

SPIKED ZINGER LILY (*HEDYCHIMUM SPICATUM*) : IDENTIFICATION OF SUPERIOR  
GENOTYPES FROM INDIAN HIMALAYAN REGION

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Spiked Zinger Lily, a perennial rhizomatous herb, belongs to family Zingiberaceae, commonly known as 'Kapur-kachari' widely available in moist, damp-shady evergreen forests and popular in traditional systems with several ethnobotanical notes. For identification of superior genotypes, a total of 34 accessions were collected from Indian Himalayan Region along with passport information. Rhizomes of all accessions were chopped, dried and subjected to Clevenger Hydro-distillation unit for essential oil extraction and observed 0.06-6.12% oil yield. In addition to this 1, 8 cineole (8.22-58.15%) was observed as a major constituent of the essential oils on Gas Chromatography (GC). Essential oil content and major chemical constituent 1, 8 cineole, both the parameters revealed an increasing trend along an altitudinal gradient of 1400-2875 m amsl.

**Keywords:** *Hedychium spicatum*, Indian Himalayan Region, Essential oil, 1, 8 cineole, Superior genotypes, Altitudinal gradient.

## Introduction

Spiked Zinger Lily (*Hedychium spicatum* Buch.-Ham. ex J.E. Smith) a genus of Zingiberaceae, found abundantly in the forest lands of Uttarakhand. It is a native herb of South-East Asian countries and known as 'Van-haldu', 'Siura', 'Bagaldu', 'Kachoor', 'Kapur-kachari', 'Kapur-kachali' and 'Gandh sathi' in local parlance. In Greek, *Hedychium* (*hedys*, sweet; *chion*, snow) refers to the fragrant white flowers. World-wide, it has 50 species reported from Madagascar, South-West China, Nepal and Indo-Malaysia, whereas, 35 species are available from the hills of Jammu and Kashmir, Himachal Pradesh, Arunachal Pradesh and Uttarakhand in India. It is widely available in moist, damp-shady and evergreen forests of oak-rhododendron and oak-deodar at an altitude of 1,000 to 3,000 m amsl (Gupta, 1968; Negi, 2001)

It is perennial rhizomatous herb; the rhizomes are bitter in taste and possess strong aromatic and camphor-like odour, therefore, widely used as an insect repellent and tobacco perfume (Anon., 1959; Gaur, 1999). It is popular in traditional systems with several ethnobotanical notes and called 'Kapura-Kachri' in folklore, Indian system of medicine (Ayurveda) and trade (Tewari *et al.*, 2008; Saraswathi *et al.*, 2009).

In addition, *Hedychium* species are being cultivated for their valuable essences (Negi, 2001; Negi *et al.*, 1998). The aerial stems constitute a useful raw material for manufacturing paper and some species are

known for their edible flowers (He, 2000). *Hedychium* is also a genus of horticultural importance; the inflorescence is aromatic and showy, resembling a cluster of butterflies consuming nectar (Gao *et al.*, 2008). In Ayurveda, *H. spicatum* has been advocated for the treatment of diarrhoea, piles, bronchial asthma, semen disorders (Sharma, 1996), skin diseases and stomach ailments (Chopra *et al.*, 1956). Initial biological screening of the 50 per cent ethanolic extract of the powdered rhizomes reported to have anti-inflammatory and central nervous system (CNS) depressant activity (Dhar *et al.*, 1973).

## Study area

A study was undertaken during September 2008 to December 2011 to explore and collect different genotypes of *Hedychium spicatum*. By and large 34 accessions of spiked zinger lily were collected from 11 districts of Uttarakhand (Central Himalayan Region), 4 districts of Himachal Pradesh (North-West Himalayan Region) and East Khasi Hills, Shillong (North-East Himalaya), from altitudinal range of 1400-2875 m amsl with passport information as per NBPGR Passport Data Format. The live planting material was introduced/acclimatized in field gene bank/herbal garden of NBPGR, Regional Station, Bhowali, at an altitude of 1600 m amsl.

## Material and Methods

The collected rhizomes from different geographical areas were washed properly, chopped,

Spiked Zinger Lily was found to contain 0.06-6.12% essential oil alongwith chemical constituent 1,8 cineole (8.22-58.15%) in Indian Himalayan region.

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oven dried at 40°C and subjected to Clevenger Hydro-distillation unit for essential oil extraction. The quantitative analysis of chemical compositions in the essential oil was carried out using a Perkin Elmer GC apparatus equipped with a flame ionization detector (FID) and factor four capillary column VF-5 (60 m x 0.32 mm i.d., film thickness 0.25 µm). Nitrogen was used as carrier gas at a flow rate of 1 ml/min a split ratio of 1:40, an injection size of 0.05 µL, heat and the injector and detector temperatures were maintained at 290°C and 300°C respectively. Component identifications were made by comparison of their retention indices with those of authentic compounds (standards). The relative amounts of individual components were calculated based on GC peak areas without applying any correction factors.

### Result and Discussion

Spiked zinger lily is a perennial, erect herb, 50-150 cm high. Flowers are fragrant, white with orange-yellow or red base in dense, terminal, 15-25 cm long spikes; capsules glandular, 3- valved with an orange-red lining; seeds black with red aril (Plate 1).

On Gas Chromatography (GC) of the essential oil samples for identification of major chemical constituents, the highest percentage was observed for 1, 8 Cineole or Eucalyptol (58.15%) in IC573208. The present result revealed that 1, 8 Cineole has increasing trend towards higher altitude (Fig. 1). On an Organoleptic test, the essential oils emerged with several colours (reddish-brown, yellow, pale yellow and colourless) and the intensity and darkness of colours decreased with the increasing altitude, while its camphoraceous odour of the essential oil increased towards higher altitudes (Plate 1).

1. Superior Genotypes for high essential oil content: The present specific genotype (IC 589086) was identified for high essential oil yield (6.12%) which is 35% greater or 1.5 times more to reported value. It was collected from district Rudraprayag, Central Himalayan region at an altitude of 1930 m amsl. Plant height 80-130 cm, dark green leaves, spike length 18-25 cm. Plant population of *Hedychium* was observed undergrowth of oak and rhododendron forest (Table 1). A remarkable variation in essential oil content ranged from 0.06 to 6.12 % and revealed the oil yield increases along an altitudinal gradient (Fig. 2) and IC589086 was found with the highest oil yield (6.12%) as compared to reported value of 4.0% on dry weight basis (Anon., 1959).

2. Superior Genotypes for high 1, 8 Cineole content: The present trait-specific genotype (IC 573208) was identified for high 1, 8 cineole content (58.15 %) which is

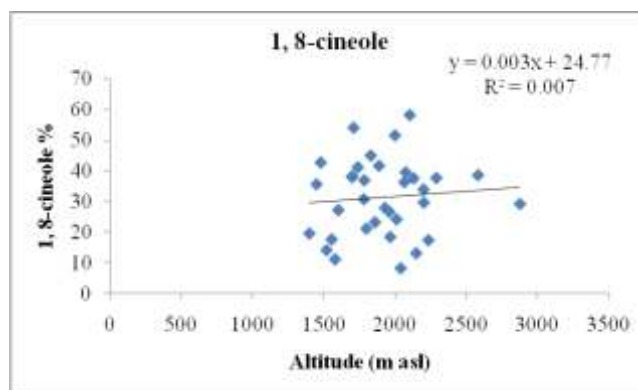


Fig. 1: 1, 8 Cineole content in the essential oil along an altitudinal gradient

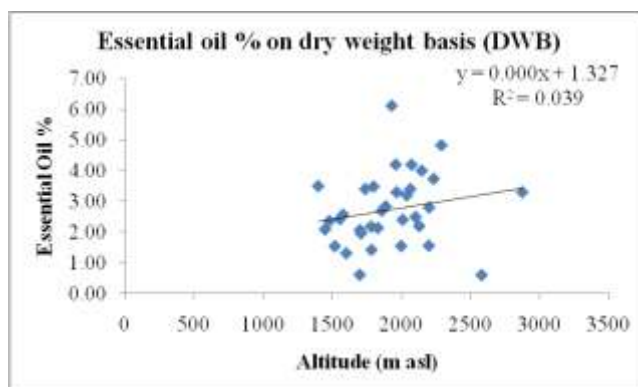


Fig. 2: Essential oil yield of *Hedychium spicatum* along an altitudinal gradient

27 % greater or 1.4 times more to local check. It was collected from district Nainital, Central Himalayan region at an altitude of 2100 m amsl. Plant population of *Hedychium* was observed undergrowth of oak mixed evergreen shady moist forest (Table 1).

The oil can be extracted from leaves, rhizomes and rootlets of its plants which is one of the finest essential oils that is used in aromatherapy. The oil has many medicinal efficacies, including cercaricidal properties, molluscicidal activity (Saleh *et al.*, 1982), potent inhibitory action, (Kumar *et al.*, 2000) antimicrobial (Medeiros *et al.*, 2003; Gopanraj *et al.*, 2005; Joy *et al.*, 2007), *In-vitro* pediculicidal (Jadhav *et al.*, 2007), anti-inflammatory and analgesic effects (Shrotriya *et al.*, 2007), mild tranquillizing, (Dixit and Verma, 1979) liver complains (Mathela *et al.*, 1980) and its chief constituent 1, 8-cineole is well-known for antimicrobial properties (Dixit *et al.*, 1977; Garg *et al.*, 1977; Nigam *et al.*, 1979; Bottini *et al.*, 1987; Sabulal *et al.*, 2007) Due to the presence of major aromatic constituent *i.e.*, 1, 8 Cineole, it is being used in perfumery, cosmetics, pharmaceuticals, food and flavour industry.

### Ethnobotanical notes

Flowering occurs during the month of July-August

Table 1 : Passport information including essential oil content, major chemical compound and oil colour of *Hedychium spicatum* germplasm collected/assembled from Himalayan region.

S. No.	Collector No.	IC Number	District	State	Altitude (m amsl)	Essential oil content on DWB* (%)	1, 8-cineole %	Oil colour
1	NMB-2886	IC566790	Pithoragarh	UK*	1740	3.40	41.15	Light yellow
2	NMB-2938	IC566842	Champawat	UK	1580	2.57	11.10	Light yellow
3	NMB-2939	IC566843	Champawat	UK	1800	3.48	21.14	Light yellow
4	NMB-2940	IC566844	Champawat	UK	1785	1.42	36.88	Light yellow
5	NMB-2941	IC566845	Champawat	UK	2130	2.20	37.53	Light yellow
6	NBH-01	IC574525	Chamoli	UK	2582	0.60	38.58	Light yellow
7	NBH-02	IC574524	Shimla	HP**	2200	1.56	33.90	Light yellow
8	NMVMKO-12	IC573211	Almora	UK	2000	1.55	51.53	Light yellow
9	NKO-37	IC573233	Kullu	HP	2066	3.40	36.27	Yellow
10	NKO-27	IC573226	Kangra	HP	1831	2.13	44.95	Light yellow
11	NKO-29	IC573228	Mandi	HP	1450	2.09	35.59	Light yellow
12	NMO-2971	IC582488	Tehri	UK	1400	3.50	19.54	Colour less
13	NMJO-2985	IC582502	Uttarkashi	UK	1860	2.70	23.19	Light yellow
14	NMJO-3000	IC582517	Uttarkashi	UK	2040	3.20	8.22	Light yellow
15	NMJO-3005	IC582522	Uttarkashi	UK	1960	4.20	26.60	Light yellow
16	NKO-59	IC574521	Shillong	MG***	1888	2.84	41.63	Light yellow
17	MMBO-3043	IC589078	Bageshwar	UK	2876	3.30	29.17	Light yellow
18	MMBO-3057	IC589081	Bageshwar	UK	1967	3.30	18.39	Yellow
19	NKO-67	IC589086	Rudraprayag	UK	1931	6.12	27.84	Light yellow
20	NKO-71	IC589089	Chamoli	UK	2075	4.19	39.48	Light yellow
21	NMJO-3090	IC589094	Tehri	UK	1520	1.54	14.11	Light yellow
22	NMJO-3105	IC589095	Dehra Dun	UK	1782	2.18	30.71	Light yellow
23	NKO-74	IC589097	Pauri	UK	2011	2.40	24.15	Light yellow
24	NKO-24	IC573223	Bageshwar	UK	1603	1.31	27.18	Light yellow
25	NKO-2965	IC573203	Nainital	UK	1480	2.36	42.67	Colour less
26	NKSK-01	IC573205	Nainital	UK	1702	2.06	38.27	Light yellow
27	NKSK-06	IC573207	Nainital	UK	2290	4.83	37.62	Colour less
28	NKSK-07	IC573208	Nainital	UK	2104	2.49	58.15	Light yellow
29	NKO-43	IC574506	Nainital	UK	1556	2.42	17.59	Yellow
30	NKO-46	IC574509	Nainital	UK	2202	2.80	29.60	Light yellow
31	NKO-53	IC574515	Nainital	UK	2234	3.73	17.37	Light yellow
32	NKO-55	IC574517	Champawat	UK	2149	4.00	13.12	Light yellow
33	NMB-2874	IC566778	Almora	UK	1700	0.61	37.89	Light yellow
34	NMB-2882	IC566786	Pithoragarh	UK	1710	1.96	54.00	Light yellow

\*Uttarakhand; \*\* Himachal Pradesh; \*\*\* Meghalaya and + Dry Weight Basis

(Rainy season) and seeds are harvested during September-October (Autumn). The forest department permits to extricate the rhizomes of spiked zinger lily after 3 to 5 years or sometimes after prolonged intervals of 5 to 7 years, to meet out industrial demands for preparations of renowned formulations *i.e.* Sudarshan churna, Chandra prabhavati, Satyadi Churna, etc. The rhizomes were chopped, dried and sold in the local market at about ` 80 per kg. Camphoraceous odour is characteristic feature of the chopped slices.

As per local folk sometimes boiled rhizome is consumed with salt during famine. The roasted rhizomes are powdered and taken for the treatment of asthma; seeds are given to women folk for abortion; Deoder dust with powdered rhizomes are given for the treatment of

tuberculosis and powdered dried rhizomes packed in muslin cloth used for safe keeping of woollen cloths. During religious ceremony, its fresh rhizomes mixed with Indian valerian for body lotion. Dried rhizome is one of the prime ingredients of incense fire (Hawan Samagri).

#### Conclusion

The present investigation may be utilized for commercial exploitation by the industrial people as well as plant breeders who may undertake crop improvement programme of *Hedychium spicatum*. The identified superior genotype for high content of essential oil and major chemical constituent *i.e.*, 1, 8 cineole can be selected and propagated for wide scale cultivation in the Himalayan region.



Natural population of *Hedychium spicatum*



Flowers of *Hedychium spicatum*



Rhizomes with rootlets



Chopped dried rhizomes



Clevenger hydro-distillation unit for extraction of essential oil



Essential oil samples showed more darkness and intensity of colour decreased with the increase altitude

Plate 1

#### Acknowledgements

Authors are thankful to the Director NBPGR (ICAR), Pusa Campus, New Delhi for necessary facilities and NAIP-IV for financial support.



**स्पाइक्ड जिंजर लिली: भारतीय हिमालय क्षेत्र से विशिष्ट जीनोटाइप्स की पहचान**

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**सारांश**

स्पाइक्ड जिंजर लिली, एक बहुवर्षीय प्रकंदीय शाक है जो जिंजरबिरेसी कुल के अन्तर्गत आता है, साधारणतया इसे कपूरकचरी के रूप में जाना जाता है, यह नमी युक्त, गहन-छाया युक्त सदाबहार वनों में प्रचुर मात्रा में पाया जाता है। अपने विभिन्न लोक-वानस्पतिक टिप्पणीयों के कारण पारम्परिक ज्ञान प्रणाली में लोकप्रिय है। विशिष्ट जीनोटाइप की पहचान हेतु भारतीय हिमालयी क्षेत्र से पासपोर्ट सूचना सहित इसके कुल 34 नमूने एकत्रित किये गये। सभी नमूनों के प्रकंदों को छोटे-छोटे टुकड़ों में काटकर, छायादार स्थानों में सुखाकर, क्लीवेंजर उपकरण द्वारा जल आसवन विधि से वाष्पशील तेल का निष्कर्षण किया गया और 0.06 से 6.12 प्रतिशत तक वाष्पशील तेल की मात्रा अंकित की गयी। इसी क्रम में जब आसवित वाष्पशील तेल का गैस क्रोमेटोग्राफी (जी0सी0) की सहायता से रासायनिक विश्लेषण किया गया तो 1-8 साइनिओल एक मुख्य रासायनिक घटक के रूप में दर्ज किया गया, जिसकी सीमा 8.22 प्रतिशत से 58.15 प्रतिशत तक पायी गयी। इसके साथ ही रासायनिक घटक 1-8 साइनिओल एवम तेल की उच्च प्रतिशत मात्रा, ऊर्चोई (समुद्रतल से 1400 से 2875 मी0) बढ़ने के साथ बढ़ते क्रम में पाया गया।

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