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International Seminar

CURRENT ISSUES AND CHALLENGES IN FOOD SAFETY:

science-based approach for food safety management

editor:

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SEAFAST CENTER

Southeast Asian Food and Agricultural Science and Technology (SEAFAST) Center
Bogor Agricultural University
CURRENT ISSUES AND CHALLENGES IN FOOD SAFETY
SCIENCE-BASED APPROACH FOR FOOD SAFETY MANAGEMENT

Proceeding of The International Seminar
‘Current Issues and Challenges in Food Safety:
Science-Based Approach for Food Safety Management’
Bogor, December 2-3, 2009

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PREFACE

On behalf of the Southeast Asian Food and Agricultural Science and Technology (SEAFAST) Center, Bogor Agricultural University, I take a great honor in introducing the publication of this proceeding. The proceeding is a results of long hours of editing the papers presented at International Seminar on "Current Issues and Challenges in Food Safety: Science-based approach for Food Safety Management"; 2-3 December 2009.

As we all know, food safety is of paramount importance for the consuming public. The importance of food safety is recognized, among other, by the International Conference on Nutrition held in Rome in 1992 which adopted the World Declaration and Plan of Action for Nutrition, calling governments and other concerned parties to "adopt" and strengthen comprehensive measures to cover the control of food quality and safety with a view of protecting the health of consumers.

However, since obtaining food is often still a challenge for many segments of the world's population, food safety issue is often overlooked. This has been the case also in Indonesia, but nowadays there is a growing recognition on the importance of food safety. This is especially true due to improved education and/or income; increase inflow of information, as well as the development of international trade.

It is realized that today's consumer demands assurance that their food supply is protected from (i) contamination by pathogenic microorganisms, chemical residues; and physical hazards; (ii) decomposition; (iii) adulteration; and (iv) deception or fraud in the form of misleading claims and descriptions on labelling or in advertising. Consequently, national food industry system needs to respond to the consumer demands for food safety. Food industries need to comply with mandatory legislation set by food safety authority, but also with trade specifications set by trade or industry organizations. To win the competition in the global market, Indonesian food industries must comply with both; one is their legal responsibility and a prerequisite for market entry, the other is simply
commercial reality, survival and development in the ever increasing competitive markets. The fact that food safety requirement applied by the importing countries is getting stricter is also a major challenge for many exporting countries to improve product competitiveness and its role in global market.

Currently, there is a general trend in several countries to consolidate their agencies toward the establishment of a single agency to lead food safety management or enforcement of food safety legislation and modified the existing food safety laws accordingly. Consolidation of food safety systems has been done in several countries. For their consolidation efforts, every country has been using different approaches. However, the countries' approaches were similar in one respects, i.e. they all are using science-based approaches and especially using risk analysis framework for developing the food safety system.

Research is undoubtedly an integral component of a national food safety programme. Food safety has been identified as one of the priorities of the Sub-Committee on Food Science and Technology (SCFST) in the ASEAN Plan of Action on S&T (APAST) (www.astnet.org). The responsibility on food safety is related to all stakeholders, such as agriculture, health, trade, industry, research etc. Cooperation between all stakeholders is essential for an effective and efficient food safety control. Cooperation between developing countries and developed countries is essential in assuring safer food supply for all. Research on food safety is particularly well suited for international cooperation with developing country such as Indonesia.

In this proceeding, our dedicated editors have presented many papers from group of experts in the area of food safety. In particular, papers from scientists of the International Commission on Microbial Specification for Foods (ICMSF) which illustrate the recent development in the area of food safety management. Many more papers from food industry scientists were also presented; highlighting industrial practices; including challenges that they are facing in producing safe food everyday. In addition; many reserach papers were also included in this proceeding; to illustrate the latest development in the area of food safety and food safety management.

With that, once again, I would like to take this opportunity to express my hearty thanks to all of the distinguished speakers and
moderators, who have prepared their papers to be published in this proceeding. Most especially; thanks to the editors who have spent many long hours in editing and shaping this proceeding to become an excellent reading reference book for food safety students, researchers and practitioners. Without their generous support and dedication, we could not have possibly published this proceeding.

I sure hope that the publication of this proceeding will help us all in improving safety of our foods for all people.

Thank you.

Bogor, September 2010

Purwiyatno Hariyadi
Director of
Southeast Asian Food and Agricultural Science and Technology (SEAFAST) Center, Bogor Agricultural University
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NUTRITION PROPERTIES AND THE PROSPECT OF SIX AMORPHOPHALLUS SPECIES OF TUBERS IN JAVA

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Center for Plant Conservation, Bogor Botanic Gardens – LIPI
Bogor 16003

ABSTRACT
Amorphophallus is perennial tuber crop and a member of the Araceae family. There are eight species of Amorphophallus in Java, i.e. Amorphophallus annulifer Hett., A. decus-silvae Backer & Alderw., A. discophorus Backer & Alwerw., A. muelleri Blume, A. paoniifolius (Dennst.) Nicolson, A. sagittarius Steenis, A. spectabilis (Miq.) Engl. and A. variabilis (Blume), of which two are widely cultivated in Java, viz. A. muelleri Blume and A. paoniifolius (Dennst.) Nicolson. The former is frequently cultivated in some regions in West Java and in East Java. The latter is only cultivated in Central Java. Nutrition properties of six species of Amorphophallus (except A. sagittarius Steenis and A. spectabilis (Miq.) Engl.) was analyzed. The results showed that the chemical content, i.e. fat, protein, amylose, amylepectin, glucomannan, Ca, Fe, P and Vitamin B1, of the six species of Amorphophallus are almost equal. This shows that all species have potential prospect as food alternative. However, further research on the physical characterization, non-nutritious properties and food processing should be carried out.

Keywords: Amorphophallus, Food, Java, Nutrition, Tuber

INTRODUCTION
The genus Amorphophallus, which is the member of the Araceae family, consists of 170 species world wide (Mayo et al., 1997), of which 25 species (14.2 %) exist in Indonesia. Distribution of Amorphophallus species exhibits a very high degree of endemism. About 18 species (68 %) are endemic to Indonesia: eight species in Sumatera, five species in Java, three species in Kalimantan and one species in Sulawesi (Hetterscheid & Ittenbach, 1996). In Java, eight
species of Amorphophallus, such as Amorphophallus annulifer Hett., A. decus-silvae Backer & Alderw., A. discophorus Backer & Alwerw., A. muelleri Blume, A. paeonifolius (Dennst.) Nicolson, A. sagittarius Steenis, A. spectabilis (Miq.) Engl. and A. variabilis (Blume) are found. Amorphophallus paeonifolius (Dennst.) Nicolson and A. muelleri Blume show a wide geographical range. The former is found from Madagascar east-ward throughout India to Malesia, southern China, Indochina, Polynesia and Northern Australia, the latter is found from Central Thailand, south-ward through Sumatera, Java, to the Lesser Sunda Islands (Yuzammi, 2000).

Tuber of all Amorphophallus species can be made edible, especially during food scarcity. However, several treatments must be done, i.e. peeling, slicing, repeated washing and boiling in water in order to remove toxic and irritative substances. In India and the Philippines, all parts of the Amorphophallus are also used as fodder. In China and Japan, the flour from the tuber of A. konjac is used industrially because of the high value of the glucomannan. It is also reported that Amorphophallus can be used as traditional medicine such as against dysentery, earache, cholera and respiratory problems, to reduce blood pressure and cholesterol level, to cure rheumatic pains and digestive problems (Flach & Rumawas, 1996). Besides that, the Amorphophallus species could be cultivated as ornamental plants.

In the past, limited natural resources in some region of Indonesia strived people to look for alternative food instead of rice. Wild taro was commonly used as food alternative, particularly in time of food scarcity. Indonesian government states planning for medium period development (RPJM) 2005 – 2009 by generated identification and cultivation of food alternative sources in responding of worldwide facing food crisis in the future. Tuber crop is one of potentially alternative source of food, for example the tuber of Amorphophallus species. In some regions in Java, taro has been used as alternative food during dry seasons, so that implementation of the tuber of Amorphophallus as food alternative seems to be feasible.
MATERIALS AND METHODS

Materials

Plant materials were obtained from cultivation as well as from wild plants in Java (Table 1). Ecological information and uses of each species were noted during field trips.

<table>
<thead>
<tr>
<th>No. Coll.</th>
<th>Species</th>
<th>Locality</th>
<th>Habitat</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRS 03</td>
<td><em>Amorphophallus</em> cf. <em>decus-silvae</em> Backer &amp; Aldrew.</td>
<td>Cidaun, Cianjur, W. Java</td>
<td>Understorey plant in secondary forest at alt. 250 m asl.</td>
<td>Wild</td>
</tr>
<tr>
<td>IRS 06</td>
<td><em>Amorphophallus</em> cf. <em>Annulifer</em> Hett.</td>
<td>Lengkong, Surade, Sukabumi, W. Java</td>
<td>Understorey plant in secondary forest at alt. 800 m asl.</td>
<td>Wild</td>
</tr>
<tr>
<td>JW 384</td>
<td><em>Amorphophallus</em> discophorus Backer &amp; Aldrew.</td>
<td>Ampel Gading, Mojo, Kediri, E. Java</td>
<td>Understorey plant in mahogany forest at alt. 835 m asl.</td>
<td>Wild</td>
</tr>
<tr>
<td>JW 376</td>
<td><em>Amorphophallus</em> decus-silvae Backer &amp; Aldrew.</td>
<td>Kemutug Lor, Baturraden, Banyumas, C. Java</td>
<td>Moist lower montane forest at alt. 772 m asl.</td>
<td>Wild</td>
</tr>
<tr>
<td>JW 388</td>
<td><em>Amorphophallus</em> muelleri Blume</td>
<td>Padas, Dagangan, Madiun, E. Java</td>
<td>Understorey plant in teak forest at alt. 315 m asl.</td>
<td>Cultivated</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No. Coll.</th>
<th>Species</th>
<th>Locality</th>
<th>Habitat</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>JW 390</td>
<td><em>Amorphophallus</em> muelleri Blume</td>
<td>Sidomulyo, Lebak</td>
<td>Understorey plant in pine</td>
<td>Wild</td>
</tr>
</tbody>
</table>
Science-Based Approach for Food Safety Management

Amorphophallus paeoniifolius (Dennst.) Nicholson

Barang, Pekalongan, C. Java

Notes: IRS = Iyan R. Sobari; JW = Joko R. Witono

Methods

The analysis of nutrition properties of the tubers comprises fat, protein, carbohydrates, amylase, amylopectin, glucomanan, minerals (Calcium, Phosphor, Fe), vitamin (A and B1), and anti-nutrition (Ca-oxalate and HCN). The methods used in the analysis are stated in Table 2.

Table 2. Methods of analysis

<table>
<thead>
<tr>
<th>No.</th>
<th>Nutrition</th>
<th>Analysis Method</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fat</td>
<td>Soxhlet</td>
<td>Jacobs, 1959; Slamet et al., 1990</td>
</tr>
<tr>
<td>2</td>
<td>Protein</td>
<td>Kjeldahl</td>
<td>AOAC, 1990; Jacobs, 1959; Osborne, 1978; Slamet et al., 1990</td>
</tr>
<tr>
<td>3</td>
<td>Carbohydrates</td>
<td>Spectrophotometer</td>
<td>Slamet et al., 1990</td>
</tr>
<tr>
<td>4</td>
<td>Glucomanan</td>
<td>Spectrophotometer</td>
<td>Slamet et al., 1990</td>
</tr>
</tbody>
</table>
RESULTS AND DISCUSSIONS

Food is an important basic need of human being besides house, clothing, education and health. The increasing number of world population has caused increase in food price, including rice. Most of Indonesian people are highly dependent on rice as their primary staple food. On the other hands, large area of rice field has been converted into real estates. Besides, in some regions of Indonesia, particularly in eastern Indonesia, prolonged dry season often results in no harvest. The dependence of Indonesian government on imported of rice from other countries could not solve the problem on food crisis in Indonesia. The government tried to persuade people to reduce their dependence on rice and substituted to food alternative. Many efforts have been made in order to reach this goal, such as through a cultivating wild crops traditionally as well as searching for the new ones.

With respect to government planning, this study focused on tuber crops of Amorphophallus species in Java. The expedition throughout Java has been carried out. From eight Amorphophallus species in Java, six of them have been found: (Amorphophallus annulifer, A. decus-silvae, A. discophorus, A. muelleri, A. paeoniifolius, and A. variabilis) and they have been cultivated in nursery of the Bogor Botanic Gardens, whereas A. sagittarius is found in certain part of Mount Gede Pangrango Natural Part. Due to the difficulty in getting the permit from the government, therefore this species might be analyzed later. Meanwhile, A. spectabilis is not easy to found. It is reported that this species exist in West Java, found in the mountain, at 1800-1800 m altitude (Yuzammi, 2000).
The results of proximate analysis of the six species of *Amorphophallus* are showed on Table 3.

**Table 3.** Proximate analysis of six species of *Amorphophallus* in Java (Nutrients per 100 g edible portion)

<table>
<thead>
<tr>
<th>Nutrient content</th>
<th>Amorphophallus species</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>0.14</td>
</tr>
<tr>
<td>Carbohydrates (%)</td>
<td>24.2</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>0.93</td>
</tr>
<tr>
<td>Amylose (%)</td>
<td>-</td>
</tr>
<tr>
<td>Amylopectin (%)</td>
<td>-</td>
</tr>
<tr>
<td>Glucomannan (%)</td>
<td>-</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>13.0</td>
</tr>
<tr>
<td>Fe (mg)</td>
<td>2.13</td>
</tr>
<tr>
<td>P (mg)</td>
<td>15</td>
</tr>
<tr>
<td>Vit. A (IU)</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>Vit. B1 (mg)</td>
<td>&lt;0.2</td>
</tr>
<tr>
<td>HCN (ppm)</td>
<td>-</td>
</tr>
<tr>
<td>Ca Oxalate (%)</td>
<td>-</td>
</tr>
</tbody>
</table>

Notes: (-) not analysis yet, (na) not available


*Amorphophallus konjac* is one of important food source in Japan due to its glucomannan (Mayo et al., 1997). This species is commonly cultivated and is used for many kinds of food. Based on Table 3, it could be seen that the percentage of several nutrients of Java's *Amorphophallus* is higher then *A. konjac*, such as protein, calcium, Fe.
P and vitamin A. The percentage of carbohydrate in *A. konjac* is almost similar to *A. paeoniifolius* and *A. discophorus*.

In general, the carbohydrate is divided into three main groups, i.e. monosaccharide, oligosaccharide and polysaccharide. Glucomannan belongs to polysaccharide group consisting of D-glucose and D-mannan units. Glucomannan has several physical astonishing characters; such as expand dramatically and rapidly in water (138 - 200%) as compared to starch (25%).

Most of the tuber of *Amorphophallus* species consists of carbohydrate equal to that in rice. The advantage of these *Amorphophallus* is they can be cultivated in between other timber plants. On the other hand, rice paddies are only cultivated by monoculture system. Moreover, the *Amorphophallus* species is extremely tolerant thus they could grow in high land or in low land; even in marginal land. This study shows that the six Javan *Amorphophallus* can be used as alternative food. The nutrient properties in all *Amorphophallus* are promising for food industry.

**CONCLUSION**

All of the *Amorphophallus* species used in this study are highly potential as alternative food. Nutritional content, i.e. fat, protein, amylose, amylopectin, glucomannan, Ca, Fe, P and Vitamin B1 of the six species of *Amorphophallus* are almost equal.

**References**


Hetterscheid, W.L.A. & S. Ittenbach. 1996. Everything you always wanted to know about *Amorphophallus*, but were afraid to stick your nose into!!!!. *Aroideana* 19: 7-131.


