Biochemical Attributes of Black Pepper Cultivar Panniyur-1

Sereen Thomas

Lecturer in Chemistry, All Saint's College, Trivandrum, India

Abstract

Various quality parameters such as oil, oleoresin, fractionation of oil and protein profile were evaluated in black pepper variety Panniyur-1. At near maturity stage in Panniyur - 1 volatile oil increased to two folds after drying and Oleoresin content increased to about 14.4%. The sun drying of berries reduced protein content to seven folds. At full maturity, oleoresin content got reduced marginally whereas the protein content increased to two folds. At near maturity stage in Panniyur-1, sabinene was found to be the highest while at full maturity stage, a three- fold increase in β-caryophyllene was observed in dried stage than that of fresh stage.

KEYWORDS: Black Pepper, Panniyur-1, High Yielding Cultivar

INTRODUCTION

Black pepper (*Piper nigrum* L.) (Family: Piperaceae) ''*King of spices'* is a perennial vine grown for its berries extensively used as spice and in medicine. India is one of the major producer, consumer and exporter of black pepper in the world. During 2012–13, 15363 tonnes of black pepper products worth Rs. 63,810 lakhs were exported to various countries. Black pepper is cultivated to a large extent in Kerala, Karnataka and Tamil Nadu and to a limited extent in Maharashtra, North eastern states and Andaman & Nicobar Islands (Anandaraj, 2014). Pepper is rated for its trenchant biting quality imputed to the alkaloid, piperine (C17H19NO3). Black pepper is used not only in human dietaries but also for an array of other purposes like medicinal, as a preservative, and in perfumery (Srinivasan, 2007). Panniyur-1, a high yielding cultivar is a hybrid between Uthirankotta and Cheriyakanikkadan.

Studies conducted so far have not elucidated the correct stage of maturity for harvesting black pepper in order to realize the maximum yield of quality parameters such as volatile oil and oleoresins. It was quite evident from literatures that tremendous variation existed among black pepper varieties as well as the stage of harvest in harnessing the maximum yield of oils and oleoresin. It therefore became a study of careful analysis to examine the correct and appropriate stage of black pepper harvest coinciding the highest yields of oils and oleoresin in the commonly cultivated cultivars. An intermediate step in lipid biosynthesis was also evaluated to understand its role in the contribution of oils and oleoresins. Fractionation of various oil components was also attempted in this study to elucidate the superiority of the Panniyur-1 and the stage of harvest in achieving the highest quality profile. Keeping this in view a study was conducted.

The major objective of the study is to fractionate the oil components of Panniyur 1 and also to evaluate the oil, oleoresin and protein profile of Panniyur 1.

MATERIALS AND METHODS

Panniyur-1 pepper berries were harvested at two stages of maturity *viz*, 30 days before maturity (near maturity) and at full maturity. For analysis, uniformly bold berries were collected cleaned, sun dried and stored in airtight containers as per the standard procedure. Various parameters like Volatile Oil, oleoresin, protein were estimated using standard methodologies. Further, fractionation of black pepper oil by gas chromatography was also carried out (Hewlett-Packard 5890.SII gas chromatogram equipped with electronic integrators).

Gas chromatographic analysis was carried out in a Hewlett-Packard 5890.SII gas chromatogram equipped with electronic integrators under the following conditions:

Column: DB-1, 30 M_X 0.25mm IDX0.25 µm film.
Carrier: Hydrogen flow 1ml/minute
Detector: F.I.D
Split ratio: 1:100
Detection gas flow: 250ml/minute
Auxiliary gas: 13ml/minute
Injection temp: 180^0C
Detector temp: 200^0 C
Over temperature Programming
Initial temperature: 80^0 C
Initial time: 3 minutes
Rate: 5^0/minute
Final temperature: 180^0 C
Final time: 10 minutes
Injection volume: 0.2 µlof black pepper volatile oil

RESULTS AND DISCUSSION

The volatile oil content in Panniyur 1 at fresh stage was found as 3.63 and 3.03%, respectively. After drying the volatile oil content rose to 6.27 in Panniyur 1. Oleoresin content at fresh stage was found to be 9.43% in Panniyur-1. However at dried stage, oleoresin content increased to about 14.4% in Panniyur-1. It is therefore suggested that oleoresin extraction in Panniyur-1 is best suited after drying the berries. Protein content was found to be 153.8 mg /g for Panniyur-1 at fresh stage. At dried stage, the protein content was reduced to 21.8 mg/g in Panniyur-1 and a seven-fold reduction was observed from that of fresh stage. In the process of sun drying most of the membrane bound proteins are degraded by rise in temperature as well as UV radiations.

Higher oleoresin content of Panniyur-1 at dried stage may possibly be due to higher protein content and higher reduction of protein content between fresh and dried stages. In the biosynthetic process glucose is the first molecule produced which gets converted to complex molecules of protein and oil as well.

The volatile oil content in Panniyur-1 was found as 3.33%. After drying the volatile oil content rose to 5.2% in Panniyur-1. Oleoresin content at fresh stage was found to be 15.19% in Panniyur-1. At dried stages, oleoresin content reduced to about 13.12% in Panniyur-1 It is therefore suggested that, oleoresin extraction in panniyur-1 is best suited immediately after harvest for higher oleoresin yield. Protein content was found to be 161.74mg/g for Panniyur-1. A two-fold increase in protein content was registered in Panniyur-1 at dried stages. It was found to be 373.3 mg/g in Panniyur-1. It was observed

that the yield of oleoresin and protein content are inversely proportional to each other; *i.e.*, as protein content increased, oleoresin yield was reduced drastically and *vice versa* at fresh and dried stages.

Chromatogram profile of oil as separated by gas chromatography pertaining to Panniyur 1 at two different stages of maturity are presented in figures. Six major components such as α-pinene, β-pinene, sabinene, β-caryophyllene, limonene and δ 3-carene were resolved in the chromatogram for black pepper oil (Tables 1 and 2).

It was clearly evident that the oil extracted after drying pepper yielded higher fractional constituents than the fresh counterparts. At both maturity stages in Panniyur 1 the fractional constituents exceeded 50%. Increase in fractional constituents of oil extracted after drying is mainly attributed to the higher oil content obtained after drying and release of some enzymatically bound oil components during the process of drying.

In Panniyur 1 all the six fractional constituents of oil separated, increased after drying except δ 3-carene. Sabinene was found to be the highest 20.4% and 22.7% for fresh and dried stages, respectively. This was closely followed by limonene and β-pinene. δ 3-carene was found to be the lowest (0.2%) at fresh stage and undetectable after drying. A four-fold increase in β-caryophyllene was observed in dried stage than that of fresh stage for Panniyur 1.

Variance in essential oil constituents in black pepper was accounted by various researchers which is attributed to the cultivar, agro climatic variation, variation in the maturity of raw material and oil extraction method adopted (Zachariah and Parthasarathy, 2008). A total of forty nine compounds were identified from the essential oil of Panniyur-1 from different locations across Western Ghats by GC MS analysis (Sruthi *et al*., 2013).

CONCLUSION

Various quality parameters such as oil, oleoresin, fractionation of oil and protein profile were elucidated in black pepper varietiY viz., Panniyur-1 at 20 days before maturity as well as at complete maturity stages. At near maturity stage, volatile oil content in fresh berries of Panniyur-1 was found as 3.63. Oleoresin content in fresh berries was found to be 9.43% in Panniyur-1. At near maturity stage, protein content in fresh berries of Panniyur-1 was found as 153.8 mg /g. Higher oil and oleoresin contents in dried stage may be attributed to the variation in the protein content and accumulation of oil from protein as reflected at the dried stage. Six major components such as α-pinene, β-pinene, sabinene, β-caryophyllene, and limonene and δ 3-carene were resolved in the chromatogram for black pepper oil. Black pepper oil extracted after drying yielded higher fractional components than those obtained from fresh berries. The fractional components exceeded 50% at both maturity stages in Panniyur-1.

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Table 1. Gas chromatographic separation of major fractional constituents of volatile oil of Panniyur-1 at near maturity stage

Fractional constituents (%)	Panniyur-1	
	Fresh	Dried
α-pinene	8.4065	9.8120
β-pinene	12.8675	16.799
sabinene	20.3930	22.6621
β-caryophyllene	0.7691	3.2206
Limonene	14.1275	16.9415
δ 3-carene	0.1661	Not detectable

Table 2. Gas chromatographic separation of major fractional constituents of volatile oil of Panniyur-1 at full maturity stage

Fractional constituents (%)	Panniyur-1	
	Fresh	Dried
α-pinene	5.5633	7.9240
β-pinene	11.2300	13.6127
sabinene	10.5512	19.1802
β-caryophyllene	Not detectable	3.2932
Limonene	4.8891	13.5499
δ 3-carene	Not detectable	0.3881