

ZINGIBERACEAE UTILIZATION FROM EAST BANYUMAS PRODUCTION FOREST AS NATURAL EDIBLE ADDITIVES

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Abstract

Benefits of Zingiberaceae family's plants for rural communities in forest villages are as raw gingery-stuff sources for food additives and health purposes. The superiority of Zingiberaceae's plants is able to grow well under tree stands and on open sites. Survey on 50 respondents at forest villages under the Forest Management Unity of East Banyumas revealed that those gingery stuffs from eight Zingiberaceae's plant species (i.e. *Alpinia galanga* (L.) Willd., *Amomum cardamomum* Willd., *Boesenbergia rotunda* (L.) Mansf., *Curcuma domestica* Val., *C. zanthorrhiza* Roxb., *Etingera elatior* (Jack) R.M.Sm., *Kaempferia galanga* L. and *Zingiber officinale* Rosc., have been utilized as edible additives for food and drinks by the community in production forest vicinity. Zingiberaceae-derived additives were categorized as safely consumed for food ingredients/dressings, colorings, aromas, and healthy drinks. Cultivation of Zingiberaceae's plants could bring economic values and positive impacts to the community and production forest environments. Several Zingiberaceae-derived food ingredients and local drinks have been modified into very-recent recipes, favored for special menus in ISFE's cuisine-related tourism sites and in modern restaurants. Prospect of Zingiberaceae is expectedly able to develop productive efforts and economies in forest villages; and sustain production forest continually.

Keywords: food and drink additives, forest farmer groups, sustainable production, Zingiberaceae

1. Introduction

Perhutani holds the authority to be the initiator and inspiration in combining operations and the implementation of the production forest security. Sustainable forest management system implemented in the country forest area or indigenous forest rights/forests implemented by local communities to improve their welfare, environmental balance and socio-cultural dynamics. The program synergies along with village and district. This stage starts from the planning process, decision-making in the use and management of funds as the priority needs in the village, until the implementation of activities, and the preservation of forest production. The main priorities are the management, productivity of the forest and its sustainability. Integrated farming and ecotourism systems are believed to be the main options to meet the needs of the people living around the forest.

In this respect, there are a lot of various gingery additive stuffs from Zingiberaceae family which could be valuable and beneficial as edible additives in food ingredients (dressings) and in

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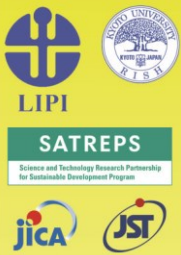
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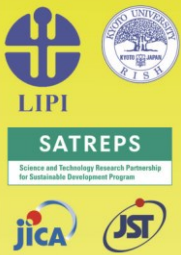
health drinks to rural community at production forest vicinity in East Banyumas. Those benefits were due to the additive's favorable characteristics such as significant essential oil contents, specific aromas, and chemical components in the Zingiberaceae's gingery rhizomes [1], [2], [3]. The preference of Zingiberaceae's plants is felt quite strategic for establishing production forest in continual and sustainable ways. Adapting to the most-recent situation, the community should be involved in the managing and undertaking of production forests. Cultivation of Zingiberaceae plants was performed under the production forest stands or trees, whereby the tree species could be e.g. *Tectona grandis* (teak), *Swietenia macrophylla* (mahoni), *Pinus mercurii* Jungh (pine) and *Agathis dammara*. In doing so, Perum Perhutani (Indonesia's State Forest Enterprise) could provide the necessary facilities; and cooperate with farmer groups and Institute for Forest Village Community. Effectiveness of those undertaking programs and their impacts could be measurably assessed through among others the community participation, program benefits, and scientific impacts on the sustainability of production forest [4].

Zingiberaceae-derived gingery-additives could enhance the qualities of foodstuffs and health drinks; as well as create particular images, because those additives could impart specific colors, tastes, and aroma to the food/drink products. Further, particular species such as *Zingiber officinale* Rosc. (ginger), *Curcuma domestica* Val. (turmeric), and *C. zanthorrhiza* Roxb. (Javanese ginger) have been popularly utilized of their specific gingery stuffs as ingredients for drink items or beverages to increase the resistance of human bodies against the widespread epidemic attacks by the corona virus-induced diseases [5]. Not only does the community utilize the Zingiberaceae-derived ingredients exclusively for such purposes, but they also include the ingredients from non-Zingiberaceae's plants. Food products in general are believed able to exert high attractive capability when consumed, not only because they have high nutrition values but since they also could impart pleasing tastes, flavors, and aroma.

Additives for foodstuffs/drinks and traditional drugs could bring about bad or negative impacts on human health and induce severe afflicting diseases, if they are not used properly with the prescribed dosages otherwise. The diseases that commonly occur in the long-time period after consuming food additives are among others destruction of human-body organs, kidney troubles, liver malfunctions, cancer infirmities, etc. The obligation of additive testing associated with pharmacology, toxicity, and clinical aspects should be imposed very soon, after the release of regulation about health in order that the foodstuffs/drinks and traditional drugs are quite safe and harmless for human consumption. This study aims to find out the types of Zingiberaceae as food additives, and its prospects as a commodity selected in the National Program for Community Empowerment to build sustainable production forests.

2. Methods

The grouping of data was performed with priority on utilization of Zingiberaceae's particular plant parts (specifically raw gingery rhizome tissues) as additives for food and drinks as well as on its bioprosects for establishing continually production forests. Primary data were obtained through formal and informal interviews using semi-structure questionnaires and field observations. The field survey was conducted at five Unity Part of Stakeholder Forest ie: Jatilawang, Kebasen, Gunung Slamet Barat, Gunung Slamet Timur, and Karangobar. Respondents numbered 50 people, consisting of 25 members of farmer groups and 25 others are ginger steamers, users in stalls and traditional markets, culinary perhutani, and modern restaurants. Respondents consisted of 25 men and 25 women, aged between 17 to 60 years.



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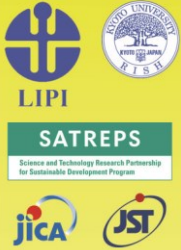
Description about primary data was acquired directly from the cultivation and users of Zingiberaceae’s plants which became the main objects of this research. As many as 50 respondents who were selected consisted of farmers, sellers/vendors, and users at small shops and traditional markets. The selected men and women as many as consecutively 30 and 20 persons were those with their ages ranged from 15 to 60 years. The cultivation of Zingiberaceae’s plants was carried out by the community members who belonged to the Forest Farmer Group. Explanation and experience obtained from those respondents were related to the significances about utilization and undertaking of continual/sustainable production forest as well as about the related consumers in each of their villages. Characteristics of the selected consumers comprised those of members and of non-members in Farmer Groups, who got accustomed to utilizing and consuming Zingiberaceae-derived additives for food cooking and health drinks.

Secondary data were obtained through assessments on the relevant literatures at libraries and from internet networks. Included also as secondary data were journals, annual reports, symposium proceedings, and statistics data about the subdistricts/regencies. Observation and checking on the fields have been conducted to complete or supplement the data sources. Those sources covered toxicity data for safety of food and health, screening data about consecutively active chemical compounds in Zingiberaceae’s gingery rhizomes, benefits of immunity modulator, properties of anti oxidants, anti microbes, liquid-shaped aqueous traditional drugs to be drunk, and other health-related benefits. The acquired data/information about the uses of Zingiberaceae’s specific gingery stuffs was compared with consecutively data/information in the literatures/references; and with Zingiberaceae’s uses in practice by the community. Primary and secondary data were completed/supplemented with photographs as illustration from the most-recent realities in the fields.

The methods which were implemented in the procuring/gathering of data/information covered the descriptive surveys and Participatory Rural Appraisal methods. Such methods were inherently an assessment process which oriented to the involvement and roles of community who actively participated in the research. Interview techniques which were used in semi-structured ways were based as a kind of guidance on specific question lists such as local/vernacular names of plant species, the plant tissue parts which were utilized, and their benefits/uses, utilizing manners, trade ways, and status of plants (wild/cultivated). Other related essential notes covered procuring the materials (especially gingery rhizomes), arranging, ingeniously compounding, and manipulating the materials, consuming gingery-rhizome-derived healthy food/drinks and traditional drugs as well as food/drink/drug contribution to household economy and to continuation/sustainability of production forest.

Users of food/beverage recipes was only surveyed on farmer housewives, food stalls, traditional restaurants in the tourist area of Banyumas district. Further, essential values of plant species from Zingiberaceae family as gingery additive sources for food and drink ingredients were determined through the modified methods implemented by Leaman *et al.* [17]. As such, the species of Zingiberaceae’s plant members would be regarded as valuable, if at least 20% of the respondents at each location/site (under Perum Perhutani administration) used those plants. Kinds of traditional drugs derived from Zingiberaceae’s plants would become essentials for those users, if the drug uses exceeded 50%. Similar manners were also implemented to look into the essential indexes of Zingiberaceae’s plant species, whereby their produced gingery stuffs were used as edible additives for food and traditional drinks.

The supplementing data which were obtained from the informants persons, such as especially farmers, pine exudates tappers, Zingiberaceae’s plants utilizers and users, and



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community participants, covered the data about population inhabitants and the data from IFVC (Institute for Forest Village Community). The success in the program undertakings (among others Zingiberaceae cultivation under production forest stands and utilization of ginger rhizomes as edible additives/ingredients for foodstuffs/healthy drinks/traditional drugs) could be measured and evaluated through the impacts on continuations of program and sustainability of production forest. Analysis on data qualitatively and quantitatively; as well as survey questionnaires on households were inherently Rural Participative Rural Appraisal through the discussion performed by focused groups and through direct observation.

3. Result

Planning of Zingiberaceae cultivation program started at village level by forest farming group. At the sub-district level, the national program of community empowerment and perhutani facilitates by providing land, some seeds and field extension. Types available are: *Amomum cardamomum* Wild., *Curcuma domestica* Val. and *Zingiber officinale* Roxb. for sale to bookers. The polyculture model also grows non Zingiberaceae such as tubers, vegetables and food crops for household needs. Plants were cultivated intensively together with the stands of *Pinus merkusii*, *Agathis dammara*, *Altingia excelsa*, *Schima walichi*, *Tectona grandis*, *Accacia mangium* in the forest of Jatilawang, Kebasen, Karang Kobar and Purwokerto area until the age of the tree was five years old. *Alpinia galanga* (L.) Willd., *Boesenbergia rotunda* (L.) Mansf., *Curcuma domestica* Val., *C. zanthorrhiza* Roxb., *Etingera elatior* (Jack) R.M.Sm., *Kaempferia galanga* L. were other types of Zingiberaceae that are utilized by local people and sold freely. Some species of Zingiberaceae grow wild in East Banyumas forest such as *Costus speciosus*, *Curcuma heyneana*, *Curcuma zedoaria* Rosc., *Hedychium roxburghii* Blume, *Zingiber zerumbet* (L.) Roscoe ex Sm., *Hornstedtia heyneana* Vahl., and *Zingiber aromaticum* Val. These types of wild grow away from settlements and communities do not use it for food additives or health drinks.

Female respondents planted Zingiberaceae ordered by buyers in the forests and yards. They also choose important types such as turmeric, galangal, ginger, kapolaga, and kencur for kitchen needs and health drinks. While the male respondents all planted in the forest production. Planting Zingiberaceae is guided by extension workers from sub-districts and directed according to the policy of sustainable production forest. Potential of land under forest stands is for the production of medicinal and agrochemical materials. Vegetation forest serves for the conservation and production of wood, but also beneficial for the economic industry of the community around the forest Its management policy as an effort to preserve the function of forests by involving the community through the Forest Village Community Development program [4], [6].

Base on respondent answer, there were eight species of Zingiberaceae, which have already been utilized as ingredients (additives) for foodstuffs, healthy drinks, and traditional drugs by the community in forest community tours (Table 1). East Banyumas tourism is spread in a number of areas, namely Cilacap Regency, Banyumas Regency, Purbalingga Regency, and Banjarnegara Regency.

The use of Zingiberaceae-derived additives as cooking ingredients in fact could not be separated from their usages for healthy drinks. The essential Zingiberaceae's species that produced ginger additives (together with the portion of consuming-respondents, which have been utilized by the community in forest villages. The community arranged and skillfully compounded the ingredients (of raw ginger rhizomes) from All species with other ingredients

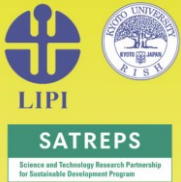
from non-Zingiberaceae's species, such as spices (pepper), chilli (red pepper), red onion, white

Table 1. Prospects for utilization by respondents and bioactive components of Zingiberaceae

No.	Species/Local name	Respondent (%)	Local Food/Beverage, Additive Recipes	Bioactive components*) & benefits
1	<i>Alpinia galanga</i> (L.) Willd. (lengkuas)	54	Serundeng, opor ayam, soto sokaraja, gudeg, sayur asem, tumis/oseng2, lodeh, nasi-lengko, lotek, nasi tumpeng, lontong sayur, sambal urap	essential oils (terpenoid group), galangin, kaemferol, and kuersetin (flavonoids), anti-microbial compounds (phenolic)
2	<i>Amomum cardomomum</i> Willd. (Kapulaga)	30	Wedang ronde, jamu-wanita, jamu penyubur wanita,	Essential oils : α -pinena, β -pinena, 1-felandrena, 1.8-sineol, β -linalol, and 1-terpineol
3	<i>Boesenbergia rotunda</i> (L.) Mansf. (Temu kunci)	10	Sayur bening, jamu kewanitaan, antidepresan karena mengandung flavonoid.	flavonoids (chalcones, flavanones, and flavones) and essential oils (terpinene, geraniol, camphor, α -ocimene, 1,8-cineole, myrcene, borneol, camphene, methyl cinnamate, terpineol, geranial, and neral
4	<i>Curcuma domestica</i> Val. (Kunyit)	58	Opor, gulai, sayur nangka, sayur asem, jamu kunyit-aseam, beras-kencur dan pewarna alami	Curcuminoids (flavonoids), essential oils: ketone, seskuioterpen, zingiberina and curcumin seskuioterpen (tumeron and antueron), curcumin t.d: diferuloilmetana, dimetoksikurkumin (hydroxysinamoil feruloilmetan), and bisdemetoksi-curcumin
5	<i>C. zanthorrhiza</i> Roxb. (temulawak)	46	Wedang beras kencur, wedang temulawak, wedang ronde, gepyokan, darah, , cabe-puyang, temulawak-madu, temulawak-kurma, pewarna alami	curcumin content 30- 60%, xanthorrhizol, curcumin and curcuminoids), as well as essential oils
6	<i>Etlingera elatior</i> (Jack) R.M.Sm. (Honje=combrang)	18	Pecel, herbal, natural dye red,	Phenolic dan flavonoid, compounds0,14443 $\mu\text{g/mL}$. alkaloid, polifenol, flavonoid dan minyak tsiri. Karotenoid, β -Karoten, Antosianin
7	<i>Kaempferia galanga</i> L. (kencur)	50	Tempe mendoan, sayur nangka, nasi gandul, nasi tumpeng, nasi campur, beras kencur, jamu-wanita	Essential oils, Ethyl-trans-p-methoxy cinnamate and trans-ethyl cinnamate very important properties that have farmakolog properties
8	<i>Zingiber officinale</i> Roxb. (jahe merah)	63	Gulai kambing, pepes dan gulai ikan, sop bening, bandrek, skoteng, jamu wedang ronde, enting-jehe, camilan jahe, jipang-jahe, roti-jahe, roti- temu-jehe-kunyit	Monoterpen-skuioterpen: ar-curcumene and myrcene. zingiberene and β -phellandrene, non-volatile components= ginger (pungent) flavors, gingerol and shogaol. proteolytic enzymes, zingibain, essential oils, oleorosin, and gingerol

*) Source: [1], [3], [5]; [2]

onion, suji leaves, salam leaves, coconut milk juices, hard-shelled nuts, sugar, cloves, lemons, and kayu manis (cinnamon). Those non-Zingiberaceae ingredients were obtained by purchasing them in the markets or through their harvesting (plucking) from their host trees at production-forest vicinities.



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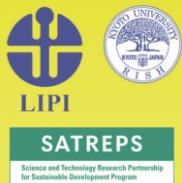
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The essential Zingiberaceae's species that produced gingery additives (together with the portion of consuming-respondents for each species) were consecutively *Alpinia galanga* (L.) Willd. 54%, *Curcuma domestica* Val. 58 %, and *Zingiber officinale* Roxb. 63% (Table 1), which have been utilized by the community in forest villages. Correspondingly, other species of Zingiberaceae family were *C. zanthorrhiza* Roxb. 43 %, *Kaempferia galanga* L. 42%. The community arranged and skillfully compounded the ingredients of raw gingery rhizomes from all species with other ingredients from non-Zingiberaceae's, such as spice, chilli, red & white onion, suji leaves, salam leaf, coconut, hard-shelled nuts, sappanwood, sugar, cloves, lemons, and cinnamon. Those non-Zingiberaceae ingredients were obtained by purchasing them in the markets or through their harvesting from their host trees at production-forest vicinities.

The recipes of processing food products that incorporated food additives in modern restaurants initially were only performed locally and separately from each other. Those recipes in their development underwent several modifications with respect to their serving and appearances. Consequently, the cooked food products with Zingiberaceae's additives were not only available at the low-level or street food vendors/sellers currently but also served in modern restaurants. Furthermore, those two kinds of Indonesia's food have become the only Indonesia's foodstuffs which were not affected or driven away by Chinese food, Indian food, and Arabian food. Local knowledge has played essential keys to utilizing renewable natural resources to become self-sufficient in relation to health and foodstuffs for the community at the production forest vicinity [7].

Zingiberaceae as the producers of raw gingery rhizome stuffs were inherently a tribe (family) rich in species; and their stuffs contain bioactive chemical compounds. Those compounds if utilized as food additives could potentially enhance the processed food/drink products such that those products were beneficial for human health. The benefits of Zingiberaceae's raw gingery stuffs as food additives/ingredients have been very deeply and strongly rooted among the local community in the production forest vicinity. Food additives that could serve as food-flavoring agent in general are not composed of only one (single) compound, but instead they also could comprise the mixture of various chemical compounds that each exhibited specific characteristic [8]. Those traditional drinks have become popular, since the miserable outbreak of epidemic corona virus (Covid-19) diseases, indicatively as efficacious remedies. For such, the community in arranging and compounding the Zingiberaceae's raw gingery ingredients into those traditional drinks, they mixed them with ingredients from non-Zingiberaceae's species, such as *Syzygium aromaticum* (L.) Merr. & L.M. Perry (clove), *Cymbopogon nardus* L. (sereh), *Cinnamomum verum* J. Presl (ceilon cinnamon), *Citrus aurantifolia* Swing. (lime lemon juice), *Arenga pinnata* (Wurmb) Merr. (palm sugar). The prospects of Zingiberaceae as sources of raw gingery rhizome stuffs for food/drink additives and traditional drugs in daily human lives could be categorized into additives for cooking ingredients, healthy drinks and prospect Zingiberaceae for the national programs of population and environments of continual production forests.

Traditional community in East Banyumas has known very much the so-called pecel, gado-gado, soto Sokaraja, serundeng ayam, opor, sop ikan, lodho, and nasi tumpeng which became specific or local food. Meanwhile, the community also have been familiar with specific foodstuffs like, soto kudus, mangut, karedok, nasi gandul, and sayur asem (sour-tasted watery soup) from other regions in Central Java. All the processed (cooked) food products were still added with specific foodstuffs or ingredients such as vegetables, tempeh (fermented soybeans), potatoes, and tofu (soybean cakes). Afterwards, all those ingredient-added cooked products were mixed with food additives that could contain various ingredients originated from one to four



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Zingiberaceae’s plant species such as *A. galanga*, *C. domestica*, *K. galanga*, and *Z. officinale*. As an interesting example, the pouring of tasty peanut sauce and soybean sauce to all those Java-typical foodstuffs could bring about their delicious flavors. The deliciousness of those Javanese foodstuffs could be attributed to the way how the community cooked them, who used additives of pandan (*Pandanus amaryllifolius* Roxb. ex Lindl.) leaves. Those leaf additives rendered the pandan-leaf-added foodstuffs to smell more fragrant. In another case, there was a kind of mixed cooked rice known in Central Java as the so-called nasi gandul and nasi gombyang; as well as in West Java popular with so-called nasi lengko and nasi campur (Figure 1). All those kinds of mixed cooked rice were still blended with various ketupat shapes and fish sauces; as well as with meats, then poured with opor gravy, gudeg, or curry, which mostly contained Zingiberaceae’s food ingredients (of raw ginger rhizome origins) and spices.

Zingiberaceae’s gingery stuffs that contain essential (volatile) oils, such as *A. galanga*, *Amomum cardamomum*, and *Z. zerumbet* in their rhizomes, which were beneficial as attractive aromas for local community in the production forest vicinity [1]. Other benefits of Zingiberaceae’s gingery stuffs were as cooking ingredients, natural coloring agents, ornamental plants (not yet harvested of their gingery stuffs; or in still their intact plant forms), and traditional drugs [9]. Gingery rhizomes of Zingiberaceae’s species, after being skillfully arranged/ingeniously compounded have been commonly utilized as food-flavoring agents, especially in South East Asia. Still related, the aromatic characteristics of gingery rhizomes from specifically *Alpinia galanga* species were often illustrated as woods, mints and flowers. Zingiberaceae’s rhizomes that contained essential oils indicatively exhibited antimicrobial activities against positive-gram bacteria, yeast, and dermatophyte. The most active chemical compounds present in those rhizomes were so-called terpinen-4-ol [10].

Warm gingery drinks, such wedang secang, wedang jahe, jahe-susu-alang-alang (jaselang and susu-telor-madu-jahe (STMJ)), were entirely believed able to improve as well as maintain health stamina of human bodies. Those healthy drinks which were inherently arranged and compounded from mainly Zingiberaceae’s gingery stuffs were at first spread out at only several particular locations in Java. Nowadays, however, those healthy gingery drinks could be found easily at other locations than in Sumatera and Kalimantan. Further, those gingery drinks have been widely available as commonly sold and served by street vendors; and as supplements in modern restaurants. Those warm gingery drinks currently have been so widespread almost any where in Java, because of their attractive aroma and tasty flavor they imparted (Table 1, 2). For example, red-colored ginger drinks afforded aroma and taste which were stronger due to the presence of bioactive chemical compounds contained inside that consisted of principally (6)-gingerly, (6)-shoal, diarilheptanoid, and curcumine. In addition, those gingery stuffs also contained shogaol and gingerol compounds [11]. In those gingery stuffs, antioxidants were always present together with other particular compounds regarded as essential nutrients in the gingers [12]. Related to that, for example antioxidants and other nutritious chemical compounds are present in warm ginger drinks typical of bandrek, in order to have special functional properties. Further, analysis results revealed that the microbiology characteristics of the gingery bandrek drinks (that contained antioxidant and other nutritious compounds) could still comply with the microbiology requirements stipulated by the Indonesia’s National Standards. Still related, the capacity of antioxidants in the instant gingery bandrek was equivalent to 256 mg/L, and total phenolic equivalent to 90 mg GAE/L [13].

Table 2. Additives and drink ingredients derived from Zingiberaceae's gingerly

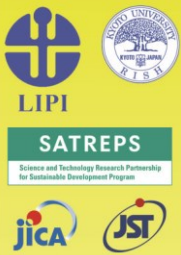
No	Food additives or beverages from the production forest:	
	Species (local name)	Categories: food, beverages or snacks
1	<i>Alpinia galanga</i> (L.) Willd. (lengkuas)	 <p>lodeh (siamese+ginger), serundeng (fried chicken, spices and lengkuas)</p> <p>nasi campur, (special spices+galangal)</p>
2	<i>Amomum cardomomum</i> Willd. (Kapulaga)	 <p>Opor (cardamom + ginger+ turmeric+galangal)</p> <p>Wedang ronde (cardamom +ginger), jamu-wanita (mixed)</p>
3	<i>Boesenbergia rotunda</i> (L.) Mansf. (Temu kunci)	 <p>fish/chicken soup (mixed with turmeric & ginger)</p> <p>Sayur bening (+fingerroot), herbs for womanhood, anti-depressants, anti-microbial</p>
4	<i>Curcumma domestica</i> Val. (Kunyit)	 <p>turmeric+lengkuas Soto-sokaraja, mixed with lengkuas</p> <p>Sayur nangka, jamu kunyit asem (herbs for drinks)</p>
5	<i>C. zanthorrhiza</i> Roxb. (temulawak),	 <p>bakwan sayur; traditional herbs for wome: (turmeric +fingerroot+ginger)</p> <p>nasi kuning campur, herbs tumeric drink</p>
6	<i>Etingera elatior</i> (Jack) R.M.Sm. (Honje=combrang)	 <p>Pecel-combrang/torch ginger</p> <p>herbal, natural dye red</p>

7	<i>Kaempferia galanga</i> L. (kencur)		
8	<i>Zingiber officinale</i> Roxb. (jahe merah)		

*)Sources: Photos (by the authors), other parts from “Collection of Indonesia’s Cooking Recipes”
(website: <https://inforesepmasakan sederhana.com/aneka resepi>)

Utilization of Zingiberaceae’s gingery stuffs in the local community lives would indicatively develop progressively and proceed continually as well as prospectively throughout the time. The further prospects of gingery stuffs depended much on number and species of Zingiberaceae’s plants as well as on benefits afforded by chemical compounds contained in the gingery stuffs. The potency of Zingiberaceae’s gingery stuffs from production forests as food additives was attributed to among others their essential (volatile) oils and coloring agents which could attract the appetite of the interested customers. Accordingly, as additional important information, those valuable antioxidants could be obtained through the food intake or food supplements which contained high nutrition diets. Several previous research results stated that several particular tree species that belonged to Zingiberaceae could develop various kinds of gingery stuffs, able to function as efficacious drugs. The particular gingery stuffs from different Zingiberaceae’s species origins exhibited their own different bioactive chemical components; and therefore, the benefits of each bioactive components after being compounded into drugs were different as well [14]. For example, traditional drugs special for women were also results of compounding various kinds of Zingiberaceae’s gingery (such as *B. rotunda*, *Z. officinale*, *C. domestica*, and *K. galanga* with non-Zingiberaceae’s stuffs (e.g. spices and betel leaves). Those two kinds of liquid-shaped aqueous traditional drugs exhibited a lot of benefits and efficacy due to their complete and complementing contents of bioactive compounds (Table 1).

Vegetations at production forests could function as both conservation purposes and wood production. However, those forests were also essential for industries. This is because in the forests there also grew various undergrowth vegetations, such as Zingiberaceae’s plant species (mainly) and particular drug-producer species. Those under growths further developed biomass stuffs, which could contain valuable chemical compounds such as polyphenol, cellulose, lignin, tannins, resins, alkaloid, flavonoid, terpenes, and other extractable compounds (able 1). Those compounds were necessary and potential as raw materials for drugs and agro-chemical stuffs. Regarding the Zingiberaceae’s plant species, as described before those plants could develop specific gingery rhizome tissues, which further could be utilized as raw edible stuffs for food additives, healthy drink ingredients, and traditional drugs. The presence of Zingiberaceae’s



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species as well as other various under growths (non-Zingiberaceae) rendered the produced gingery stuffs and other brought-out valuable chemical compounds to become essential biomass sources from the forests. Those biomass sources further could afford high economy values; and those encouraging green potencies have been suggested by the Institute for Forest Village Community at Salamsari (West Banyumas), Central Java [6].

The total number of Zingiberaceae’s species which have been utilized as gingery food additives (in the forms of e.g. food ingredients, aroma, and coloring agents) in the forest villages reached 8 species (Table 1, 2). A part of those ten were cultivated under the particular plant species of production forest tree stands, among others teak, pine, and mahoni. Meanwhile, non-Zingiberaceae’s plants were also cultivated under the production forest stands as producers of various biomass stuffs, such as essential oils (nilam oils & serai oils), and carbohydrate-containing tuber-shaped root stuffs. Those carbohydrate-predominated tuber-shaped stuffs were among Araceae (type root tubers). Toba ethnics have utilized the potency of 92 plant species as ingredient producers for drugs; and seven of those species belonged to the Zingiberaceae family [15], [16]. Those seven consisted of consecutively *Alpinia galanga*, *Curcuma domestica*, *Curcuma xanthorrhiza*, *Kaempferia galanga*, *Zingiber officinale*, *Kaempferia pandurata*, and *Curcuma aeruginosa* species. In another case, the community in Banjar Baru (South Kalimantan) has utilized the specific chemical compounds extracted from seven plant species that belonged to Zingiberaceae family, as raw stuffs for traditional drugs. As such, the specific compounds from each of the Zingiberaceae’s seven species origins imparted different specific efficacies against particular diseases, such as breath troubles, fevers, internal diseases, and blood neutralizers.

4. Conclusion

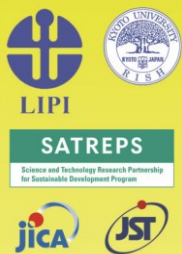
Six important species of Zingiberaceae used as food and beverage additives were *Alpinia galanga* L., *Amomum cardamomum* Willd., *Curcuma domestica* Val., *C. xanthorrhiza* Roxb., *Kaempferia galanga* L., and *Zingiber officinale* Rosc., which have been utilized by the community in forest villages, as cooking ingredients and healthy drinks.

The cultivation of Zingiberaceae’s species in the production forest areas could impart advantageous economy and positive impacts on the community and production forest environments. Several gingery-stuff-derived ingredients for local food and drinks have developed tremendously to become modern culinary food (cuisine) which afforded high-selling values.

Further, Zingiberaceae’s gingery stuffs have been modified into most-recent recipes, which were favored as special menu at the Perum Perhutani-administered culinary tourism locations and modern restaurants. Prospects of Zingiberaceae’s gingery stuffs were able to develop productive endeavors and economy in forest village; and to maintain the sustainability as well as continuation of production forests.

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