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Research Article

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Phytochemical profiling, standardization and quality control of Indian red chilli

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ABSTRACT

Red chilli is a commercial crop which is used in a wide range of food products in India as well as across the world. The varieties of red chilli available in different geographical zones of India show remarkable variation in their pungency. There is absolutely no information available on its standardization and quality control which of course is essential for establishing authenticity, quality and efficacy of herbal products. In the present study an attempt has been made to standardize red chilli samples collected from different geographical locations. The method developed for standardization employed qualitative evaluation of physicochemical characters and HPTLC profiles.

Keywords: Red chilli, Geographical location, Standardization, Quality control, HPTLC profile

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INTRODUCTION

India is the largest producer, consumer and exporter of red chilli. The countries to which chilli is exported are Malaysia, Bangladesh, Sri Lanka, USA and UAE [1]. It is famous for its unique flavor. The flavor of chilli is because of seven closely related compounds of capsaicinoids – primarily capsaicin which are present in the placenta of the fruit. It is widely used in Indian, Cajun and Maxican cuisine. The usefulness of chili has also been described in spiritual and ethnobotanical practices [2-3]. In Ayurveda red pepper has been recommended for digestive problems[4]. There are reports showing chilli as an inhibitor of H. pylori [5]. Bactericidal property of capsaicin has been demonstrated to be more pronounced at lower pH [6]. Red chili because of its lachrymatory effect on eyes is used in pepper sprays for defense purposes [7].

Red chilli belongs to the genus capsicum which consists of 22 wild and five domesticated species. According to Spice Board of India there are eighteen different varieties of red chilli available in India. All these varieties are variation of five main species *C. annuum, C. chinense, C. pubescens*, *C. baccatum* and *C. fruitescens*. They all have peculiar shape, size, colour [8]. The variation in pungency often noticed in each variety is due to different concentration level of capsaicin and capsaicinoids. The production of capsaicinoids is inherited as a dominant trait and is controlled by Pun 1 locus [9]. However, the expression of capsaicinoids and other phytochemicals is also regulated by the maturity of the fruit [10-11], environment and genotype - environment interaction [12-14]. Any change in growth conditions such as alterations in soil pH, altitude, light and moisture may directly affect the levels of active constituent and group of active constituents [15-16]. This suggests that same plant growing in different geographical location will show variation in the expression of their phytochemical constituents. Red chilli pepper is a commercial crop which is used in various food items, food products, and ethnobotanical purposes. Therefore its

standardization and quality control is of utmost importance. Literature survey reveals that pharmacopeial standards for Indian red chili have not been developed so far. Keeping this in view efforts have been made through this study to standardize four different varieties of red chilli.

EXPERIMENTAL SECTION

Collection and authentication of raw materials

The samples for this study were collected from three different geographical locations namely - Bangalore, Chennai, Meerut and Chitrakoot.

Physico-chemical tests

Organoleptic characters and physico-chemical analysis of all the samples were studied. Quantitative analysis for loss on drying at 105^{o}C, alcohol soluble extractive, water soluble extractive, total ash, acid insoluble ash [17-18] was also carried out.

Preliminary phytochemical screening

Preliminary phytochemical evaluation was carried out by using standard procedure [19-21].

HPTLC profile

For HPTLC, 2gm of each sample was extracted with 25 ml of acetone on boiling water bath for 25 minute consecutively of 3 times using fresh portion of 25 ml acetone, filtrate and concentrated. TLC of extracts of all the samples was carried out on Silica Gel 60 F_{254} precoated plates (0.2 mm thickness; from Merck India Limited Mumbai). A TLC applicator from Camag Linomat-5 (Camag Switzerland 140443) was used for band application. For documentation of chromatographic fingerprints a photo documentation unit (Camag Reprostar-3: 140604) was used. The mobile phase selected for the study was Toluene: Ethyl acetate: Acetic acid (5:4.5.:0.5). The plate was developed over a distance of 9 cm in a saturated development chamber (Twin trough chamber (10 x 10 cm with SS lid), and visualized under visible light, 254nm and 366nm. The plates were also visualized after spraying with Anisaldehyde - sulphuric acid reagent followed by heating at 110^{0}C for 5-10 minutes [22-24].

RESULTS AND DISCUSSION

A coarse powder, red in color with odor *tikshan* and taste *tikht*. All the particles passed through 710 µm IS Sieve (old sieve number 22) and not more than 10 percent passed through 355 µm IS Sieve (old sieve number 22).

Physico-chemical parameters

Physico-chemical tests were carried out on all the samples and results have been given in Table -1.

Table 1: Physico-chemical contents of chilli samples

Name of samples	LOD (%)w/w	Total ash (%) w/w	AI ash (%) w/w	ASE (%) w/w	WSE (%) w/w
A-Sample	11.96	8.25	0.33	27.95	27.60
B-sample	12.47	13.89	0.66	16.50	28.27
C-Sample	11.65	13.42	0.60	27.50	22.80
D- Sample	11.14	8.57	0.33	29.31	27.35

Note- *LOD-Loss on drying, ASE- Alcohol soluble extractive, WSE -Water soluble extractive, AI -Acid insoluble*
Sample details - A-Bangalore market, B-Chennai market, C-Chitrakoot market, D- Meerut market

Preliminary phytochemical screening

The preliminary phytochemical test was performed on the extracts of chilli sample. They showed the presence of the alkaliod, flavonoid, saponin and carbohydrate (Table 2) in the sample.

Table 2 : Chemical constituents of chilli samples

S.N.	Parameters	Samples			
		A	B	C	D
1.	Alkaliod	+	+	+	+
2.	Flavonoid	+	+	+	+
3.	Resin	-	-	-	-
4.	Saponin	+	+	+	+
5.	Tannin	-	-	-	-
6.	Carbohydrate	+	+	+	+
7.	Proteins	-	-	-	-

Note: + Present, - Absent

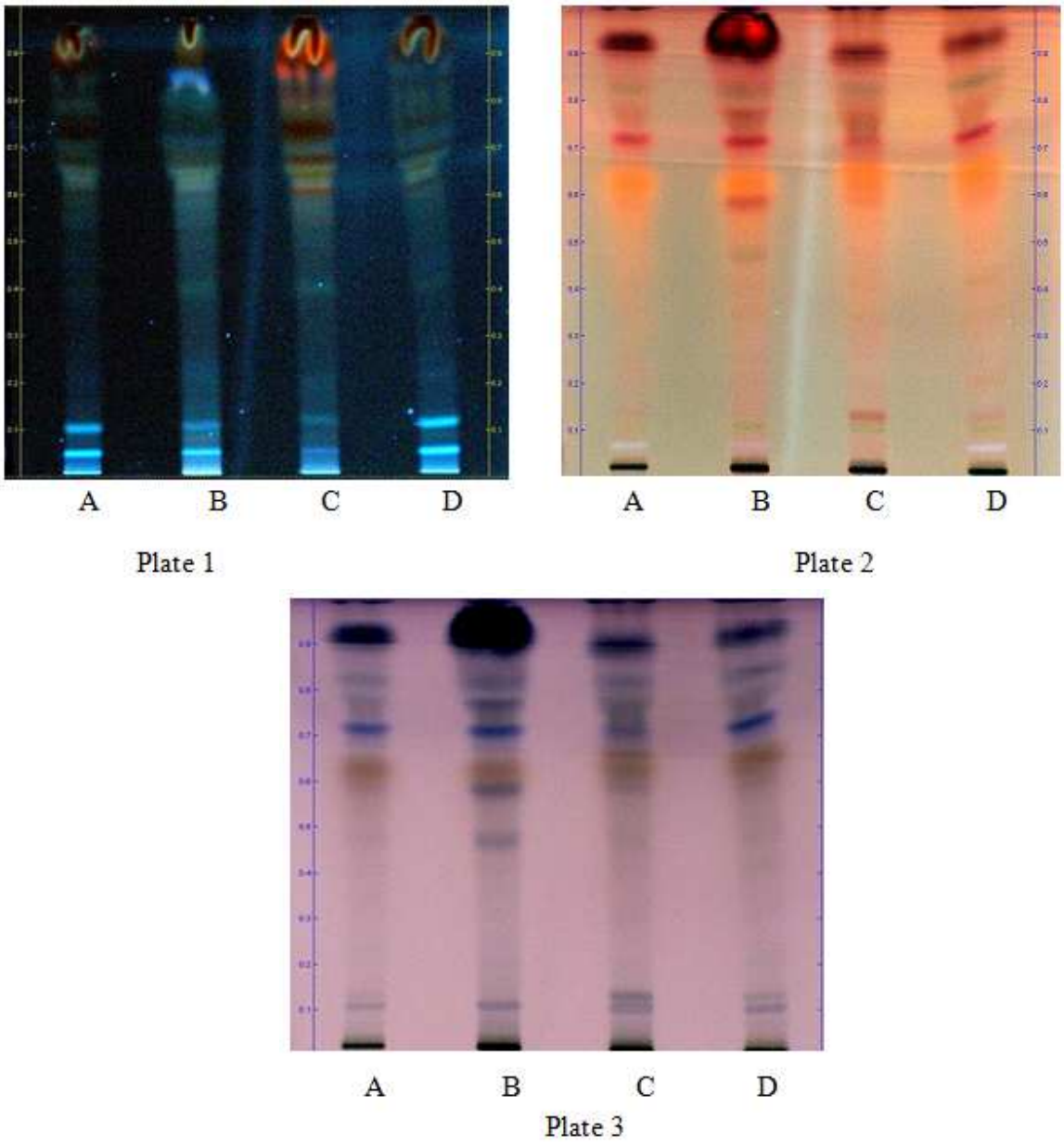

Plate 3

Plate 1- HPTLC fingerprints profile at 366nm (before derivatization)
Plate 2-HPTLC fingerprints profile at 366nm (after derivatization)
Plate 3- HPTLC fingerprints profile at visible light (after derivatization)
Track A: Bangalore market, Track B: Chennai market, Track C: Chitrakoot market, Track D: Meerut market

HPTLC finger print profile

HPTLC fingerprint profiles of the different samples of red chilli have been depicted in (Plate 1-3). Plate 1 reveals that TLC profiles of sample A, B, C, and D. The major bands observed in this case were at R_f 0.97 (all spots red), 0.94 (all spots yellow), 0.94 (all spots orange). In addition to this bands were also noticed at R_f 0.10 (all spots grey), 0.06 (all grey), However, sample A, C and D also showed some extra bands at R_f 0.59, 0.74 (both spots red), 0.87 (orange) but these bands were totally absent in sample B. The intensity of all the bands was more pronounced in sample C followed by sample B and then sample D.

The TLC plate was also examined under visible light, after derivatization and the results have been presented as Plate 2. The analysis of the results show that the band pattern observed for sample A, B, C and D showed major spots under visible light at R_f 0.92 (all dark blue), 0.82 (all spots grey), 0.72 (all spots blue), 0.62 (all spots brown). A dark grey band at R_f. 0.77 also appeared in sample B. Sample B in track 2 also showed additional bands at R_f. 0.57 (grey) and 0.44(grey). Also in the case of sample A, C and D a blue colour doublet was present between R_f 0.11-0.13 but sample B showed only a single band (blue) at R_f 0.10

The TLC profile developed for all the four samples at 366nm after derivatization (Plate 3**)** showed major bands at R_f 0.12 (green all), 0.64 (all orange), 0.82 (all green) 0.97 (all brown). In addition to this sample B also showed a very prominent band at R_f 0.47 (green), 0.58 (red). Interestingly, a band at R_f 0.77 was also noticed in sample B and C. A red colour band at R_f. 0.13 was seen in sample C and D. Also a white colour band was present at R_f 0.04 in all the samples but absent in sample C.

CONCLUSION

The pharmacognostical features of chilli studied in the present study have been utilized in developing standards of different varieties of chilli plant growing in different geographical locations. From the results presented above it is clear that all the four varieties exhibit variation in their band patterns which could be linked with their phytochemical constituents. This information will be useful in establishing its identity and authenticity of the plant material. It can also be utilized for monitoring the quality maintaining batch to batch consistency of the raw material and finished products.

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