Aroma profile of seeds of *Carum carvi* Linn. cultivated in higher hills of Uttarakhand Himalaya

Garima Gwari, Ujjwal Bhandari, Harish Chandra Andola*, Hema Lohani and Nirpendra Chauhan

Centre for Aromatic Plants, Industrial Estate, Selaqui-248 197, Dehra Dun, Uttarakhand, India

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*Carum carvi* Linn. (Caraway) is an established promising source of essential oils. The variation in the oil content and essential oil composition of its cultivated crop in higher hills of Uttarakhand Himalaya was evaluated. Samples were collected from Mereng (Chamoli), Parsari (Chamoli), Kapkot (Bageshwar), Ganeshpur (Chamoli) and Chakrata (Dehra Dun) for quality evaluation. Oil content of seeds varies from 3.3-4.8 per cent. Quality was determined by GC and GC-MS and the results revealed that all the farmer’s field samples contained carvone as a major component and maximum percentage was found in the sample collected from Chakrata (Dehra Dun). The second major constituent was found to be DL-limonene which varies among the samples. Other useful components were also found in the essential oil of caraway like limonene oxide, trans-dihydro-carvone and β-myrcene. It is implicated that seeds of caraway can be taken from such areas for commercial utilization of essential oil.

**Keywords:** *Carum carvi*, Caraway, Aroma profile, Seeds, Uttarakhand Himalaya.

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**Introduction**

*Carum carvi* Linn. is commonly known as Caraway (Hindi-Shia-jira) which is grown for its high content of essential oil which is mainly found in seeds. It is a biennial plant which belongs to family Apiaceae and native to Asia, Europe and North Africa. Due to high content of essential oil, it attracted enormous attention of researchers worldwide to experimentally validate the therapeutic uses of caraway seeds, which are documented in several indigenous healing systems. Carvone and limonene, the essential components of caraway oils in addition to trace amount of other constituents. Caraway seed also contain lipid (13-21%), nitrogenous compounds (25-35%), fibre (13-19%) and water (9-13%). Its antibacterial and fungicidal properties are important in pharmaceutical applications and also in human and veterinary medicines. It is widely cultivated spice, found in wild throughout Russia, Siberia, Persia, Caucasus and Himalayas. The seed is also used in the treatment of bronchitis and are an ingredient of cough remedies especially useful for children and mothers for increasing breast milk. Considering the above facts *C. carvi* seed is a very economic resource for farmers of Uttarakhand region. Therefore, in continuation of quality assessment program, present study is designed to analyze the patterns of oil constituents present in cultivated produce.

**Materials and Methods**

**Collection of seeds**

Seeds of *C. carvi* were collected from Mereng (Chamoli), Parsari (Chamoli), Kapkot (Bageshwar), Ganeshpur (Chamoli) and Chakrata (Dehra Dun) and identified by taxonomist of Centre. Voucher specimen has been kept in the herbarium of Centre for Aromatic Plants, Selaqui, Dehra Dun. The samples of seeds were air dried at room temperature (25-30°C) for 15 days then subjected to hydrodistillation.

**Isolation of essential oils**

Seeds were subjected to hydrodistillation in a Clevenger apparatus for 6 h to extract oil; which was dried over anhydrous sodium sulphate and stored in a refrigerator till used for analysis. The essential oil content was determined as percentage on fresh weight basis as average of three independent extractions of each site to minimize error. The combined oil was used for further analysis.
Gas Chromatography

Analysis by GC was performed by using HP 6890 gas chromatograph equipped with a FID detector and a HP-S fused silica column (30 m × 32 mm × 0.2 µm film thickness). Nitrogen was used as a carrier gas during analysis. The injector and detector temperature were maintained at 210°C and 230°C, respectively. The column oven temperature was programmed from 60°C to 220°C with an increase in rate of 3°C/min.

Gas Chromatography-Mass Spectrometry

Analysis was carried out on a Perkin Elmer mass spectrometer (Model Claurus 500). Coupled to a Perkin Elmer Claurus 500 gas chromatograph with a 60 m × 0.32 mm × 0.2 5 µm film thickness column of RTX5. Helium was used as the carrier gas (flow rate 1ml/mm). The mass range was scanned from 40-600 Daltons. The oven temperature programme range was 60°C to 220°C with an increase in the rate of 3°C/mm. Other conditions were same as described under GC. The identity of the constituents of the oils was established on the basis of GC retention indices, by comparing their 70 eV mass spectra with those reported in literature and by computer matching with NIST & WILEY libraries. Where possible, co-injection was done with authentic standard compounds available in our laboratory.

Results and Discussion

Present study revealed oil constituents of C. carvi cultivated in five locality of Uttarakhand Himalaya (Table 1). Oil content of the species varies from 3.3-4.8%. Maximum oil yield was found in Ganeshpur district Chamoli followed by Mereng, Parsari, Chakrata and minimum in Kapkot, district Bageshwar. GC and GC-MS fingerprinting showed similar constituents in all nine samples. Carvone varied from 65.77-78.80% . The minimum percentage was seen in the sample from Kapkot, district Bageshwar and maximum was seen in the sample collected from Chakrata region. The second major constituent in this locality is DL-limonene which varies among the samples. It showed maximum i.e. 31.64% in sample collected from Kapkot, district Bageshwar and minimum i.e. 19.38% in sample collected from Chakrata. All the investigated samples constituted other minor constituents like β-myrcone, trans dihydro-carvone, limonene oxide which are present in very trace amount. Carvone which is a major constituent gets divided into carvone (47.0-62.0%), and limonene (34.0-50.0%)9,10. The herb oil of Caraway was found to consist of germacrene D (7.5%) with α-caryophyllene, α-elemene, humulene, germacrene A and B and two cadinene11. Reports from Bangladesh revealed that C. carvi seed oil contains thymol as major constituents including δ-terpinene, cymene and other minor components6. The essential oil from caraway seeds grown in China showed limonene (43.5%) as the major component followed by carvone (32.6%) and apiole (15.1%)12. Our study resemble with previously reported results from Uttarakhand Himalaya13. Carvone is an ingredient of a nontoxic botanical pesticide trade name TALENT14, DL-limonene is used as an active ingredient of commercially available flea shampoos, mosquito repellents and different agrochemicals14. In view of this, C. carvi components can be used in various industries. Considering the above facts, there can be amplest possibility to this seed oil. It is concluded that the variations in chemical constituents is not due to geographical divergence and biological conditions but it is due to different chemotypes.

Table 1—Chemical composition of Carum carvi Linn. seeds collected from Uttarakhand Himalayas

<table>
<thead>
<tr>
<th>S.N</th>
<th>Components</th>
<th>RI</th>
<th>R.T. (%)</th>
<th>Merang (Chamoli) (%)</th>
<th>Parshari (Chamoli) (%)</th>
<th>Ganeshpur (Chamoli) (%)</th>
<th>Chakrata (Dehra Dun) (%)</th>
<th>Kapkot (Bageshwar) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>β-mycene</td>
<td>985</td>
<td>11.56</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
<td>0.12</td>
<td>0.18</td>
</tr>
<tr>
<td>2</td>
<td>Limonene</td>
<td>1048</td>
<td>13.33</td>
<td>22.86</td>
<td>20.70</td>
<td>23.69</td>
<td>19.38</td>
<td>31.64</td>
</tr>
<tr>
<td>3</td>
<td>Limonene oxide</td>
<td>1159</td>
<td>17.98</td>
<td>0.08</td>
<td>0.06</td>
<td>0.06</td>
<td>0.07</td>
<td>0.10</td>
</tr>
<tr>
<td>4</td>
<td>Trans-dihydrocarvone</td>
<td>1182</td>
<td>20.59</td>
<td>0.12</td>
<td>0.52</td>
<td>0.15</td>
<td>0.36</td>
<td>0.33</td>
</tr>
<tr>
<td>5</td>
<td>Carvone</td>
<td>1218</td>
<td>23.24</td>
<td>71.80</td>
<td>76.66</td>
<td>74.59</td>
<td>78.80</td>
<td>65.77</td>
</tr>
<tr>
<td></td>
<td>Total (%)</td>
<td></td>
<td></td>
<td>98.09</td>
<td>98.09</td>
<td>98.64</td>
<td>98.73</td>
<td>98.02</td>
</tr>
<tr>
<td></td>
<td>Oil Yield (%)</td>
<td>3.6</td>
<td>4.6</td>
<td>4.8</td>
<td>4.1</td>
<td>3.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RI: Relative index to C5 – C32 n-Alkenes calculated on non polar Rt Capillary Column
Conclusion

The present study reflected that seed oil of *Carum carvi* can be tapped gainfully from Uttarakhand. This is the first report on essential oil compositions and percentage of various constituents of the oil from seeds collected from different regions of Uttarakhand which was not previously described from this region. Hopefully this study will help in encouraging cultivation of this crop, extraction of oil and promotion of business opportunities.

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