Chemical quality of the 'Agmark' grades of black pepper berries

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Abstract. Fifteen export grades (Agmark) of Indian black pepper have been studied for their chemical quality. The most popular grades MG I and II are quite rich in flavour components and medium in starch, whereas the heaviest and largest (TGEB) are rich in starch and medium in flavour components. The lightest (Pinheads) are rich in per cent piperine and poor in aroma and starch. Weight of berries does not appear to be directly related to flavour characteristics.

Introduction

India had been exporting black pepper since the Second and First Millennia BC. Even today, it maintains a major role as an exporter of spices. Black pepper accounts for more than 55 per cent of India's export trade in spices [1]. India exports 20 to 25 thousand tonnes of black pepper annually earning a foreign exchange of Rs 35 to 40 crores [7].

India was the first country to adopt quality control and preshipment inspection in black pepper at the export level [1]. In order to ensure that only good quality pepper is shipped, all exports are subjected to compulsory quality control and preshipment inspection.

There are more than 70 cultivated varieties of black pepper existing in India [8]. They differ in size and colour of berries, length and shape of spikes, yield, resistance to diseases, etc. Black pepper of commerce is a mixture of berries which vary in the above characteristics. In the international market, preferences differ from one consuming country to another. Considering the varying needs of buyers, grading of produce was enforced. For this purpose, standard grades are prescribed by the Government of India [10].

The Agmark grades of black pepper have been formulated on the basis of size, extraneous matter, pinhead and light berry contents and other physical characters. In grading, moisture content is also considered.

Indian black pepper, under the Agmark grading system, is classified into eight different schedules, consisting of fifteen specific grades and one non-specific grade. For the best grades of Indian black pepper, a very low limit of not more than 2–3 per cent of light berries are allowed. Moisture content is not allowed to exceed 11 to 12 per cent (a low moisture level prevents the formation of mould during transit).

Apart from the grade and cleanliness of spices, their flavour (aroma and pungency) is most important to the consumer. An attempt by Dwarkanath *et*

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al. [5] was made to study the chemical quality of some of the black pepper trade grades. However, it was not an extensive study. Hence, the objective of the present study was to screen all the approved trade grades (the standard Agmark Grades) for their chemical quality and also for a few of their major physical characteristics. An attempt has also been made to relate the general consumer preference of the popular grades to their chemical quality.

Material and methods

All the Agmark grades (given in Table 1), except the non-specified (NS grade X), were collected with the help of the respective marketing officers responsible for the Black Pepper Grading Schemes at Calicut and Cochin. The materials (packed in polyethylene bags) were brought to the Research Institute, milled to fine powders, stored in glass containers and studied for their chemical quality.

Moisture percentage was determined by the toluene distillation method [2], essential oil content was estimated by the steam distillation method using a modified Clevenger trap [3], oleoresin was estimated by the cold percolation of acetone method [9], piperine was estimated spectrophotometrically using carbon tetrachloide as the solvent [6]. Starch content was determined by direct acid hydrolysis [4].

Apart from these chemical characters, average diameters and weights per berry were measured and the average number of berries per gram determined.

Results

Results of the study are given in Tables 1 and 2.

Physical characters

Grades I, III, II, XII and XI were superior in their berry diameter. Grades XIV and XV were found to be smaller among these grades. Grade I was the heaviest (as expected) with XIV the lightest. The maximum number of berries per gm was observed in Grades XIV and XV. Grades V, VI and VII had intermediate values for the characteristics studied.

Chemical characters

It is quite interesting to notice that Grade I berries which are superior in their physical characteristics (a, b and c; Table 1) are not so chemically, except for % starch (i; Table 2) which although a desirable character for the powdered spice industry, is not a flavour characteristic. Grades V and VI berries, though medium in physical characteristics (a, b and c; Table 1), are quite superior in their flavour characteristics (e, f, g, h; Table 2). Their low starch content is a favourable characteristic as viewed by the flavour industry. The boldness and bulky nature of Grade I and II berries are mainly due to their high

Table 1. Average physical characteristics of berries from various AGMARK grades of black pepper

Grades	Average Diameter (cm) (a)	Average Weight (g) (b)	Average Number of berries/gm (c)
I TGSEB	0.50	0.0664	15.2
II TGEB	0.40	0.0496	20.0
III MUG-1	0.40	0.0368	34.2
IV MUG-II	0.37	0.0297	31.3
V MG-I	0.31	0.0348	29.4
VI MG-II	0.31	0.0364	29.0
VII TG	0.31	0.0440	28.3
VIII UGL (Spl)	0.38	0.0188	72.0
XI UGL-I	0.38	0.0180	57.5
X UGL-II	0.36	0.0188	95.7
XI GL-I	0.40	0.0204	57.0
XII GL-II	0.43	0.0176	65.4
XIII GL (Spl)	0.38	0.0212	66.8
XIV PH-I	0.18	0.0040	328.0
XV PH (Spl)	0.16	0.0204	362.0

Table 2. Average chemical characteristics of berries from the different AGMARK grades of black pepper

Grades	Moisture % (d)	Ess. oil % (e)	Oleoresin (acetone) % (f)	Piperine in oleoresin % (g)	Piperine in berries % (h)	Starch % (i)
I TGSEB	12.25	1.75	10.70	27.20	2.93	37.34
II TGEB	9.50	2.70	8.00	25.05	2.00	36.00
III MUG-I	14.25	2.75	11.00	34.77	3.81	28.52
IV MUG-II	13.75	2.75	11.20	25.22	2.25	25.26
V MG-I	12.25	3.50	14.90	34.34	5.00	24.52
VI MG-II	11.00	2.75	13.20	25.95	3.40	34.73
VII TG	11.75	2.67	13.40	39.15	5.25	29.22
VIII UGL (Spl)	13.00	2.05	11.00	31.89	3.37	21.12
IX UGL-I	13.25	2.12	13.20	26.98	3.56	20.31
X UGL-II	13.75	2.00	11.30	17.13	1.90	7.80
XI GL-I	13.25	1.62	9.10	28.90	2.75	7.46
XII GL-II	13.25	2.25	11.70	26.56	2.96	14.40
XIII GL (Spl)	12.75	2.25	11.80	23.84	2.81	9.67
XIV PH-I	11.25	1.00	2.52	59.32	1.50	3.65
XV PH (Spl)	12.00	0.65	2.32	86.69	2.00	3.00

starch content. A high level of essential oils (e, Table 2) makes them rich in aroma. Their superiority in pungency is shown by their high content of piperine (g, h, Table 2). These characteristics collectively make these grades the most popular ones. An additional advantage of these grades (I, II, IV V) is their level of light berries and extraneous matter. Another important grade is Grade VII. Though the berries in this grade are not very heavy, they rank among the first three of the heavier grades. They are above average in their physical characteristics and are very much superior in their flavour components, and have a reasonable starch content in relation to their bulk.

Though good in flavour components, the berries of Grades VIII, IX and X are high in moisture content which makes them susceptible to mould and other microbial problems. Black pepper with less than 11 per cent moisture can be stored without the growth of surface mould [11]. These Grades are also quite high in their levels of light berries and extraneous matter.

Grades XI, XII and XIII contain berries with an advantageously low starch content but they are poor in relation to their flavour characteristics. More hollow (light) berries are also present in these grades.

Grades XIV and XV berries are very low in starch content, and are quite rich in oleoresins piperine per cent, but are weak in their levels of aroma constituents. These grades are also very high in extraneous matter. The berries in these grades, however, would seem to be a quite promising source of piperine as compared to its cost.

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