment of natto and their transmitted root.

Narezushi is one of the peculiar fermented preservation foods representing Southeast Asia the most.

For tribes living in the laurel forest, obtaining animal protein is an important issue as vegetable fresh foods. Fishes are also important protein not to say animals. However, sometimes they hunt a great volume of animal and fish. As described before, it is true that the laurel forest is under an ideal natural environment to dry food although only dried food is a problem. This is only our speculation but we think those people already had a judging and selecting high great ability for flavor. It is obvious that they were using salt as seasoning in the laurel forest that time. This fact is described by Pan Ku (21). In the warrior period in Han, one of the administrative policies was execution of monopolization of salt and iron, "Ministry of Finance asked the opinion of Kong Jin, Vice Minister of Salt and Iron and Xian Yang in Dong Guo, a city in the east. 'Mountain and oceans are a reserve of heaven and land, their income should be belonging to our prefecture, but the Emperor does not let me acquire them but let belong to Ministry of Finance to assist national finance. Here am I to ask you to gather people to pay the fee, the government should provide people's apparatus to produce salt and should give rewards.

Those people who do not work but eat are becoming rich by having mountainous and oceanic resources one-sided and still are apt to have more benefit from poor people by forcing them to work. I would imagine that talks of banning this policy to be mounted too many to hear one by one but I would fetter the left foot of those let me cast iron and produce salt privately. I will abduct the apparatus and the products.

On the county which does not product iron, I would settle a small administer of iron and have him belong to their prefecture.' I ordered Kong Jin and Xian Yang by having commuter horses to visit the whole country to execute the monopolization of iron apparatus and settled municipal office to observe."

This description suggests that in Han's warrior dynasty, use of salt was a national demand not to say

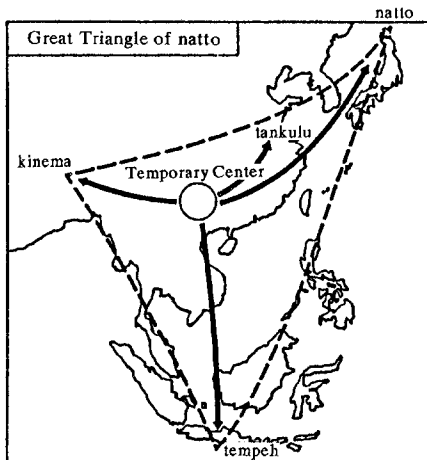


Fig. 4 Ueyama, S., Sasaki, K. and Nakao, S.: Laurel Forest Culture (Second Volume), Chukou Shinsho, p.129, Tokyo (1976)

the expansion of iron.

This leads us think that there was a proof of demand of a certain amount of salt all over China that time and taxation helped the national finance enriched.

Pan Ku (22) says that in Han's warrior dynasty, there settled 36 salt administrative offices in the whole China. Among them ten were belonging to the laurel forest, especially "Yizhou", (current Kunming of China) at the center of Yunnan Highlands. (Figure 5)

This assumes that in Yunann Highlands or their central region of "East Asian Crescent" of the laurel forest, the use of salt was received actively to their life from quite old days.

The production method of salt those days were: to collect salt from salt lake water only in the dry season, to pump up salt water from the underground and collect salt by heating away water, and to collect from salt rock are main methods. In later years, purifying salt from sea water was said to be settled.

Those tribes living in the laurel forest were leading lives of hunting and gathering in the beginning of the age. Then in the next age, "Hunting-Gathering plus Aurum Crop", and "Hunting-Gathering plus Aurum Crop plus Cereal Crop", then "Hunting - Gathering plus Aurum Crop plus Cereal Crop plus Pulses Crop", and finally "Hunting-Gathering plus Aurum Crop plus Cereal Crop plus Pulses Crop plus Rice Crop": they have developed to truly systematized complex agriculture. This is the laurel forest culture

and is the accumulation of their wisdom.

The systematized agriculture inevitably demand people more plans than in the life of haphazard way such as hunting and gathering. With "the Crop Complex mainly with summer crops" introduced from neighboring regions require people to labor, which life style did not exist before. People started to demand salt as the labor increased which they did not demand much in the age of "Hunting - Gathering". We believe that the necessity of salt increased as this labor started. That is, along with the development of agriculture, salt demand became necessary more than ever. (23)

We can also imagine that the inhabitants in the laurel forest who remembered the taste of salt knew that it would be tasty to eat animals with salt which were hunted as animal protein or fish. Therefore, they must have eaten row or grilled meat with salt. However, they could not keep balanced volume of animals or fish hunt. Sometimes they could catch few and other times caught a lot. They might have thought of their way of preservation. That is, they must have thought seriously how "effectively" they could preserve the leftover. This comes from what we call "their spirit of treating foods carefully, it is no good to waste".

It is natural for them to hit the idea of preserving the leftover (animal or fish meat) with salt from the beginning since people would eat them raw or

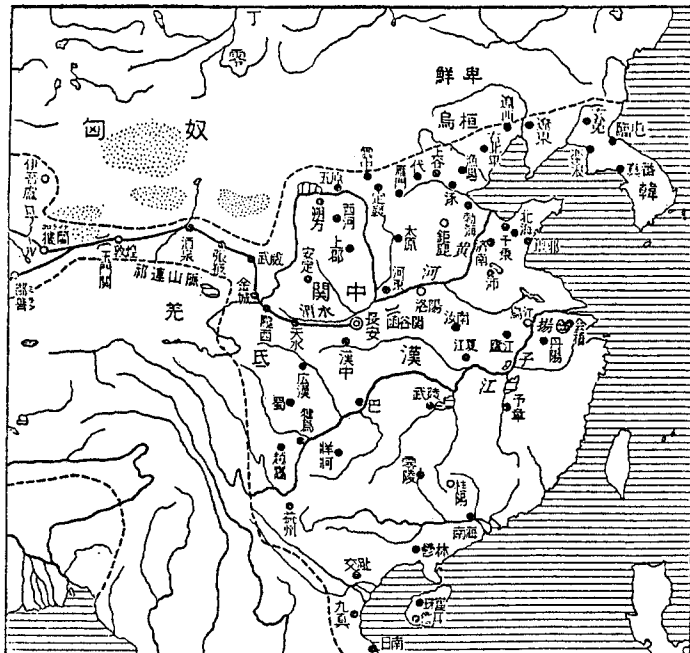


Fig. 5 Suzuki, S.: Chinese History, Yamakawa Shuppansha, p.65, Tokyo (1964)

grilled with salt later. Therefore, people preserve them with pots or jars. On the other hand, because of "their spirit of treating foods carefully", they also keep leftover of cereals or rice in the same pots or jars.

This shows that adding salt and leftover rice to those with "their spirit of treating foods carefully" would proceed lactic acid fermentation naturally. With lactic acid fermentation and the proteolytic enzyme contained in the internal organs of animals, preservation food in the pots or jars begin to have taste and flavor with the existence of lactic acid or amino acid. Although it was a series of acts to preserve primarily, a new tasty food was born with a trick of fermentation along the time passing. This is narezushi.

We assume that the animal protein first preserved was eaten gradually and utilized to the end. Therefore, they must have learned at what point it is most tasty in the preservation method. And, they settled the production of narezushi by tracing back the orthodox preparation.

Now what about the production of hishio or fish sauce?

We described about natto before. In a part of the same laurel forest in the Chinese Continent, hishio seemed to have completed with the application of natto which raised and settled in the laurel forest. That is, a variety of technical matters and Chinese food culture were added to natto which was produced in the laurel forest of Nepal, Tibet, Assam Highlands and Yunnan Highlands, it was a product produced secondly to natto.

Judging from detailed points of view, hishio is understood as a product of the Chinese Continent, but we can well say that it is the product of the laurel forest in consideration of the relation natto is contained in the product.

On this matter, Sasaki (24) tells in details: "Anyhow, although extremely rich species of pulses such as *cajanus cajan*, cowpeas and chickpeas were eaten in Indian world, soybeans are hardly regarded important. However, soybeans can be utilized suddenly widely once in the laurel forest of Himalayas. However, it is an evident worth gazing that they were processed to this unique fermentation food.

Not only in Himalayas region but also in China, preparation and utilization of this species of soybean fermentation foods became more and more active with its increasing number of species. Among them, *kuki* or dried natto and hishio or fish sauce seemed to be main products. Since China is a country

of characters, there are ancient records on their preparation.

For example, "qiminyaoshu" (a total agricultural book, the oldest in China in 10 volumes) describes the preparation method of *kuki* and hishio as the followings.

Kusa has two kinds as *tankuki* (salt-free dried natto) and *shiokuki* (salt and water added natto). The former is made with boiled soybeans piled up inside the house for two weeks, have molds grow and cover them with straws to be fermented. That is with the action of mold or yeast attached to the straw, they dissolve protein of soybeans and have them amino acid fermented.

The making of *shiokuki* is much more complicated. Boiled soybeans are spread over straws, covered with blady grasses and have molds produce, then tap in the pot with malted rice and salt water, and pickled for a month...

On the other hand, "*toshu*" is pickled for three to six months in pots with salt, several species of malted rice and herbs after soaking soybeans in boiled water again after steamed and dried. The malted rice and its activity dissolve protein gradually and made amino acid fermentation. This sauce not only was used as everyday life side-dish but also used as seasoning, tamari or sauce from refined soy...

Anyhow, in the 6th Century China, these soybean fermentation foods were produced widely. Especially, when the soybeans were boiled without salt, it is obvious that naturally fermented *tankusa* was similar to soybean fermented foods as *kinema* or *ribi-ippa* basically in the Himalayas...

With all points, at least in the Han Dynasty period, there surely existed a soybean fermentation food called "*kuki*". Perhaps, up to that time, soybean cultivation from the laurel forest in Huanan, or the south was assumed to spread over Huazhong, the center and Huabei, the north of China.

It is true that still today, in so-called "East Asian Crescent" from Yunnan, Guizhou and Kunnan provinces, a lot of fermentation food such as paste-like or unrefined sake-like or in other forms existed rich." We assume that these soybean fermented foods were delivered from Assam highlands, Yunnan Province Highlands of China, a belt of the laurel forest from Guizhou and Hunnan where salt resources is especially rich in China. These soybeans were then improved with the malted rice delivered from "East Asian Crescent", and produced new malted rice for a variety of species, they produced hishio, a

new product "unique fermented food" with so-called "malted rice" and "salt".

A newly born all - purposed seasoning hishio derived from natto which was improved and delivered, born originally in the laurel forest can be valued as the most superior fermented preservation food people ever produced as natural seasoning food.

That is, as a result that tribal people living in the laurel forest under an ideal condition for food preservation, never threw food away with "the spirit of taking good care of food" and preserved them in pots or jars or kept the leftover on straws or blady grasses, a fermented food with new taste and flavor people never have even dreamed of through an invisible mediator as microbes. It is clear that such production was a great treasure of people from the laurel forest culture and a gift at the same time.

Nakao (25) describes the condition preservation food produced and established totally in the laurel forest as: "In view of food preservation, Tibet is especially an interesting area. Because the natural environment of Tibet is the most superior for food preservation in the world and their life style applies to it. Tibet is located in almost 4000 meters high land have low temperature and dryness as a generally ideal condition for food preservation. Moreover, their air is as thin as half of that of over the surface of the sea.

This means they have less oxygen which troubles food preservation, and, on the contrary, they have strong drying ability of water. Regarding this lack of oxygen, it is an ideal condition even civilized nations cannot imitate easily to preserve." Nakao emphasizes on the unification of people and nature in a broad sense and assists the fact that the relationship with nature and the inhabitants produced wonderful fermented foods as authors mentioned earlier also praised highly.

What inhabitants cooperated with this extremely great nature and survived established in a long history is the laurel forest culture.

Section 5

Value as food and preservation of sake, natto, narezushi and tosho from food preservation theory

We described our own hypotheses of production and establishment of fermented foods. Here we would like to study the character and application of each food such as sake, natto, narezushi and tosho, comparing their character and preservation with food preservation theory.

1) Food preservation theory

Kato *et.al* (26) state that "food preservation is to keep food for a certain period of time without having them changed their quality and rotten."

Almost all fresh foods to be eaten, whether they were hunt, gathered or cultivated, will diminish their value in contact with air when left alone and with biochemical issue along the time proceeds.

With enough care to preservation, the value of the food is maintained and the human food life can be stabilized and enriched.

The changes of quality and deterioration derive from various causes. What especially believed as a strong cause is the involvement of microbes to foods. Another cause is the case food itself change its quality and deteriorate by the dissolution of the ingredients composed in the food or the activity of oxygen existed in the food.

Kato *et.al* (27) state the prevention way of deterioration of food by microbes are "two ways by sterilization and growth inhibition by microbes". They also tell that "the sterilization is the method to sterilize microbes which deteriorate food existed in the jar by after sealing the food. Canning is such method. The growth inhibition of microbes is to establish an environment difficult for microbes to grow or reproduce within or around the food. There is respective ideal condition for microbes to grow and reproduce.

That is, there need water, temperature, the pH and nutrients to be appropriate. When even one of them lacks, it prevents them from growing and reproducing. Therefore, the purpose is realized for growth inhibition of microbes by diminishing water of the food, keeping food in low temperature, heightening osmotic pressure of food by increasing the density of soluble solid within the food and applying acid or chemical substances of food."

Therefore, when we are to preserve food, it is necessary to prevent ingredients of food from changing its quality and deterioration by air or light, inhibit the activity of enzyme existed in the inside of the food at the time of inhibiting the influence of microbe to food.

2) Food preservation method

The following methods are popular for food preservation. (1) Drying and dehydrating, (2) refrigerating and freezing, (3) sterilizing and disinfecting, (4) salting, (5) sugaring, (6) vinegaring, (7) gas storing, (8) smoking, (9) antiseptics, (10) natural addictives, (11) food irradiating and (12)

food packing materials.

Among these 12 methods of food preservation, the preservation method produced and settled in the laurel forest culture especially contrasting to fermentation preservation food are assumed to be related to (4) and (6).

3) Food reservation theory of sake liquor, natto, narezushi and tosho

It is well known that sake is produced with malted rice. Malted rice in the laurel forest culture zone near the Tibetan Mountains is made with crushed special wild plants or flowers to the powder of *Eleusine* and kneaded by applying water. When these are left inside the house, molds grow naturally to become malted rice.

Liquor production in the laurel forest is as follows: first cooked rice or steamed cereals are put in jars or pots, the previously mentioned native malted rice is added for 7 to 10 days, the mouth of jars and pots are sealed and tightened, left statically inside the house and gone under fermentation. The drinking method is to dilute it in hot water or water after opened. Then they are drunk. Its density is adjusted to the taste.

In liquor production, saccharification and fermentation are done parallel. It is called parallel fermentation because the former is fermentation by enzyme and the latter is so-called general fermentation.

Regarding microflora of liquor production stages, the flora included in the malted rice activates subjectively. At the early stage of fermentation, lactic acid fermentation progresses mainly with the activation of lactic acid bacteria, then it is transferred to alcohol fermentation with yeast. As a result of lactic acid fermentation, when the pH reaches to pH 4.5 to 5.5 in pots or jars, most of the lactic acid bacteria diminish and alcohol fermentation by yeast become the main.

In liquor production with malted rice, generally the genus *Leuconostoc*, the genus *Streptococcus* and the genus *Lactobacillus* involve in lactic acid fermentation as lactic acid bacteria and alcohol fermentation with the genus *Saccharomyces* progresses to alcohol.

Campbell - Platt (28) reports that the main microflora within rice wine in general are *Aspergillus Oryzae*, *Saccharomyces sake*, *Leuconostoc mesenteroides* and *Lactobacillus sake*.

On food preservation theory, with the activation of the above mentioned microbes, by removing the

pH value to the acid side in the sake fermented, we assume it applies to the item of "inhibition of growth and reproduction of harmful microbes" because it activates growth inhibition of so-called harmful microbes.

On flavor, taste and aroma issue, sake begins to have taste and aroma after fermentation and aging. The main causes of aroma are alcohol, ester, acid, carbonyl compound, amine, compound content and other substances. Also, the causes for taste are sweetness, sourness, hotness, bitterness and astringency. These depend on content ratio with glucose, oligosaccharide, saturate monocarboxylic acid, saturated dicarboxylic acid, ethyl alcohol, aldehyde, choline, arginine, tyrosine and salts.

The preparation of natto is: first, soybeans are rinsed well, soaked in 3 to 4-fold volume of water for 12 to 18 hours and drained off the water after well absorbed water. Water soaked soybeans for 2 to 3-fold are packed in containers, water to just cover the soybeans is added, then they are condensed.

The soybeans are kept boiling for 4 to 5 hours with water being added. When the beans are softened, turn off the heat, and let cool at room temperature. They are placed in solid form on straws or blady grasses. After 2 to 3 days, natto is completed.

Fermentation of natto is conducted with the activity mainly with the genus *Bacillus*. In case of the laurel forest, they are assumed to be wild strains. Anyhow, we believe *Bacillus subtilis*, *B. cereus*, *B. megaterium*, *B. mycoides* and others involved. For such reason, natto in the laurel forest which Nakao (29) and Sasaki (30) report, does not apply to the above mentioned strains because they are without viscosity.

So-called natto in Japan is with viscosity, fermented alone and prepared by inoculating *Bacillus natto* artificially.

Campbell-Patt (31) reports that there exists a quite similar product to natto which was produced and settled in the laurel forest in Southeast Asia called tempeh. On this microflora, there are reports on *Rhizopus oligosporus*, *Enterobacteriaceae* bacteria, *Kiebsiella pneumoniae* and others but no report in the genus *Bacillus*.

In food preservation theory, the genus *Bacillus* act mainly in producing taste peptide especially by proteolysis and amino acid, also in aging substance compounded from amino acid and glucose. The similar group to *B. natto* of the genus *Bacillus* usually grow at 40 to 45 °C with its ideal pH 6.5

to 7.5, but according to the fermentation stage, they may grow up to pH 5.0 to 4.8.

On flavor and taste issues, those main strains similar to *B. natto* of the genus *Bacillus* are taste peptide and amino acid growing from soybean protein with enzyme they have, and a small amount of ammonia as one of the characteristics of natto. Others involving in flavor of the products are a slight volume of organic acid such as acetic acid, lactic acid, propionic acid and butyric acid. These are all in very small amount.

Production of narezushi divides in two methods. The first method is prepared with animal protein (animal meats or fish), cooked rice and appropriate volume of salt as an original method in the laurel forest. First, animal protein is cut appropriately, steamed rice is added, salt is sprinkled onto it, all is sealed in pots or jars, left statically for 1 to 2 months and they are eaten when needed. As the fermentation is long, animal protein in the jars or pots are dissolved by enzyme existed in the internal organs of animals or fishes becoming gradually to muddy form.

Another method is as follows: animal protein is cut appropriately, each internal organs and salt are added and sealed in jars or pots, left statically for 6 to 12 months inside the room and fermented. Animal protein is dissolved mostly with the enzyme internal organs have and formed liquid or paste. These are mainly applied for seasonings.

For fermentation of narezushi, there are two preparatory methods. We introduce the former method here.

First, in the jars or pots, wild strain lactic acid bacteria on cooked rice medium intervene and act as the media of cooked rice to have lactic fermentation progresses. As a result, ingredients prepared inside the jars or pots have their pH value decrease gradually to the range of pH 4.5 to pH 5.5. This is from the phenomenon as lactic acid accumulated inside.

When lactic acid fermentation ends, amino acid fermentation by yeast and proteolysis is done with enzyme in the internal organs, then becomes to narezushi.

Campbell - Platt (32) describes about the microflora of narezushi that in narezushi or gyosho intervene genus *Micrococcus*, the genus *Staphylococcus* and the genus *Bacillus*. However, from the consequence of our research (currently under isolation and identification), admitted the existence of strains assumed to be a certain species of lactic acid bacteria.

From food preservation theory, with the action of lactic acid fermentation, the pH value in narezushi decreases to 4.5 to 5.5, production of so-called harmful bacteria is pressed at a certain degree, with several continuous fermentation, it would settle to around pH4.5 in the end. Accordingly, it would apply to "inhibition of production and expansion of microorganism (harmful bacteria)".

Consequently, on the issue of flavor and taste, in narezushi contained organic acid producing flavor and neutral carbonyl compound, which are rich. Also, amino acid that effects the taste, that is, glutamate and aspartate.

Preparation of *tosho* or soy bean sauce is as follows: first, roasted and crushed wheat and steamed soybeans of the same volume are mixed. Malted rice bacillus is inoculated to make malted rice. Then a high density salt water is added and fermented for a long period as about 6 months to 3 years to become tosho.

During this period, as a result of dissolution of ingredients by malted rice bacteria, lactic acid bacteria and yeast, amino acid, peptide, glucose, organic acid, alcohol, ester and others are produced. Moreover, chemical change is applied and unique gloss and aroma are brewed.

The microflora on tosho contains many numbers of ascospore bacteria as *Bacillus subtilis* in the first stage, nutrient bacteria are to be perished soon.

Then halophilic lactic acid bacteria *Pediococcus halophilus* starts growing actively. With this strain producing lactic acid, the pH value in the ingredients decrease, the growth of yeast such as *Saccharomyces rouxii* activates and amino acid fermentation progresses. In this range, formerly active lactic acid bacteria activity ceases. Then it will be yeast centered fermentation.

Campbell-Patt (33) reports that in tosho exist *Aspergillus oryzae*, *A. soyae*, the genus *Bacillus*, the genus *Lactobacillus*, *Pediococcus halophilus*, *Saccharomyces rouxii* and others.

On flavor and taste, lactic acid fermentation is done in the early stage while tosho is fermented, it will reach to pH 4.5 to pH 5.5 in effects from formation acid. Most of the formation acid are lactic acid, acetic acid and succinic acid. These soreness is harmonized with other tastes as savor and sweetness to form taste of tosho.

Also, for seasoning and flavor, with yeast fermentation through formation production route, formed alcohol and amino acid.

Regarding food preservation theory, with this tosho and other previously mentioned fermentation food group, with lactic acid fermentation and salting, it would apply to "inhibition of growth and expansion of microbes (harmful)".

As mentioned above, on sake, natto, narezushi and tosho, expect for natto, the flow of fermentation form starts from lactic acid fermentation and goes through the end as yeast fermentation. Moreover, to the common point to all we notice through a series of fermentation route that the decrease of pH on the product increase the preservation. Also, it is very interesting that flavor and taste exist on dissolution formation by lactic acid fermentation, yeast fermentation and enzyme.

Section 6

The beginning and origin of traditional fermented preservation food present in Southeast Asian region

Currently, it is told that there are a tremendous number of traditional fermented food existed broadly in Southeast Asia. The ingredients are almost cereals, aurum, rice, pulses, fruits and fish.

With a point of view in food, they are categorized in alcohol drink, side-dish food and seasoning food. Although when classified more in details, there is some food difficult to be categorized in above, we want to set like this here.

First, regarding alcoholic drink, when we think from the ingredients, they are categorized in rice-origin, sugarcane-origin and coconuts-origin. Commonly, in fermentation styles, alcoholic drink are categorized in three: "single fermented liquor" as wine which is fermented directly with glucose, "double fermented liquor" which is fermented after protein is dissolved to glucose with malted rice or malt, and "mixed liquor" which is made with these two together.

Liquor originated from rice belongs to double fermented liquor, liquor originated from sugarcane belongs to mixed liquor because it is made with rice, tree leaves, plants and bark added at fermentation stage as glucose and coconut liquor belongs to single fermented liquor.

Next, regarding the beginning of these three kinds of alcoholic drinks, we would like to state clearly the area from Assam of the laurel forest to Yunnan province highlands of China as the roots of liquor originated from rice because it is made utilizing malted rice as original products of the laurel forest.

For liquor originated from sugarcane, we estimate Cuba as the root because it is the roots of sugarcane

production or somewhere around the Philippines in the Southeast Asia, if anything, because historically it is the country to cultivate sugarcane.

For coconuts wine, it is the original of India. The tribe producing this kind of liquor is formed by Indian colonies in Southeast Asia while native people scarcely drink it.

For side-dish food groups, when we categorize in base of main materials, they are categorized in four as rice, pulses, cereals and aurum. There are cases when these four main materials are utilized individually or many kinds mixed as side-dish food.

The basic style of cooking is with two methods; one is to grind them in a stone mill and the other is to wash with water as harvested. Generally, the method to cook is whether with "baking" or "steaming". We estimate that "baking" as cooking method is at least from the influence of cereal culture. And we assume that "steaming" is the style with the uniqueness of the laurel forest culture. Therefore, we think that it is a totally unified cooking method of Indian and the laurel forest cultures.

Succeedingly, the seasoning food group is used in fishes, pulses, cereals and fruits when they are categorized based on raw materials prepared. As the preparation of side-dish food group, many of these are in mixed preparation of single or plural kinds.

First, those prepared mainly with fish is basically to the group of narezushi. It is evident that the laurel forest culture produced it. In general, it is called gyosho and loved widely in respective regions. Gyosho is prepared in two kinds; one with freshwater fish as main ingredients and the other with seawater fish as main ingredients. The former is distributed many in the inside of the Continent or mountain range and the latter is seen many in the coastal zone.

However, we would like to point out that the origin of narezushi started from freshwater fish preservation.

The seasoning food group with pulses or cereals as main ingredients, all produced for market have the influence of the laurel forest culture with the malted rice as starter. However, because malted rice is admitted in increased number of the kinds and in improvement, at least especially Chinese food culture is counted in East Asia.

Seasoning foods of fruits can be seen occasionally, but the main project is only to enjoy unique aroma those fruits have the main subject. The preparation method is by adding appropriate amount of salt to the fruits and have them fermented in jars or pots.

RESULTS

In the area of the laurel forest from the south edge part of Tibetan mountains including Nepal, Bhutan and Assam mountains to Yunnan highlands of China, Guizhou and Hunnan province had extremely instable situation in food gaining in the ancient days. On the other hand, the southern region is gifted with the Tropical Rain Forest climate, those tribal people living there used to receive natural care all through the year and have never lacked in obtaining fresh foods.

However, in the northern laurel forest, under the Temperate Summer Rain climate which environment is with rainfall for half a year, fresh food obtaining was especially difficult. The inhabitants of this region must have wished to survive searching for food all the time even to bite grass roots.

In order to survive the dry season, they reached to develop "soaking-in-water" and "heat-treating" method to extract starch with experiments and studies on and on using their human wisdom. This phenomenon is the beginning of remarkable culture. However, this wonderful invention could not solve all the stabilization of food.

They continued to look for fresh foods, they searched it all the direction as east, west, south and north. First they paid attention gradually in the south and tried to use arum. After continuous failures, they explored a certain species and cultivated seriously. Regarding yet unstable food obtaining issue, in communication with western culture, they managed to learn so-called cereal cultivation and succeeded it in the burnt field.

In the long history, the human wisdom accumulated in the inhabitants found rice plant in the laurel forest they live in and succeeded its cultivation.

The laurel forest cultivation culture developed from "Hunting-Gathering", "Hunting-Gathering plus Root Crop", "Hunting-Gathering plus Root Crop plus Miscellaneous Cereal", "Hunting-Gathering plus Root Crop plus Miscellaneous Cereal plus Pulse" to "Hunting-Gathering plus Root Crop plus Miscellaneous Cereal plus Pulse plus Rice" is, not too much to say, an accumulation and crystal of wisdom as human of inhabitants constructing the region.

As seen the above mentioned flow, a cultivation method to aim at harvesting a good deal of many species was systematized, it was difficult to evade a tendency harvest time and cultivation time are concentrated except for only

a part. It is the risk a limited period has concentrated harvest.

Here, they face a proposition how much food they should obtain.

The Temperate Summer Rain Climate, or the laurel forest is equipped with a natural condition ideal for food preservation. Therefore, what could be preserved dry could be dissolved easily.

However, they must have had been perplexed in obtaining stable animal protein, other food, that is something excluding cereals, pulses and rice.

The problem is what to do when they hunted big animals or caught a big volume of fishes. However, from "a spirit to care for food" they have learned in the long history, they spontaneously discovered preservation method. Moreover, they made it able by improving the quality of food such as flavor, taste and seasoning.

They discovered the fermented food by microorganisms in the air attached to the ingredients, developed and established it.

Through the steps of high preservation and fermentation, the fermented food prepared in the laurel forest has flavor, taste and seasoning that fresh foods do not have, and the sticky taste like rice cake which the inhabitants of the laurel forest is fond of was delivered gradually to south and east.

The fermented food group created in the laurel forest culture zone then spread to the whole Southeast Asia. The question is why this region has many kinds of fermented food currently.

We cannot forget that the southern area especially is with high temperature and high humid throughout the year and it is under the most appropriate natural environment for necessary microorganisms to activate at fermentation. They fill all the appropriate conditions of rich ingredients and activity of microbes.

It is a peculiar region where those prepared with so-called natural fermentation, or everything made with malted rice or other similar ones as starter can be produced throughout the year aside from those high quality fermentation technique is demanded.

Most of the fermented preservation foods are originated from the laurel forest culture zone but one part includes those of Babylonian Culture. Anyhow, the food culture was delivered to this area by land or sea routes. The food established as a lot of fermented preservation food until today and distributed in all Southeast Asia.

It is the theory that the laurel forest is the bud

zone for rice plant cultivation. As time passes, from Assam mountain to provinces of Yunnan, Gizhou and Hunnan of China, the culture was delivered far as to Japan. Then the original cultivation method of course went to south and the rice plant culture spread in all Southeast Asia. Speaking of food preservation, fermented foods as one of the food preservation techniques, which is a part of the laurel forest culture, was delivered along with rice plant culture and established in all Southeast Asia. We believe that such fermented foods have been handed down until today as traditional fermented foods.

ACKNOWLEDGEMENT

On producing this report, we received precious advice and guidance from the late Dr. Toshitaka Nakae, Professor Emeritus at Graduate School of Natural Science and Technology, Okayama University on the importance of role as a part of this doctoral dissertation. We also were honorably helped in collecting references, research methods and technical advices by Dr. Reinosuke Nakamura, professor at Graduate School of Natural Science and Technology, Okayama University.

Also, we would like to thank Mr. Hidetoshi Morita in Doctor Course at Graduate School of Natural Science and Technology, Okayama University for his devoted assistance from discussion on arranging figures to word-processing throughout the production of this report.

BOOKS REFERRED TO

- 1) Watabe, T., Ogoh, T., Kurihara, H. and Maeda, K.: *Introduction to Crop Production*, Rural Culture Association, 159, Tokyo (1977)
- 2) Watabe, T., Ogoh, T., Kurihara, H. and Maeda, K.: *Introduction to Crop Production*, Rural Culture Association, 48, Tokyo (1977)
- 3) Watabe, T., Ogoh, T., Kurihara, H. and Maeda, K.: *Introduction to Crop Production*, Rural Culture Association, 47, Tokyo (1977)
- 4) Watabe, T., Ogoh, T., Kurihara, H. and Maeda, K.: *Introduction to Crop Production*, Rural Culture Association, 45, Tokyo (1977)
- 5) Watabe, T., Ogoh, T., Kurihara, H. and Maeda, K.: *Introduction to Crop Production*, Rural Culture Association, 49, Tokyo (1977)
- 6) Watabe, T., Ogoh, T., Kurihara, H. and Maeda, K.: *Introduction to Crop Production*, Rural Culture Association, 54, Tokyo (1977)
- 7) Nagazumi, A.: *History of Southeast Asia*, Gendai Shinsho, Kodansha Ltd., 12, Tokyo (1977)
- 8) Delvert, J. (translated by Kikuchi, K.): *Geography of Southeast Asia*, Hakusuisha, 9, Tokyo (1969)
- 9) Nakao, S.: *Origin of cultivation plant and agriculture*, Iwanami Shinsho, 69, Tokyo (1966)
- 10) Sasaki, K.: *Path to the laurel forest culture*, NHK Books, 64, Tokyo (1982)
- 11) Sasaki, K.: *Path to the laurel forest culture*, NHK Books, 64, Tokyo (1982)
- 12) Sasaki, K.: *Path to the laurel forest culture*, NHK Books, 66, Tokyo (1982)
- 13) Watabe, T.: *Rice Road*, NHK Books, 194, Tokyo (1977)
- 14) Watabe, T.: *Rice Road*, NHK Books, 101, Tokyo (1977)
- 15) Watabe, T.: *Rice Road*, NHK Books, 102, Tokyo (1977)
- 16) Watabe, T.: *Rice Road*, NHK Books, 103, Tokyo (1977)
- 17) Watabe, T.: *Rice Road*, NHK Books, 104, Tokyo (1977)
- 18) Shinoda, O.: *Chinese Food History*, Shibata Shoten, 29, Tokyo (1974)
- 19) Ishige, N. et al.: *Food Culture of East Asia*, Heibonsha, 21, Tokyo (1981)
- 20) Sasaki, K.: *Path to the laurel forest culture*, NHK Books, 106, Tokyo (1982)
- 21) Pan Ku (translated by Nagata, H. and Umehara, K.): *Chronicles of the Han Dynasty; Books of food & economy, geography and canal & waterway*, Heibonsha, 139, Tokyo (1988)
- 22) Pan Ku (translated by Nagata, H. and Umehara, K.): *Chronicles of the Han Dynasty; Books of food & economy, geography and canal & waterway*, Heibonsha, 142, Tokyo (1988)
- 23) Ishige, N., Ohtsuka, S. and Shinoda, O.: *Food History*, Chukou Shinsho, 148, Tokyo (1974)
- 24) Sasaki, K.: *Path to the laurel forest culture*, NHK Books, 129, Tokyo (1982)
- 25) Nakao, S.: *Cultivation plant and origin of agriculture*, Iwanami Shinsho, 136, Tokyo (1966)
- 26) Kato, H., Fujimaki, M. and Sakurai, Y.: *Process and Preservation of Food*, Kouseikan, 185, Tokyo (1985)
- 27) Kato, H., Fujimaki, M. and Sakurai, Y.: *Process and Preservation of Food*, Kouseikan, 185, Tokyo (1985)
- 28) Campbely-Patt, G.: *Fermented Foods of the World*, Butterworths, 184, London (1987)
- 29) Nakao, S.: *Origin of Cooking*, NHK Books, 121, Tokyo (1972)

- 30) Sasaki, K.: *Path to the laurel forest culture*, NHK Books, 127, Tokyo (1982)
- 31) Campbely-Patt, G.: *Fermented Foods of the World*, Butterworths, 209, London (1987)
- 32) Campbely-Patt, G.: *Fermented Foods of the World*, Butterworths, 69, London (1987)
- 33) Campbely-Patt, G.: *Fermented Foods of the World*, Butterworths, 197, London (1987)
- 20) Fukui, S., Yabuki, M. and Hoshino, K.: *Life Microbiology*, Jihodo Shuppan, Tokyo (1980)
- 21) Noshiro, K., Ozaki, M. and Yoshii, H.: *Zymology*, Kodansha Scientific, Tokyo (1982)
- 22) Yamaguchi, K., Kaneko, Y. and Yoshii, H.: *Food Microbiology*, Jihodo Shuppan, Tokyo (1972)
- 23) Ohta, S.: *Theory of Food Seasoning*, Sachi Shobo, Tokyo (1976)
- 24) Shu, T., Chong, D. and Nakao, S.: *Food Culture of Asia*, Osaka Shoseki, Osaka (1985)
- 25) Ozaki, M. and Ishige, T.: *Culture and Fermentation and Food*, Domes Publishers Co., Tokyo (1986)

REFERENCES

- 1) Iwama, I.: *Restructure and producing district technology of plain livestock*, Meibun Shobo, Tokyo (1985)
- 2) Asai, U.: *On Comparative Wine Culture*, Chukou Shinsho, Tokyo (1981)
- 3) Sato, M.: *People and Climate*, Chukou Shinsho, Tokyo (1987)
- 4) Yoshida, Y.: *Folklore of Seasoning*, Chukou Shinsho, Tokyo (1988)
- 5) Ienaga, Y.: *Origin of Crop Culture*, Kokin Shoin, Tokyo (1982)
- 6) Ohtsuka, S.: *Cultural History of Food*, Chukou Shinsho, Tokyo (1975)
- 7) Tsukuba, T.: *Civilization of Cooked Rice and Meat*, NHK Books, Tokyo (1969)
- 8) Yano, T.: *Structure of Southeast Asian World*, NHK Books, Tokyo (1984)
- 9) Ueyama, S. and Watabe, T.: *Rice Crop Culture*, Chukou Shinsho, Tokyo (1985)
- 10) George, P. (translated by Motooka, T. and Yamamoto, O.): *World Agricultural Geography*, Hakusuisha, Tokyo (1956)
- 11) Egami, N.: *Mounted Tribe Nation*, Chukou Shinsho, Tokyo (1967)
- 12) Kojima, M. and Ito, T.: *Food Science*, NHK Books Tokyo (1983)
- 13) Ueyama, S.: *Laurel Forest Culture*, Chukou Shinsho, Tokyo (1969)
- 14) Ueyama, S., Sasaki, K. and Nakao, S.: *Laurel Forest Culture (Second Volume)*, Chukou Shinsho, Tokyo (1976)
- 15) Ishige, T., Ohtsuka, S. and Shinoda, O.: *Food History*, Chukou Shinsho, 148, Tokyo (1975)
- 16) Iwamura, S.: *Silk Road*, NHK Books, Tokyo (1966)
- 17) Misugi, T.: *Silk Road in Sea*, Shinchosha, Tokyo (1984)
- 18) Sasaki, K.: *Before Rice Crop*, NHK Books, Tokyo (1971)
- 19) Suzuki, S.: *Chinese History*, Yamakawa Shuppansha, Tokyo (1964)