Unveiling the importance and consequences on the use of morphologically allied medicinal plants bearing ethnohomonyms: a case study with two ethnomedicinal orchids from West Bengal, India

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Research

Abstract

Background: The same common names are attached to different medicinal plant species, and morphological similarities in their parts used as crude drugs often lead to the substitution of herbal drugs and misidentification of the species. The present study documented a hitherto unreported ethnobotanical perspective based on the ethnohomonyms and similarities in morphology of pseudobulbs and habits in vegetative state of the two ground orchids *Eulophia explanata* Lindl. and *E. diffusiflora* M.W.Chase, Kumar & Schuit. from West Bengal, India, interpret the possible causes of their misidentification during collection from natural habitats.

Methods: Following standard methods, 35 Santal tribal key medicine men were identified in the districts Birbhum, West Barddhaman and Bankura, West Bengal who are well known to both the orchids. Visual stimuli and *in-loco* identification techniques have been employed to note down the local names, morphology and ethnomedicinal uses of the two plants.

Results: Etymology of folk nomenclature of the homonyms attached to these two orchids was explained along with their diverse folk medicinal uses which reveal the needs for phytochemical explorations and pharmacological validity. The crucial morphological characters of these orchid species along with photographs have provided for a better understanding elaborated in this topic.

Conclusions: Documenting ethno-taxonomical names by cross-cultural examination with different communities will be helpful for the proper identification of the plants using different modern scientific tools and to safeguard the related local herbal knowledge.

Keywords: Tribal Homonyms, Morphology, Allied Taxa, Pseudobulbs, Ethnomedicine

Background

Folk nomenclature of biological organisms including plants helps us to understand how communities identify and use the surrounding resources based on their traditional believes. Local communities use specific, often metanymical and metaphorical names for plants which are culturally very significant since such plants are known, accessible for collection and medicinally potent (Franco *et al*. 2022). In Ethnobiology, when vernacular homonyms are used to denote biological organisms well-known to an ethnic culture, known as ethnohomonyms (Cavalcanti and Albuquerque, 2013). Such folk nomenclature has a great importance in understanding the doctrine Traditional Knowledge on the use of plants referred by an ethnic community (Hidayati *et al*. 2022). Beside the use for the identification of specific taxon in the forest locality, ethnohomonyms are equally useful to acquire knowledge on easy know-how on the concerned ethnomedicine. Several ethnobotanical studies have already been addressed the importance of local names in different perspectives, like cultural importance, structural aspects and their specific uses (Singh, 2008; Mondal and Rahaman, 2012; Hidayati *et al.* 2018; Patil, 2020; Hidayati *et al*. 2022; Ahamidé *et al*. 2023). But, very often the use of identical local or folk names, i.e., Ethnohomonyms of different plants make a great confusion to distinguish such taxa, particularly in their natural habitat. Such ambiguity is existing among the people belonging to tribal or traditional communities as, morphological alike taxa, irrespective of their taxonomic distinctiveness, sometimes, could have been treated as one taxon or one common herbal resource by the folk knowledge holders.

The present ethnobotanical study explored and elucidated the ethnohomonyms and morphological alikeness in pseudobulbs and in vegetative habits of the two orchid species *Eulophia explanata* Lindl. and *E. diffusiflora* M.W.Chase, Kumar & Schuit. from West Bengal, with a highlight on possibility of their misidentification. These two species of the genus *Eulophia* are traditionally used by the Santal tribal people of Birbhum, Bankura and West Barddhaman districts of West Bengal in curing different health disorders of humans and veterinary animals. Depending on the availability local folk people use anyone of the two species for preparation of ethnomedicinal formulations. The present study further illustrates the consequences of homonyms and morphological closeness of these two ethno-species of orchids, including their future bioprospecting attributes, and conservation aspects.

Materials and Methods

Study area

During repeated ethnobotanical field explorations from 2015 to 2022 in some tribal-dominated forests pockets and adjoining areas of Birbhum, West Bardhhaman and Bankura districts of West Bengal state (Fig. 1) we came across two rare species of ground orchids. After their close morpho-taxonomic examination and relevant literature consultations (Rahaman *et al.* 2015; Mondal *et al*. 2023) we could confirm the two species reported as *Eulophia explanata* Lindl. and *Eulophia diffusiflora* M.W.Chase, Kumar & Schuit.

Data Analysis

For data collection, Santal tribal people of different villages adjoining to the forest areas of the districts Birbhum, West Barddhaman and Bankura were interrogated. We applied purposive sampling technique (Tongco, 2007) and identified 35 tribal key-medicine men who know *very well* both the orchids *Eulophia explanata* and *E.diffusiflora*. Visual stimuli (showing photographs of the two orchid species including the pseudobulbs) (Madeiros *et al.* 2014) and *in-loco* identification techniques (Albuquerque *et al.* 2014) have been employed during interrogation of each of the traditional healer of the three districts surveyed to note down the local names, morphological characteristics of both pseudobulbs and whole plant, and ethnomedicinal uses of *E. explanata* and *E. diffusiflora*. Cross-checking of the collected information regarding the uses, local names, and morphology of species has been done during repeated field visits and consultations with the tribal people of the districts. Free Prior Informed Consent has been taken from the participants involved in the interview. Socio demographic profile of the tribal medicine men is given in the Table 1. The collected plants have been studied for their morphological features and distinguishable characters noted following standard literature (Rahaman *et al*. 2015; Misra, 2019; Singh *et al.* 2019; Mondal *et al*. 2023; Agrawala *et al*. 2023). Herbarium specimens of the two species have been deposited in the Herbarium section for the Ethnomedicinal Plants in the Department of Botany, M.U.C. Women's College, West Barddhaman, West Bengal, India (vide Herbarium Field Collection No. – 533) and to the Herbarium of Botany Department, Bankura Sammilani College, Bankura (vide Herbarium Field Collection No. – 721).

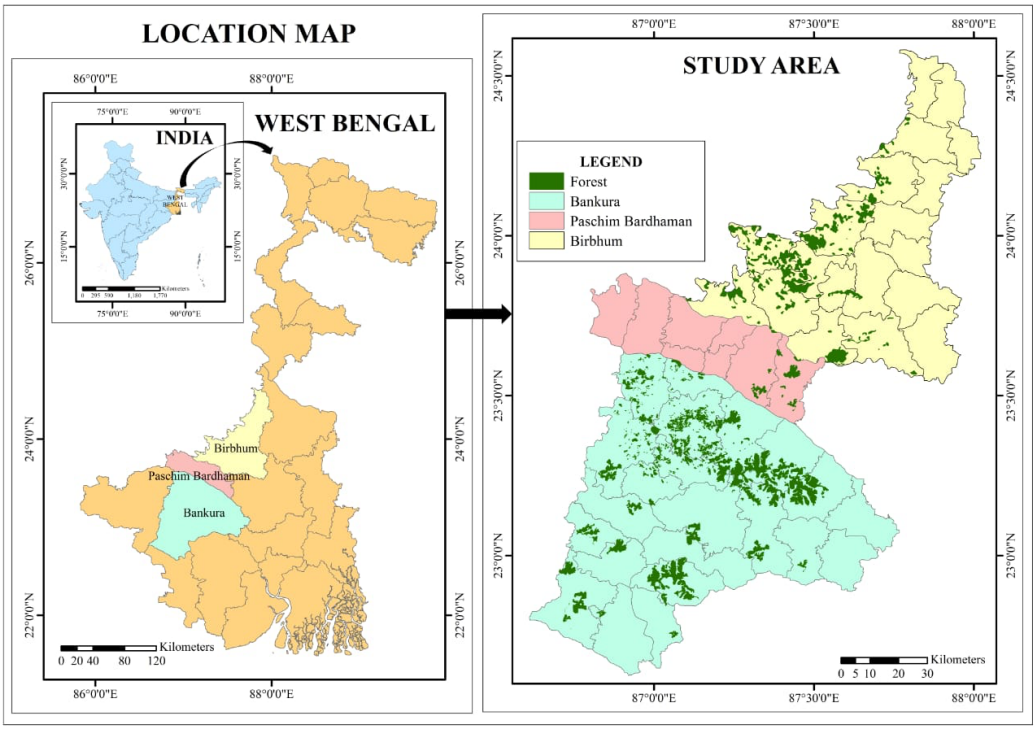

Figure 1. Map of the study areas

Results and Discussion

In this study, total 6 ethnohomonyms of these two orchids have been recorded during the ethnobotanical survey and etymology of each nomenclature was elaborated with proper explanation. It has been found that both *E. explanata* and *E. diffusiflora* are locally known by the same names *viz*. *Gitiya* (গিতীয়া), *Gite* (গিটে), *Gaihamla* (গাইহামলা), *Birfol* (বীরফল), *Rabanmata*(রাবনমাতা), *Rabanmatha* (রাবনমাথা) among the Santals of the said districts.

According to the traditional healers belong to the Santal communities of the three studied districts, the name "*Rabanmatha*" indicates that the species has multiple pseudobulbs attached and its morphological similarity with the 10 heads of the "*Dashanan Ravana*" [Dashanan (দশানন), *Dasha* (দশ) means ten and *Anan* (আনন) refers face or head] described in the ancient Indian epic *Ramayana*. The name *Gitiya and Gite* confirms its doctrine of signature in curing joint pain or arthritic pain [Bengali: Gite baat (গীটেবাত)]. One pseudobulb of the plant is jointed with another which has morphological similarities with the limb joints of human (Figure-2G, H). The name *Gaihamla* refers to the pseudobulbs of the orchids used as medicine for placental expulsion in Cows after delivery of a calf [in Bengali *Gai* (গাই) = Cows*; Hamla* (হামলা) = Roar/ Moo], whereas *Birfol* denotes the large pseudobulbs [Bir (বীর) = large; Fol (ফল) = pseudobulb].

Phenological characters are very important for the identification and distinguishing the closely related species. During the study of morphology of these herbs, it was found that several vegetative characters are very close in them (Figure 2A- C, F). In the vegetative stages, it is quite difficult to confirm the exact identity of the two species, at least for any non-botanist people and for amateur botanist by visual observations. However, perenniality of vegetative structures like leaves, stems, etc. favors easy collection by the forest dwellers. Under vegetative conditions, these two cannot be distinguished. Flowering may help to correctly identify the plants. Dug-out bulbs of the two species when mixed, it seems these are collected from one species (Figure 2K, L). The flowering and fruiting periods of these two species starts from June and continues up to the month of September (Agrawala *et al.* 2023), the ideal time for easy identification since these reproductive features, particularly inflorescence and flowers can be distinguishable in naked eyes (Table 2; Figure 2-D, E). The senescence of inflorescence starts at the end of August when individuals of these two species bear only mature leaves and sometimes have green(living) and/or dried peduncles. Similarities are also there in the shape of fruits and their arrangements over the inflorescence axis (Figure-2I, J). However, there are some comparable characters of the two species in cases of shape and size of the pseudobulb, leaf, fruit, and flower structure and colour (Table 2) which will be helpful to the researchers for easy identification these two species of orchids in the field condition. For example, psuedobulbs are irregularly ovoid or cylindric-globose and 3.7 cm diam. In *E. explanata* whereas in *E. diffusiflora* it is oblique, ovoid, slightly compressed and 2–4 cm diam.

Leaves up to 3 in number, simple, broadly elliptic in *E explanata*. In *E. diffusiflora* leaves are up to 5 in number, ovate-lanceolate to elliptic-lanceolate. Purplish yellow or greenish yellow coloured flower with ovate- oblong labellum found in *E. explanata.* In *E. diffusiflora*, flowers are white coloured with cymbiform labellum. Capsule spindle-shaped and oblong-ellipsoid in case of *E. explanata* and *E. diffusiflora*. respectively.

However, in ethnobotanical practices, unintentional mixing of the closely similar pseudobulbs of the two species and their use as a single drug is quite common incident which has been observed in the studied locality. We can regard these morphologically alike, ethnohomonym species used as a common herbal resource among the ethnic people, as *Ethno-sibling plants.* From our study, *E. explanata* and *E. diffusiflora* can be regarded as Ethno-siblings. However, it is very much possible that such Ethno-sibling species may propagate the misunderstanding among the ethnobotanist, medicine men and medicinal plant suppliers and to other knowledgeable persons for the correct identity of the plants and its crude drugs (Lankasena *et al*. 2024). Consultation of relevant literature (Rahaman and Pradhan, 2011; Mondal and Rahaman, 2012;Pradhan & Rahaman,2014;Jain and Jain, 2016; Santosha and Kar, 2017; Vineeta *et al.* 2022; Karmakar,2022 Pradhan and Mondal, 2023) reveals that tribal people of Birbhum, Bankura and Bardhhaman districts use vegetative parts like roots, tuber, bulbs, leaves, and stems of several plant species having same vernacular names for the formulation of different ethnomedicines.

During repeated interviews with the local people and medicine men residing in the studied forest localities it has been found that they have a common consent regarding the use of psuedobulbs of these two phylogenetically close species as local people know these two different species by the same local names. Both the species, *E. explanata* and *E. diffusiflora* are used in curing gout, indigestion, kidney pain, appetite enhancer of animal and in placental expulsion of cows after delivery. The Santal people of Birbhum district use the pseudobulbs for treatment of oligospermia to increase sperm count in semen in males and for the treatment of joint pain. This medicinal importance is highly significant for open up the scope for further research on these two ethnomedicinal species in the line of pharmacognosy, phytochemistry and pharmacology. Also, as these two species are considered as common resource in folk medicine, ample scope exists to unwind the unexplored and Hidden Diversity of chemicals and therapeutic possibilities (Cavalcanti and Albuquerque,2013). Successful exploration of these potentials may surely establish these two taxa as good drug development candidates.

E. explanata and *E. diffusiflora* are frequently and indiscriminately harvested by the local medicine men and forest dwellers in bulk amount for their underground drug parts during the monsoon (June to August) to meet the demand of crude drugs. It causes more vulnerability in their conservation in the natural habitat since exploitation of the underground parts may eliminate the possibility of vegetative reproduction. Pradhan and Mondal (2023) reported the indiscriminate and unsustainable harvest practices of the ground orchid species from Birbhum district of West Bengal. As these two studied taxa are treated a common resource by the medicine men, the use-pressure may be shared equally due to collection of any one of the species at a time, also because the growing season of these two species is quite same and folk people harvest the required plant parts from the population of both the orchid species. Photographs of two-ground orchids in vegetative and reproductive stage are presented in Figure 2.

Conclusion

Folk names of plants are the mirror of the Traditional Knowledge existing in a community like Santal people. Use of different folk names of the species highlights the rich cultural heritage of tribal nomenclature system of the Santal people of the study areas. Documenting ethno-taxonomical names by cross-cultural examination with different communities will be helpful to protect the unique medicinal knowledge and the concerned local language.

Techniques like Convolutional Neural Networks (CNN) and K-Nearest Neighbor Algorithm (KNN) will be purposeful to identify plants like *E. explanata* and *E. diffusiflora* with close morphologically similarities. Research on phytochemistry and pharmacology of these plants could be prospecting due to their common therapeutic uses.

Declarations

Ethics approval and consent to participate: The development of the study followed the ethical and legal guidelines for the development of research on traditional knowledge. The participation of healers was subject to the acceptance of the Free and Informed Consent Form.

Consent for publication: Not applicable

Availability of data and materials: Not applicable

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Author contributions: S.M. conceptualized the work, collected the data, analyzed, and wrote the manuscript. B.P. participated in the data collection, theoretical background, helping with discussions.

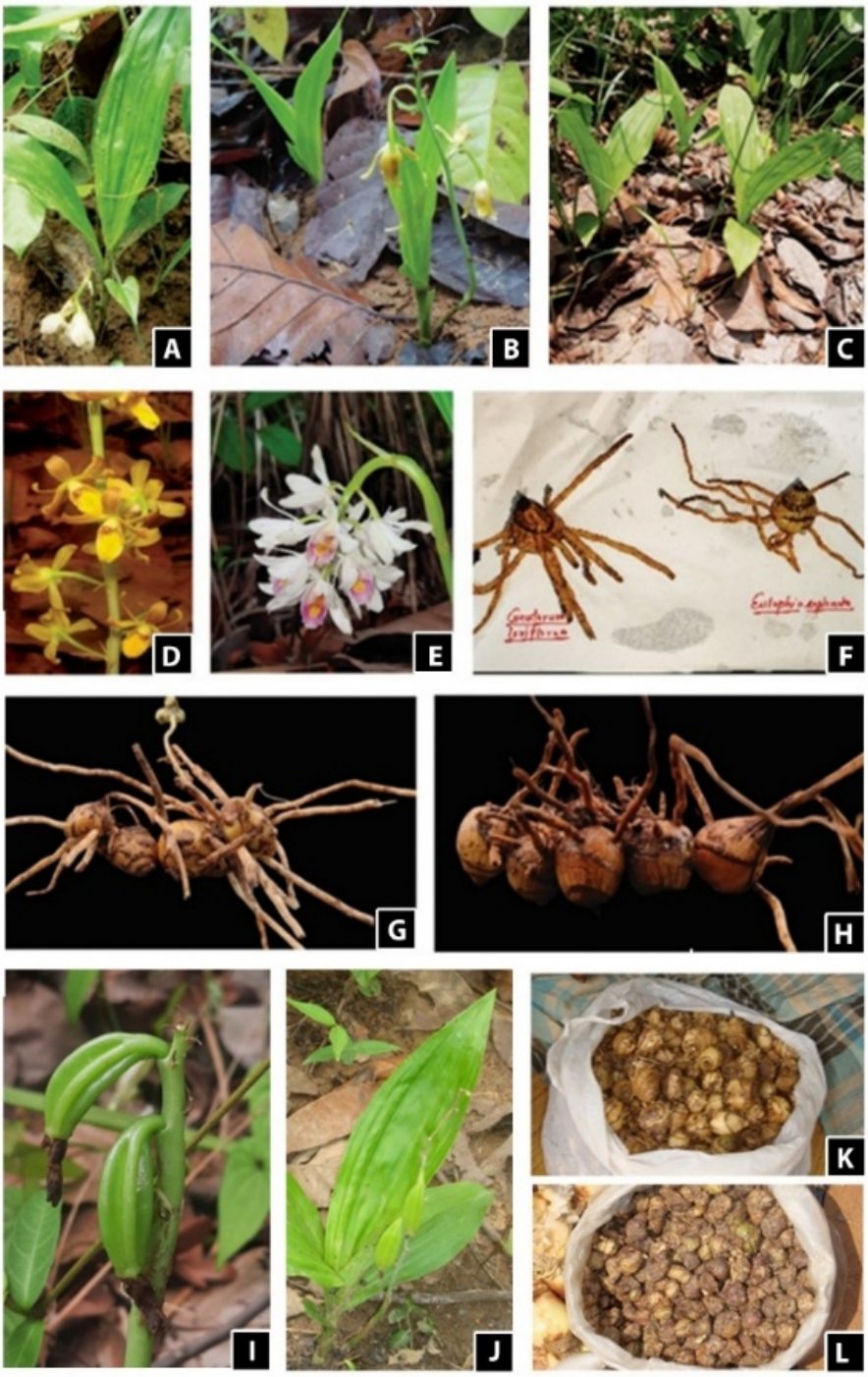

Figure 2. A: Habit of *E. diffusiflora*; B: Habit of *E. explanata*; C: An unknown population of *Eulophia* in vegetative stage; D: Inflorescence of *E. explanata*; E: Inflorescence of *E. diffusiflora*; F: Single fresh tuber of both species; G: Dug out chain of fresh pseudobulbs of *E. diffusiflora*; H: Dug out pseudobulbs of *E. explanata*; I: Fruits of *E. explanata*; J: Fruits of *E. diffusiflora;* K & L: Bulk collection of dried/ fresh and mixed up tubers of both species sold in the market. 2023-2024. Photo credit: Authors.

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