Vol 1, Issue 1, 2014

Case Study Article

A STUDY ON THE VOLATILE OIL AND PHENOLICS OF THE FRUITING SPIKES OF WILD PEPPER (PIPER PEEPULOIDES ROXB.)

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ABSTRACT

Wild Pepper *(Piper peepuloides* Roxb), is an evergreen climber which grows wild in tropical evergreen forests of North eastern India, the fruiting spikes of which are used as a substitute of long pepper. In the present work, the fruiting spikes of this plant are studied for the volatile oil constituents and phenolics. The volatile oil was rich in sesquiterpenes like farnesol, α-cubebene, caryophyllene etc. Other chemical constituents of the spikes are flavonoids (in traces), phenolic acids such as syringic and melilotic acids. Coumarins, proanthocyanidins, tannins and iridoids were found to be absent in the fruit. In chemical constituents Wild pepper is very similar to long pepper for which it is substituted.

Keywords: Wild Pepper, *Piper peepuloides,* Sesquiterpenes, Phenolics

INTRODUCTION

Piper peepuloides Roxb, commonly known as wild pepper, is an evergreen climber which grows wild in tropical evergreen forests of Goalpara, North Cachar Hills, and on southern slope of Meghalaya including part of Jaintia Hills, Khasi Hills, and West Khasi Hills districts. This plant grows luxuriantly in the areas with high rainfall at lower elevations ranging from 100 to 800 m above mean sea level. In Meghalaya, to meet the market demand, farmers have domesticated it in areca nut agro-forests and betel leaf agro-forests. In India, wild pepper is used in a variety of Ayurvedic medicines. Local people of Meghalaya uses powdered dry seeds mixed with honey and egg yolk for the treatment of severe cough. In spite of its high market demand, there is little information with respect to habit, economic aspects, conservation, and harvesting and processing.

Plant is a climber with glabrous stem. Leaves are elliptic-oblong 5-10 x 1.2-3.8 cm unequal, base obtuse or rounded with 5 prominent veins petioles sheathed at base. Spikes solitary, opposite to leaves: male spikes slender, bracts peltate, female spikes shortly cylindric, fruiting spikes cylindric, dense, 2.5 to 4.5 cm long, 2.5mm across, pungent. It is commented that in Indian market, the fruiting spikes of *Piper longum* are not available, and instead under the name of "Chotipeepal", spikes of *P.peepuloides* and under the name of " Bari peepal", spikes of *P. chaba* are supplied [1].

The previous chemical reports on this plant include alkamides pellitorine (2E, 4E) - isobutyldodecadienamide and piperine [2], piperamides such as 2' methoxy – 4' 5' – methylenedioxy – *cis* – cinnamoyl piperidine and 2' methoxy – 4' 5' – methylenedioxy – *trans* – piperidine and pyrrolidine and alkamides, 1 – 3 – (6 – methoxy – 1, 3 – benzodioxol 5 – yl) – 1 – oxo – 2 – propenyl – Z pyrrolidine and peepuloidin from leaves[3,4] and pyrrolidinamide dimers like cyclobutane – 2 – (1, 3 – benzodioxol – 5 – methoxy – 6 – yl) – 4 – (1 – 3 – benzodioxol – 6 – yl) – 1, 3 – dicarboxa pyrrolidide and cyclobutane – 2 – 4 – bis (1, 3 – benzodioxol – 5 – methoxy – 6 – yl) – 1, 3 – dicarboxapyrrolidide from stem[5]. Lignan (+) – diaeudesmin[6] (Parmar *et al*., 1998) was detected from the leaves and fruits, whereas sesamin[2] was found to be present in the fruits. Steroids from the leaves and fruits are daucosterol[7] (Banerji and Pal, 1982b), β-sitosterol and its glucoside[8]. The flavones, 5-hydroxy – 3' 4', 7 – trimethoxy flavone[9], 5 – hydroxy – 7 – methoxy flavone; 7, 4' – dimethoxy – 5 – hydroxy flavone, apigenin dimethyl ether, luteolin 3', 4', 7 – trimethyl ether[6] are identified from the fruits.

Since there is no study on the volatile oil constituents and phenolics, in the present work, the fruiting spikes of this plant is studied for these compounds.

MATERIAL AND METHODS

The fruiting spikes of *Piper peepuloides* were obtained from Indian Institute of Spices Research Centre, Calicut. The volatile oil was extracted by hydrodistillation in a Clevenger apparatus for 4-5 hrs. The volatile oil that condensed in the graduated arm of the apparatus was measured and collected. The percentage yield of the oil was calculated. The analysis of the oil was done using Shimadzu GCMS-5000 with CBPI capillary column and non-polar polydimethyl siloxane phase at Southern Petrochemical and Industrial Corporation (SPIC), Science Foundation, Chennai. The identification of the terpenoid constituents of the oil was done by matching the spectral data with three libraries, WILEY 139.LIB, NIST 62.LIB and NIST 12.LIB, present in the same instrument. Standard methods were followed for the analysis of flavonoids and phenolic acids and for testing the plant parts for other natural products[10,11].

RESULTS

The fruiting spikes yielded 0.25% a light yellow volatile oil with aromatic, pleasant, penetrating odour and pungent taste. The oil was rich in contained sesquiterpenes which amounted to 80.56% and monoterpenes were 19.44%. Though a large number of components were present only 12 compounds were identified with the help of three libraries, WILEY 139.LIB, NIST 62.LIB and NIST 12.LIB. They were farnesol (5.6%), α-cubebene (4.8%), β-caryophyllene (4.6%), bisabolene(4.0%), germacrene B(2.2%), α-terpineol(2.0%), ledol (1.9%), α-humulene (1.7%), farnesene (1.6%), β-gurjunene (1.6%), α-muurolene (1.2%) and (-)β-caryophyllene oxide (0.8%). Other chemical constituents of the spikes are flavones (in traces) and phenolic acids such as syringic and melilotic acids. Coumarins, proanthocyanidins, tannins and iridoids were found to be absent in the fruit.

DISCUSSION

The spikes of *P.peepuloides,* which is known as wild pepper and is being sold as "Chotipeepal", is very similar to long pepper to which it is substituted, in its chemical constituents. The volatile oil is rich in sesuiterpenes as in the case of long pepper and the constituents like β–caryophyllene, β – bisabolene, germacrene-D, *cis*-β-farnesene, α-cubebene, α-humulene, γ-muurolene, are the major compounds in both oils of *P.peepuloides* and *Piper longum.* In both oils, monoterpenoids occur as minor components. Other constituents of both these plants also are similar. Both contain flavones and same phenolic acids. A flavone apigenin is reported from *P.longum*[12] while methoxy derivatives of both apigenin and luteolin were reported from *P.peepuloides*[6]. Phenolic acids such as syringic and melilotic acids are present in both the plants. The absence of coumarins, simple phenols, tannins and iridoids is another common feature here. The presence of piperine and other alkaloids is another feature shared by both the spikes.

Among the volatile oil components identified in the present study, farnesol has been suggested to function as a chemopreventative and anti-tumor agent[13]. Caryophyllene is aldose- reductase-inhibitor, analgesic, antiinflammatory, antitumor and gastroprotective. All the flavonoids and phenolic acids are excellent antioxidants. The pharmacological properties of piperine and related alkaloids are very well-known to be discussed here. In addition, the property of piperine as a bioenhancer to other pharmacologically active compounds, is an added advantage of using this plant as a medicine or in place of long pepper.

Thus the present study proves that the spikes of wild pepper (*P.peepuloides*) is a viable substitute of long pepper and can be used likewise. Thus the actions of the state of Meghalaya in domesticating this spice in areca nut and betel leaf agro-forests to meet the market demand is highly commendable. It can be used in place of long pepper in all economic and medicinal preparations and this will ease the pressure on long pepper.

CONCLUSION

Since it is proved by the present study, the fruiting spikes of wild pepper (*P.peepuloides*) is a viable substitute of long pepper and can be used likewise.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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