Plant Physiol & Biochem, New Delhi, Vol. **22** (2), 151-153, July, 1995

Essential Oil and its Major Constitutents in Selected Black Pepper Accessions

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Forty-two accessions of black pepper (*Piper nigrum*) germplasm were evaluated for its essential oil and chemical contituents. Good variability could be established in the accessions with respect to flavour and quality. Accessions rich in oil and constitutents like pinenes, sabinene, limonene, caryophyllene and myrcene could be identified.

Key words : Black pepper, *Piper nigrum,* carypophyllene, limonene, myrcene, pinenes, sabinene.

INTRODUCTION

Black pepper (*Piper nigrum,* L.) is known for its various applications in the field of industrialised cooking, canning etc. More than 69 varieties are known to be cultivated in India and these are distinguished by different names either given by planters or generally known by the names of the places of cultivation. Transportation of one variety or cultivar from one area to another caused a natural variation within the same genotype due to differential ecological situation. This has resulted in the same variety being known by different names in different places. Generally black pepper yields 2.6% volatile oil. The oil yield depends on the maturity at harvest. In laboratory where hydro-distillation is employed, the oil yield goes up from 2.5 to 7% depending on the variety and maturity. Pepper oil is a complex mixture of hydrocarbons, monoterpenes (70-80%) and sesquiterpenes (20-30%) (Lewis *et al.* 1969). Small amounts of oxygenated compounds are also present. Although the characteristic odour of pepper oil is due to these oxygenated compounds to some extent the mono- and sesquiterpenes appear to possess the main desirable attributes of pepper flavour. This is the major reason for the spicy flavour of freshly ground pepper.

Lawrence (1987) has described the general gas chromatographic pattern of black pepper essential oils. Sumathykutty *et al.* (1990) reported that among the different grades of *Piper nigrum,* caryophyllene was highest (33%) in the garbled light special grade of CV. Panniyur-1.

The major constituents of the oil are α and β-pinenes, sabinene, myrcene, limonene, β-caryophyllene and humulene. (Jennings *et al* 1968). These constituents impart specific flavour to the oil individually and collectively like turpentine, pleasant, lemony etc. (Zachariah and Gopalam 1987). As there are large number of accessions available in the pepper germplasm with distinct morphological and physical characteristics, an attempt is made here to examine the variability available with respect to oil and some of the chemical constituents in these accessions.

MATERIALS AND METHODS

Forty-two black pepper germplasm accessions maintained at the experimental farm of National Research Centre for Spices, Calicut, were used in the study. Matured spikes were harvested, despiked, cleaned and sundried to a moisture level of 10%. Essential oil was determined by the Cleavenger method of hyrdo distillation (lighter than water type) (ASTA 1968). The oil percentage was computed as volume by weight. Gas chromatographic evaluation of the oil was carried out in a 5730A Hewlett Packard GC equipped with HP 3390A integrator. The column used was carbowax 20M at an oven temperature of 70C to 210C @ 8C/min using nitrogen as carrier gas. The compounds were identified using authentic standards from Sigma Chemical Co. USA.

RESULTS AND DISCUSSION

The range of items present in black pepper are essential oil 2.3 to 4.4%, pinene 3.8 to 16.6% sabinene 2.2 to 33%, myrcene 1.6 to 31.8% limonene 3.6 to 21.2%, linalool 0.2 to

Table 1. Essential oil content and its major chemical constituents (% of essential oil) in black pepper accessions.

Accn. No.	Ess. oil (%)	Pinene	Sbinene	Myrene	Limonene	Lina lool	Caryophyllene
CLTP-41	3.0	13	13.3	8.5	11.5	0.3	12.6
12	3.2	12.6	16.2	12.2	15.3	1.1	21.7
09	2.5	9.0	30.7	10.8	14.8	0.6	11.8
122	2.6	8.8	24.3	-	18.5	0.6	36.7
2	2.4	14.1	25.8	2.7	20.7	0.2	20.8
185	3.4	5.9	17.2	16.6	19.2	1.1	18.8
221	2.9	6.3	20.1	15.4	16.8	0.4	27.8
202	2.6	4.7	9.7	31.8	20.1	0.7	20.0
208	2.6	4.3	10.0	25.0	19.2	0.5	25.7
44	2.6	5.6	16.3	18.3	15.5	1.1	26.3
65	2.6	7.4	19.6	14.0	18.7	-	25.4
184	2.4	5.9	16.6	18.5	18.2	-	23.6
186	3.3	3.8	6.5	27.1	20.9	0.3	27.8
99	3.3	16.6	30.6	12.0	16.5	0.9	13.8
74	2.3	10.4	18.8	16.6	17.5	0.3	21.5
105	2.4	5.9	19.2	12.6	17.2	0.2	29.0
80	2.7	11.8	11.4	22.7	20.8	0.2	26.0
96	2.6	8.6	29.8	2.4	14.0	0.2	33.0
17	3.1	6.7	23.7	3.1	13.2	-	34.3
95	4.2	4.2	15.2	0.4	12.1	-	35.3
43	4.4	4.2	15.1	9.7	12.0	1.7	32.3
221	3.3	4.2	14.6	9.7	10.6	0.5	34.7
7	3.6	5.1	19.7	3.6	10.0	0.3	41.2
232	3.4	6.1	22.8	4.5	15.7	1.3	31.0
226	3.1	7.3	25.5	6.7	17.0	0.5	33.8
26	2.4	12.0	8.8	4.5	14.8	0.2	38.8
24	3.8	4.9	17.0	12.3	15.0	1.5	27.0
218	2.4	4.5	14.6	14.6	14.9	0.6	32.5
58	3.4	6.2	20.1	11.2	10.4	0.2	34.6
30	4.0	10.0	33.0	2.7	14.0	0.5	19.0
10	3.4	10.5	2.2	23.3	3.6	1.0	16.3
4	3.0	5.9	19.7	7.7	9.1	0.6	34.2
23	3.7	8.3	25.9	9.1	11.3	1.4	28.8
224	2.9	7.7	20.4	2.9	7.7	0.9	34.3
123	3.2	7.3	27.0	2.6	10.5	0.3	41.8
132	3.0	12.3	31.4	3.9	13.1	0.7	21.0
108	2.8	4.4	11.1	15.7	11.2	1.5	37.8
107	3.4	5.1	17.7	9.6	11.6	1.8	31.6
182	3.6	7.0	27.6	2.9	10.8	0.3	28.8
236	3.3	7.3	13.3	8.2	7.2	0.5	33.5

1.8% and caryophyllene 11.8 to 41.8% in these accessions (Table 1). There are reports that cultivars with more pinenes have undesirable turpentine like odour and those which have high monoterpenes like limonene and sesquiterpenes like caryophyllene have pleasing odour, (Pangborn *et al.* 1970, Richard *et al.* 1971). The study establishes that there is wide variability avaiable in the germplasm. For instance CLTP-43.95 and 30 have high oil (above 4%), CLTP 7.95, 108, 122 and 123 have high caryophyllene (>35%) CLTP 2.89, 186, 201, and 210 have high limonene (>20%). Pinenes known to represent turpentine like odour, myrene-pleasant, limonene -lemony, caryophyllene -turpentine and phellandrene pepper like odur (Govindarajan 1982). As per this pattern CLTP-10 202, 208 and 210 which have more myrcene will have dominating pleasant odour. However, considering all the parameters CLTP-43, 95 and 7 are superior among all the accessions evaluated. The variability available in the germplasm can very well be exploited in the future breeding programme.

ACKNOWLEDGEMENT

The author wishes to expres his deep sense of gratitude to Dr. K.V. Peter, Director, National Research Centre for Spices, Calicut, for the facilities.

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