What is kopi luwak? A literature review on production, quality and problems

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Abstract. Kopi luwak or civet coffee is known as one of the most popular coffee in the world. This coffee produced from the finest and ripest coffee berries that are eaten by luwak (Paradoxorus hermaphroditus), a cat like-animal. Kopi luwak is currently recognized as the most special and most expensive coffee in the world. Kopi luwak production is initially done naturally by collecting kopi luwak from nature. However, due to the limited number, farmer began to cultivate kopi luwak with captivity (caged kopi luwak). A number of problems arise in production, consumption and trade. Indonesia as the first country to produce kopi luwak certainly needs to pay special attention to the development of this coffee. Some research results show that wild kopi luwak and caged kopi luwak have different characteristics. Kopi luwak production with captivity needs to be well studied so that it can be accepted by the world market. Counterfeiting kopi luwak is still common. Standardization of kopi luwak quality needs to be developed, certification of kopi luwak as a quality guarantee will increase consumer confidence and maintain the continuity of this coffee.

1. Introduction
Coffee is one of the most consumed beverages in the world due to its flavor and stimulant properties [1, 2]. The aroma and flavor of coffee are directly related to the chemical composition of the green beans and typical coffee aromas are developed during the roasting process [3-5]. One of Indonesian coffee which is known in the world market and is a superior commodity is Civet coffee or Civet coffee. Luwak is an Indonesian term for ferrets (Paradoxorus hermaphroditus) [7,8].

Indonesia is the first country known as the country of origin of civet coffee. Civet coffee is coffee that has been eaten by civet, then passes through the digestive tract of civet (fermented) and released in the form of intact horn-skinned seeds along with civet droppings. Civet
chooses coffee fruit that is ripe as food, coffee beans that are protected by hard and undigested skin will come out with civet droppings [7-9].

According to coffee connoisseurs, civet coffee has a better taste than ordinary coffee. This is due to some features that are owned by civet coffee. The specialty obtained from civet coffee is because the coffee is low in caffeine, low acidity, low fat, low bitter, so this civet coffee is dubbed as the most delicious coffee in the world, even has broken the record recorded in the Guinness Book of Records as The 1st Excellent & Most Expensive Coffee in the World [10].

Indonesian civet coffee began to be internationally popular after the world-class presenter Oprah Winfrey in 2003 introduced and demonstrated how to brew Arabica Gayo civet coffee in the reality show The Oprah Winfrey Show which is very famous in the United States. Furthermore, Indonesian civet coffee products are increasingly known and sought after civet coffee became a favorite drink in the 2007 film Box Office The Bucket List, starring famous Hollywood actors Jack Nicholson and Morgan Freeman [11].

The natural fermentation process in the civet stomach changes the chemical composition of the coffee beans and can improve the quality of the taste of coffee because, in addition to being at the optimal fermentation temperature, it is also assisted with enzymes and bacteria present in the digestion of the civet. In the fermentation process, a chemical reaction occurs which is very useful in the formation of coffee bean flavor, namely the formation of flavor precursor compounds such as amino acids and reducing sugars [8,12, 13]. This allegation causes the aroma of civet coffee to be very special [13-15]. The specialty of the flavor and the uniqueness of the production process causes the civet coffee to be increasingly in demand among local and foreign coffee lovers. With its unique production, highly dependent on the biological system of civet, the presence of civet coffee is certainly very limited. This paper outlines the knowledge of the existence of civet coffee namely production, quality, and problems.

2. Civet Coffee Production
Based on the production process, civet coffee consists of natural civet coffee production or often called wild civet coffee and cultivation of civet coffee production (civet coffee cage/ caged). Civet coffee production was initially carried out naturally by collecting civet feces from coffee plantations adjacent to the forest. However, due to limited production, farmers began to cultivate Caged civet coffee. Physically the two types of civet coffee products have similar characteristics, but there are several sensory properties distinguish these two types of civet coffee [7,8,16].

a. Wild civet coffee production (natural)
This production occurs in nature, where is usually located in plantations close to the forest. This is possible because there are still large populations of civet in the forest area. Civet coffee is collected everyday by searching for places that are usually used by civet to remove dirt. Some places that are often used as weasel dumps are grass under coffee trees, on dry wood on dry branches, on hard rock or soil and even on the ceiling of a house. Coffee that has been collected then soaked and washed with running water until it is clean and dried in the sun to dry. Civet coffee which still has horn skin is then stored until waiting for the sale [9].
b. Cultivated civet coffee production (caged)

Producing civet coffee from civet captivity is another method used to obtain civet coffee. This method is used to overcome difficulties in obtaining and collecting wild civet coffee. In this type of production, civet healthiness and daily needs are put in the premium care. Civet must be caged alone. Placing them in one cage will be harmful since they are likely to be alone. The feed given to civet must also vary. In the cage in addition to providing fresh coffee as food, bananas, papayas, chicken, salted fish and rice are also fresh. This is done so that the civet is not bored so the must be changed every day. The amount of coffee that can be produced from a civet every day ranges from 300-400 grams of wet-skinned coffee or the equivalent of 200 grams of dry coffee. Civet coffee production can reach 0.12 kg/head per day during the harvest which will last for 120 days each year. Thus in one season, a civet can produce 14 kg of civet coffee. The post processing of caged civet coffee is then processed the same as wild civet coffee. Soaked and washed clean, dried in the sun to dry, then stripping the skin of the horn and sorting to get coffee beans with physical quality. Generally, the civet that is commonly cultivated to produce civet coffee, is kind of the civet moon and civet pandanus [7,10]

3. Characteristics of Civet coffee

Up to now, civet coffee quality does not have a specific standard. Scientific studies of civet coffee are still very limited recently, however physicochemical or sensory characteristics of civet coffee have been studied by several researchers both at local and international [16].

The physicochemical characteristics of civet coffee from Indonesia and Ethiopia have been analyzed. Civet coffee from Indonesia analyzed was Robusta Luwak coffee. Some parameters analyzed were the weight and color of the coffee bean, proximate analysis, some mineral elements and the enumeration of the number of microbes both in the form of green coffee and roasted coffee. The results indicate that civet coffee contains a lower total protein. This indicates that during digestion the protein is not only broken down / broken down but also comes out of the seeds. This is interesting because lower protein levels can reduce the level of bitterness of coffee. This is due to protein acts as a bitter taste precursor during roasting [8,12,15].

Characterization of civet coffee collected from nature and civet coffee bred from the types of Arabica and Robusta have also been carried out. The results showed that wild arabica civet coffee has a strong fragrance, aroma, flavor and aftertaste, moderate acidity, medium body and, good balance level. But sometimes it is accompanied by a strong earthy taste [9].

Civet coffee beans mixed with animal civet feces have a high-water content that is 38.89% so it still needs to be carried out the cleaning process and the perfect drying process. Standards on moisture content of unprocessed rice seeds range from 10-12%, while the water content of coffee beans is by following Indonesian National Standard No. 2907-2008 is 12.5%. The results of the analysis of protein, fat, ash and carbohydrates in fruit and coffee beans and civet coffee beans showed significantly different results. The results of the color analysis note that the brightness of fresh coffee has a higher value than civet coffee beans. The process in civet digestion causes a change in the color of coffee beans to be darker [16]. Furthermore, civet coffee has a better and more specific aroma than regular coffee. Volatile components and organic acid metabolite compounds contained by civet coffee can prove the authenticity of civet coffee [17-19].

The profile of wild arabica civet coffee and Caged origin from the Gayo Highland shows a difference in quality. Even though both of them have good taste scores, a Caged civet coffee
has an excessive aroma of papaya and guava. Both types of fruit are very often given by farmers to feed civet because is cheaper and hugely available. Interestingly this aroma appears in the flavor test [20]. In subsequent studies, analysis of six wild civet coffee samples from the Gayo highlands showed that nutty, fishy, chocolaty, herby, toasty and earthy were the dominant characteristics that were common. The resulting cupping scores ranged from 83.75 to 85.75 with an average of 84.58 and were categorized as special (very good) based on SCAA [21,22].

Caged arabica civet coffee has a better flavor and aroma than Caged robusta civet coffee. With its superior sensory property civet coffee commonly classifies as a specialty coffee, although some improper handling might cause the downward quality [9,23]. Caged civet coffee production might be a temporary solution to maintain the continuity of Indonesia's increasingly wild civet coffee. Besides that, it has added a line of Indonesian specialty coffee in the world market which certainly has a positive impact on increasing the competitiveness of Indonesian coffee products in the international market [11].

4. Civet coffee’s Problems
Civet coffee with unique flavors and very limited production would be a very exclusive product. The high price of civet coffee attracts naughty businessmen to fake it. At the local trade level, trust is the capital in buying and selling civet coffee. An effort is needed to guarantee the authenticity of civet coffee for example by implementing a quality assurance certificate [24,25]. Quality assurance aims to guarantee the fulfillment of product quality requirements such as safety, reliability, functional properties and so on. In this case, to fulfill the requirements for the authenticity of civet coffee, a deeper scientific study is required. Manufacturers who have obtained this certificate will be increasingly trusted and chosen because of their ability to assure the quality of their products [26].

Indonesian Ulema Council (MUI) has issued a fatwa that Luwak coffee is halal for consumption [27]. Halal civet coffee is consumed as long as the coffee is still wrapped in horn skin, washed thoroughly. However, civet coffee production that is uniquely obtained from civet droppings raises a variety of opinions in its consumption. Some consumers still feel disgusted to consume civet coffee because the seeds are mixed with civet droppings [21, 20]. For this reason, Luwak coffee production without involving animals needs to be considered.

Civet coffee production by cultivation is one of the efforts to increase Luwak coffee production. But these efforts also have weaknesses including expensive costs and its life-threatening the sustainability of civet. Civet breeding needs special attention both cage, food and animal health of civet. Luwak is not only eaten fresh coffee fruit, but also chicken as sources of protein. The sustainability of civet is also threatened because nowadays cultivated coffee farmers only think of producing civet coffee without caring for the cultivation of civet. Civet cultivation on a large scale has received sharp attention by the world community of animal lovers, namely PETA (People for ethical treatments of animals). Civet breeding to produce civet coffee is considered to reflect the heinous behavior of animals. International coverage of bad civet captivity has an impact on the decline in demand for civet coffee in the world [7,9, 16]. Caged civet coffee production requires the standard procedures as a quality guidance. This effort should be done in order civet coffee might be accepted in the world market. In the business of producing civet coffee cultivation there are several main things that must be considered, namely: (1) the availability of civet animals; (2) the availability of coffee fruits; (3) food availability and nutrient intake for animals; (4) the availability of healthy cages [7, 11].
The complexity of the civet coffee problem led to the intensive efforts of several researchers. They carried intensive study to possibly to produce this coffee without involving animals. Several researchers have reported that microorganisms, enzymes or a combination of both can be used to modify coffee flavor [28-32]. Luwak coffee fermentation may be replicated by copying the fermentation that occurs in the digestive tract of the civet. However scientific information about the biochemistry of the civet digestive tract is still very limited [7, 11, 33]. Exploration of microorganisms from civet origin both lactic acid bacteria and non-lactic acid bacteria are an effort to obtain superior microorganisms that can be used as a culture starter in the production of synthetic civet coffee. The production of probiotic civet coffee is one of the efforts to imitate the characteristics of the original civet coffee [34-36]

5. Conclusions

Luwak coffee production can be done naturally or in captivity. The characteristics of wild civet coffee are still better than caged civet coffee. But with the increasing difficulty of finding wild civet coffee, the production of caged civet coffee needs to be increased. The problems that hit the issue of the caged civet actually can be overcome by doing good cooperation with various parties. It is necessary to study good breeding methods (effectiveness and ethics of captivity, feed, etc.) so that civet can be treated well (humanely) and the resulting civet coffee has a quality that is not inferior to wild civet coffee.

Studies on the development of artificial civet coffee using microbes and enzymes that try to imitate fermentation in the digestive tract of civet need to be studied intensively. In-depth studies of fermentation conditions and the types of microorganisms that play a role are needed. Civet coffee production efforts taste close to or equivalent to civet coffee will increase the diversity of coffee flavor in the future that could be able to produce coffee with a better flavor than civet coffee.

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