

**Original Article****Distribution, ethno-botanical appraisal and floral trait variability of *Euphorbia wallichii* Hook. f.-An important medicinal plant of Kashmir Himalaya**Afrozah Hassan^{1*}, Irshad Ahmad Nawchoo¹, GG Mohi-Ud-Din², Shabana Gulzar¹

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Abstract

The present study was carried out on a medicinal herb *Euphorbia wallichii* Hook .f. (family Euphorbiaceae) growing in Kashmir Himalaya. The intensive survey and explorations reveal that the species is distributed in the mountain ranges restricted to alpine and sub-alpine habitats, preferring open sunny meadows and open sunny slopes, along and beyond the tree line, at an altitudinal gradient of 2800m to 3600m asl. As revealed by the present studies floral dimensions show abundant variability across different selected populations. The ethnobotanical appraisal indicated that the species is used for the treatment of skin allergies of cattle, paste of leaves is used for the treatment of leprosy.

Keywords: *Euphorbia wallichii*, floral dimensions, skin allergies, tree line.

Introduction

Euphorbia wallichii Hook .f. locally known as-Kaali Heerbi is a member of the family Euphorbiaceae distributed in the Himalayas, including Qinghai-Tibetan Plateau area of China, India, Nepal, and Kashmir [1]. It is a rare medicinal plant of Chakesar valley of Pakistan [2] *E. wallichii* is used as a Chinese folk medicine for the treatment of edema and skin diseases [3]. The dried root extracts of this plant possess anti-oxidant, anti-fungal and anti-bacterial activities [4]. Seeds of *Euphorbia wallichii* are used as a remedy for exanthema, asthma and anthrax (Haq *et al* [1]. The crude methanolic root extracts of *E.wallichii* possess cytotoxic and chemo preventive potential [1]. Dried leaves of the plant are given to children for bowel complaints and its juice is used against ringworm [5] The juice of plant is applied externally on warts to treat dermatological infection [6].Two novel

rearranged trachylobane diterpenoids designated as wallichanol A and wallichanol B and, a new ent-trachylobane diterpenoid - 3-oxo-ent trachyloban- 17-oic acid were isolated from the roots of *Euphorbia wallichii*. These compounds potentially block osteoclastogenesis *in vitro* suggesting that it has a potentially therapeutic application in prevention of osteoporosis [3]

Materials and Methods**Distribution**

An intensive exploration of Kashmir Himalaya was carried out to identify specific sites. The selected sites were surveyed and monitored in different seasons during the year 2014-2015.

Species morphology and floral traits

Morphological characters include plant height, rhizome length, and rhizome breadth, leaf dimensions, floral dimensions of the selected species were studied in natural populations. Both qualitative and quantitative parameters were studied on the basis of morphological features given by [7] Photographs were taken using Canon camera and Olympus zoom stereo microscope. Morphometric studies of flowers at full bloom was carried out using stereo- and dissecting microscope. Qualitative and quantitative characters of flowers which include, caythophyll length caythophyll breadth, number of rays, ray length, ray breadth, number of glands, gland length gland breadth, female flower length, female flower breadth, male flower length and male flower breadth were studied at different Kashmir Himalayan populations. 35 flowers were selected randomly from each study site in order to carry out the flower study in terms of both qualitative and quantitative traits. The arrangement of male and female flowers in a cyathia and also within a population were carried out with the help of the magnifying glass in the field. Photographs of floral parts were taken using stereo zoom microscope.

Ethnobotanical appraisal

In order to get valuable information on the ethno medicinal uses of the plant species structured interviews were conducted with elderly people, local practitioners, Bakerwals and gujjars residing in the area. Regular field trips were carried out in the selected sites in order to gather the undisclosed knowledge from them.

Results

Distribution

The intensive survey and explorations of Kashmir Himalaya reveal that the species is sporadically distributed in the mountain ranges restricted to alpine and sub-alpine habitats, preferring open sunny meadows and open sunny slopes. The major areas of its distribution are Yusmarg, Sinthantop, Doodpatri, Khillanmarg, Tangdar, Apherwat, Karna, Brinal and Hallan. It is distributed along and beyond the tree line, at an altitudinal gradient of 2800m to 3600m asl. It grows in diverse habitats, such as in Brinal and Hallan, it grows in sunny open slopes facing towards the sun. However in Khillanmarg it grows in rocky slopes and resides in shady slopes in Sinthantop.

Species morphology

Euphorbia wallichii is a perennial herb, 14-77 cm tall; having many stems arising from the base of a woody terete rhizomatous stock 5-18 cm long and 1.3-5.7cm broad;

Stems clustered glabrous, solid- attaining attractive dark pinkish colour upon maturity. Leaves alternate; sessile or subsessile; elliptic, lanceolate to ovate-lanceolate, attenuate at base, acute; subacute or obtuse at apex, with white-pinkish midrib prominent on both surfaces of the leaves; stipules absent; leaf blade elliptical. Dark pinkish leaves arise from the base of stem, positioned alternately and are narrow and short, while as upper dark green elliptical leaves are large and broad. Leaves on the stem are alternate except the top most whorl subtending the terminal inflorescence.

At the apex of the stem are present 5-9 Primary involucre leaves ovate-elliptic or oblong leaves with rounded or sub truncate base and obtuse to acute apex. These are pale yellowish in color having length of 1.9-6cm and breadth of 0.4-2.9 cm respectively. Secondary involucre leaves are 5-6 in number. In the axils of these leaves 6-8 rays arise which form a cup like structure of flowers at the top called as cyathia (terminal pseudumbel). Individual flower of cyathia is called as cyathium. Each cyathium consists of three petal like appendages called as caythophylls. All the three caythophylls overlap one another at the base. In the axil of these rays one hermaphrodite flower without caythophylls is present which anthesize prior to the lateral flowers. The number of rays is equal to the number of flowers. The rays are 1.1-3 cm long and 0.1-0.3 cm broad. The caythophylls are 1.1cm- 1.9 cm long and 0.2-1.4 cm broad. Each cyathium consists of a single middle female flower of 0.2-1cm long and 0.1-0.2 cm broad surrounded by two groups of 5-35 male flowers of 0.3-0.4cm long and 0.1-0.3 cm broad enclosed in a campanulate involucre. At the rim of the involucre 5-6 kidney shaped glands of 0.3-0.5 long and 0.1-0.2 cm broad are present. These glands are greenish and then attain yellow colour upon maturity. Male flowers show asynchrony in the development, some male flowers mature first and come out from the involucre when others are enclosed in an involucre. When the colour of the first anthesized group of male flowers becomes white, another group starts coming out from the involucre. Both male and female flowers consist of stalk. Pedicel of female flower (ovary) is long as compared to male flowers (stamens). Seeds grey or brown, angulate; striate, enclosed in 3 lobbed capsules with white caruncle. Stigma shows different movements during various developmental stages and style remains persistent up to the completion of the fruiting stage. Emergence of the ovary from the involucre marks the beginning of the female phase.

Coloration of the latex comes out from the plant is different in above ground and in below ground parts, rhizomatous portion possesses yellow latex while as above

ground portion possesses white latex, hence differentiation of latex is essential for taxonomic purpose and also helps in the differentiation of the species from other species of the same genus. At different selected sites of the Kashmir Himalaya the cyathophyll length varies from 1.27 ± 0.13 to 1.45 ± 0.42 . Cyathophyll breadth ranged from 0.15 ± 0.03 to 1.24 ± 0.50 . The number of glands turned out to be 4.5 ± 0.51 to 5.6 ± 0.51 . Gland length ranged from 0.242 ± 0.05 to 0.37 ± 0.05 . Gland breadth varies from

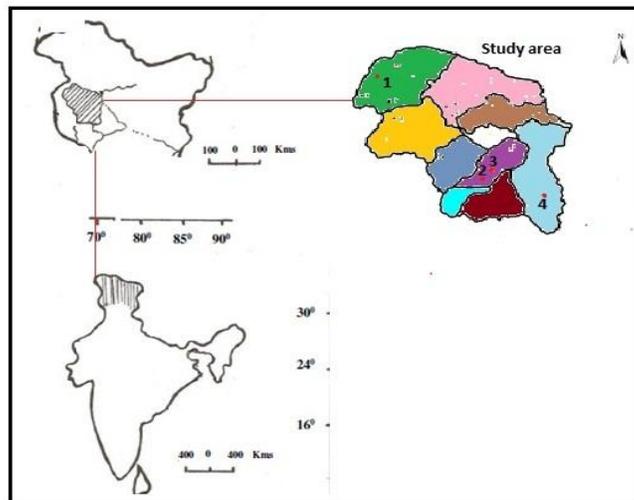
0.14 ± 0.050 to 18 ± 0.05 . Female flower length ranged from 0.48 ± 0.07 to 0.81 ± 0.11 . Female flower breadth ranged from 0.15 ± 0.07 to 0.25 ± 0.04 . Male flower length ranged from 0.23 ± 0.04 to 0.41 ± 0.07 . Male flower breadth ranged from 0.08 ± 0.05 to 0.15 ± 0.05 .

Ethno botanical appraisal

Economically important parts of the plant species are underground rhizomatous portion, leaves and seeds. Tribals in the Kashmir valley use the species for the treatment of skin allergies of cattle which lead to loss of wool over their bodies. As there is differentiation of latex in the above ground as well as the below ground portion of the species. White latex oozed from the leaves used for the treatment of external skin warts and the yellow latex of the rhizomatous portion is rubbed over the iron for prevention of the rusting and cleansing of the steel utensils by local tribals of Kashmir (Bakarwals). In the month of the September some caterpillars sit over the leaves for 10-15 minutes, the tribals collect only those leaves and then grind them to form a paste and use this paste for the treatment of leprosy.

Table 1: Salient features of the Kashmir Himalayan sites selected for the present study

| Study sites | District | Altitude (m-asl) | Latitude and Longitude | Climatic zone | Habitat |
|-------------|----------|------------------|------------------------|---------------|-------------------|
| Hallan | Kulgam | 2800m | 33° 38' N 75° 1' E | Subalpine | Sunny open slopes |
| Brinal | Kulgam | 3080m | 33° 38' N 75° 1' E | Alpine | Sunny open slopes |
| Khillanmarg | Kulgam | 3125m | 34° N 74° 23' E | Alpine | Rocky slopes |
| Sinthantop | Anantnag | 3600m | 33° 34' N 75° 30' E | Alpine | Shady slopes |



1=Khillanmarg 2=Brinal 3=Hallan 4=Sinthantop

Figure 1: Distribution of *Euphorbia wallichii* in Kashmir Himalaya

Table 1: Quantitative floral traits of *Euphorbia wallichii* at different study sites

| Floral character | Populations | | | |
|----------------------------------|---------------|---------------|--------------------|--------------------|
| | Hallan(2800m) | Brinal(3080m) | Khillanmarg(3125m) | Sinthontop (3600m) |
| | n*=20 | n=20 | n=20 | n=20 |
| Cyathophyll length(cm) | 1.45±0.42 | 1.35±0.20 | 1.42±0.09 | 1.27±0.13 |
| Cyathophyll breadth(cm) | 1.24±0.50 | 0.94±0.36 | 1.20±0.05 | 0.15±0.03 |
| Number of glands | 4.5±0.51 | 4.5±0.52 | 5.6±0.51 | 4.8±0.63 |
| Gland length(cm) | 0.24±0.05 | 0.37±0.05 | 0.34±0.05 | 0.28±0.10 |
| Gland breadth(cm) | 0.16±0.01 | 0.18±0.05 | 0.14±0.05 | 0.15±0.04 |
| Female flower(ovary) length(cm) | 0.72±0.14 | 0.59±0.24 | 0.81± 0.11 | 0.48±0.07 |
| Female flower(ovary) breadth(cm) | 0.25±0.04 | 0.24±0.09 | 0.16±0.05 | 0.15±0.07 |
| Male flower(stamen) length(cm) | 0.36±0.07 | 0.32±0.07 | 0.41±0.07 | 0.23±0.04 |
| Male flower (stamen) breadth(cm) | 0.2±0.04 | 0.1±0.05 | 0.15±0.05 | 0.08±0.05 |

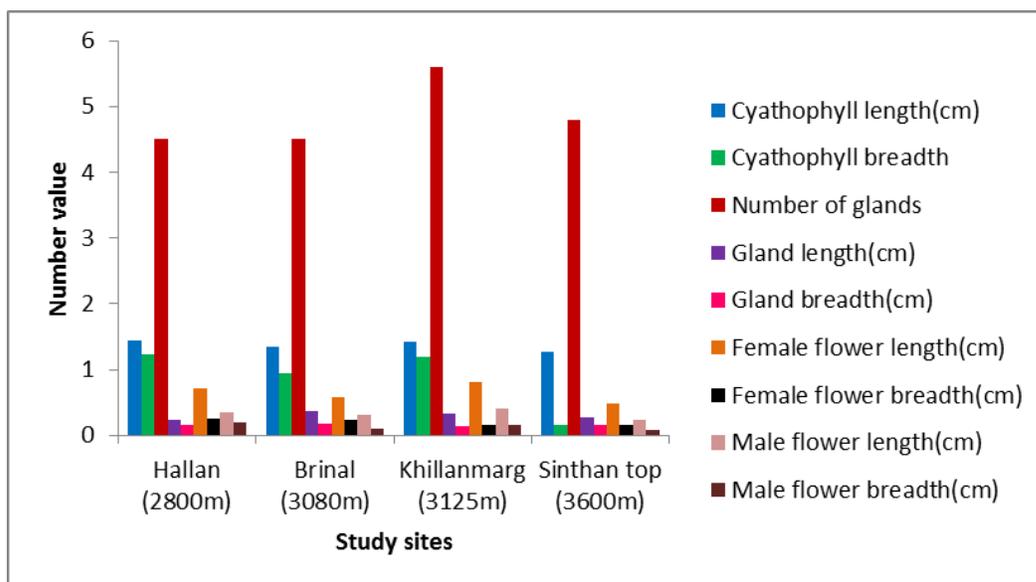


Figure 2: Floral traits of *Euphorbia wallichii*

Figure 3: *Euphorbia wallichii* in peak flowering season

Discussion

Present studies reveal that *Euphorbia wallichii* Hook.f-a perennial herb is distributed in the sub alpine- alpine mountain slopes of the Kashmir valley. It is distributed along and beyond the tree line, at an altitudinal gradient of 2800m to 3600m asl. It grows in diverse habitats, such as in Brinal and Hallan, it grows in sunny open slopes facing towards the sun. However in Khillanmarg it grows in rocky slopes. At Sinthontop it grows in shady alpine slopes. The family Euphorbiaceae occurs in widely varied habitats from arid regions to wet humid topics [8]. In Kashmir Himalaya the areas where the species is distributed include Yusmarg, Doodpatri, Tangdar, Karna, Khillanmarg, Brinal, Hallan and Sinthantop. Annual plants

decline with increase in altitudinal gradients and high number of long living clonal species that rely on clonal reproduction for population dynamics persist for longer duration [9]. *Euphorbia wallichii* - a perennial herb of 14-77 cm tall is having many stems arising from the base of a woody rhizomatous stock which is 5-18 cm long and 1.3-5.7cm broad. Leaves are alternate. Basal leaves are narrow and short while as upper elliptical leaves large are broad. At the top of the stem whorl of 5-9 primary involucre and 5-6 secondary involucre leaves are present which pale yellowish in color. In the axils of these leaves 6-8 rays arise which form a cup like structure of flowers at the top called as cyathium (terminal pseudumbel) which consists of a single female flowers surrounded by two groups of male flowers enclosed in an campanulate involucre. At the rim of involucre 5-6 kidney shaped glands of 0.3-0.5 long and 0.1-0.2 cm broad are present. These glands are greenish in color and then attain yellow color upon maturity. The flowers in *Euphorbia* are unique in being unisexual and aggregated into a specialized inflorescence called cyathium; the latter shows a vast range of variations useful for taxonomic delimitation [10]. One to five nectar glands, sometimes with petal-like appendages, are associated with the cuplike axis of each cyathium. In spite of its great vegetative diversity of the Euphorbiaceae including many xerophytic species whole genus is morphologically integrated by the possession of cyathium- a highly reduced inflorescence that resembles a single flower[11].

References

- [1] Haq N, Ullah G, Bibi S, Kanwal M, Ahmad S and Mirza B., "Antioxidant and Cytotoxic Activities and Phytochemical Analysis of *Euphorbia wallichii* Root Extract and its Fractions". Iran. J. Pharm. Res., 11: 241-249, 2012.
- [2] Shah M and Hussain F., "Conservation assessment of plant resources of chakesar valley, district Shangla, KPK, Pakistan". Pak J. Botany, 44: 179-186, 2012.
- [3] Pan L, Zhou P, Zhang X, Peng S, Ding L and Qiu SX., "Skeleton-Rearranged Pentacyclic Diterpenoids Possessing a Cyclobutane Ring from *Euphorbia wallichii*". Org Lett., 8: 2775-2778, 2006.
- [4] Ali MS, Ahmed S and Saleem M., "Spirowallichione: A rearranged multiflorane from *Euphorbia wallichii* Hook F". (Euphorbiaceae). Molecules, 13 : 405-411, 2008.
- [5] Akhtar N, Rashid A, Murad W and Bergmeier E., "Diversity and use of ethno-medicinal plants in the region of Swat, North Pakistan". J. Ethnobiol. Ethnomed., 9: 1, 2013.
- [6] Farooq U, Abaas G, Saggoo MIS and Dar MA., "Ethno botany of some selected Monochlamydeae plant species from the Kashmir Himalaya" India J. Med. Plants Res., 8: 834-839, 2014.
- [7] Kaufman PB, Carlson TF, Dayanandan P, Evas ML, Fisher JB, Parks C and Wells JR., "Plants their Biology and Importance", Hoppe and raw Publishers, New York, 714-730, 1989.

- [8] Balakrishnan NP and Chakrabarty T., "The family Euphorbiaceae in India: a synopsis of its profile, taxonomy and bibliography", *Dehra Dun: Bishen Singh Mahendra Pal Singh xx, 500p.ISBN 812110579X En Many new taxa. Geog. 6. 2007.*
- [9] Klimes L, Klimesova J, Hendriks R, and Van Groenendael J., "Clonal plant architecture a comparative analysis of form and function", in: eds de kroon, H and Van Groenendael, J., the ecology and evolution of clonal plants PP.1-29. Backhuys Publishers, Leiden, 1997.
- [10] Pritchard A., Introduction to the Euphorbiaceae. Venegone, Italy: Cactus and Co. 63p.-col. illus. ISBN, 300116548, 2003.
- [11] Steinmann V and Porter J., "Phylogenetic Relationships in Euphorbiaceae (Euphorbiaceae). Based on ITS and ndhf Sequence Data", *Ann. Missouri Botanical Garden, 89: 453-490, 2002.*

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