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Analyze the Species Richness and Abundance of Orchid Bees in Eastern Ghats Rainforests

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Abstract: This is one way in which the biodiversity of the Amazon is priceless. Geography, climate, and biotic interactions have always played a role in shaping evolutionary pathways, and these factors continue to do so now. Diverse taxonomic groupings exhibit substantially different speciation times. One type of Neotropical bees that is more well-known is the euglossina bee, sometimes known as the orchid bee, due to its aesthetically pleasing metallic green and blue colours. The warm and humid equatorial zones are home to the most biologically diverse orchid bees, which are only found in the Neotropical area. These bees are members of the tribe Euglossina, which is a subfamily of Hymenoptera: Apidae.

Keywords: Geography, Orchidae, Eulophia, Neotropical area, Hymenoptera

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INTRODUCTION

Herbaceous perennials orchids may thrive in a variety of conditions and have a broad range of growth habits. Their range allows us to classify them as tropical, subtropical, or temperate, and they may thrive in a variety of habitats as terrestrials, epiphytes, lithophytes, etc. From the lowlands to a height of 4,300 meters, orchids have been found all throughout India. The order Orchidae, which includes 25,000–35,000 species in 1,000 genera, is the most complex group of monocotyledonous plants. Orchids number over 1300 species, and they're spread out all throughout India. But the North Eastern Himalayas are home to more orchid species than any other location in the Himalayas.

This region accounts for 70% of India's orchid flora, with reports of 876 species belonging to 151 genera. The decorative value of many of these rare and unique species is significant. The species of paphiopedilum include: fairrieanum, insigne, villosum, spicerianum, hirsutissimum, and venustum. Furthermore, the species A. sikkimensis, B. coerulea, C. imschootiana, D. retusa, and A. anoectochilus Three species of Pleione: maculata, praecox, and humilis the area is home to many potential orchid species, including Cymbidium eburneum, Dendrobium Hookerian, Dendrobium densiflorum, Dendrobium devonianum, Dendrobium thrysiflorum, Thunia marshalliana, and many more. This is true across all eight of India's northeast, Sikkim is known as the orchid paradise due to its abundance of 137 genera and 525 species of orchids. Arunachal Pradesh comes in second with 126 genera and 550 species of orchids.

The Western Ghats are home to tropical rain forests. At elevations of up to 300 meters, epiphytes including Acampae praemorsa, Bulbophyllum acutiflorum, Bulbophyllum elegantulum, Bulbophyllum fimbriatum, and Bulbophyllum fuscopurpureum experience high temperatures, significant rains, and a lot of moisture. According to Abraham and Vatsala (1981), a number of species were documented, including the species in question include B. neilgherense, B. keralense, B. mysorense, B. nodosum, B. orezii, B. proudlockii, and others. rheedei, B. rosemarianum, B. silentvalliensis, B. tremulum, Cymbidium aloifolium, Dendrobium macrostachyum, Luisia zeylanica, Pholidota pallida, and Eulophia epidendraea, a terrestrial orchid. We find a denser population of orchids as we approach the mountain ranges. Species such as Aerides ringens, Dendrobium ovatum, Oberonia var. Burtonian with var. flavescens emerged when the density of vegetation grew between 300 and 600 meters.

The Western Ghats of India are home to over 267 different species of orchids (Kumar, 1991). Out of the 125 orchids native to this area, 98 were exclusive to the Western Ghats and 27 could be found in the Eastern Ghats as well (CAMP Report, 2001).

Typical rain forests, characterized by a thick canopy and low light penetration, were located between 600 and 1300 meters in elevation. Because of the low levels of light reaching this zone, epiphytes were uncommon. In this zone, you may find terrestrial orchids like Eulophia macrostachya, Calanthe masuca, and Acanthephippium bicolour.

LITERATURE REVIEW

Tripathi, Shri et.al. (2016) Forests not only provide vital products and services to humans, but they also house a great deal of biodiversity. Forest ecosystems are particularly vulnerable to biodiversity loss, which is also quickly becoming one of humanity's greatest challenges. Biodiversity or biological richness estimation is a challenging and, without technology inputs, unachievable aim. Nearly half of the Indian subcontinent's blooming plants are found in the comparatively untouched Northeast India, which is a component of the Indo-Burman biodiversity hotspot. Traditional shifting (jhum) agricultural techniques, which are prevalent in this economically depressed area, put enormous strain on the region's forests. Incorporating both modern research and traditional wisdom, this article seeks to provide a synopsis of the conservation efforts underway in Northeast India's forests and the biodiversity they support. In addition, several methods of characterizing biodiversity have been prioritized for the purpose of using information technology, such as GIS, to plan appropriate conservation and prioritization in order to maintain the region's biodiversity.

Gogoi, Khyanjeet, et al. (2012) This study examines the current situation of natural orchid variety resources in the Dibrugarh District of Assam in Northeast India. The areas have yielded 113 species of orchids belonging to 50 different genera. Out of all the species, 29 belong to 17 genera that are terrestrial, while the remaining 84 are epiphytic, belonging to 33 genera. Attempting to correctly identify and evaluate orchid species in the Dibrugarh District in the Indian state of Assam, in terms of their habitat, phenology, locale, voucher specimen, and presently recognized botanical nomenclature is the first stage in this process

Marchese, Christian. (2014) To lessen the impact of human-caused climate change, habitat degradation, and species extinction, conservation efforts are essential. As an example, land usage is escalating and ocean acidification is becoming worse in many regions, both of which have devastating effects on biodiversity. In spite of its detractors, biodiversity hotspots have gained traction as a method for prioritizing conservation efforts and a factor in determining the most cost-effective ways to protect species in both terrestrial and marine environments. One of the greatest ways to keep a lot of the world's biodiversity alive is to use this area-based method, which works on any scale of geography. The danger of ignoring regions, like cold spots, that have various forms of conservation value, is a consequence of the subjective and quantitative criteria used to demarcate hotspots. It is now well understood that biodiversity encompasses much more than a region's species richness and that conservation efforts should not be centered on taxonomic diversity alone. Rethinking conservation objectives and moving towards an interdisciplinary approach via the formation of science-policy collaborations is, therefore, the central theme that emerges

According to Prasad, Rama et.al. (2019) Despite its designation as a forest reserve, Kondapalli's parched evergreen woodland in the Indian state of Andhra Pradesh is deteriorating and losing its biodiversity. Therefore, the objective of this research was to survey the Kondapalli Forest for its flora and fauna. In the 0.36 hectares of Kondapalli Forest, there were 566 trees (≥10 cm) with a forty-six different species from forty different genera and 21 families. Among plant families, the Mimosaceae has the most species and the Rutaceae the fewest. On one hand, Melia azedarach and Syzygium cumini dominated basal area, while Atalantia monophylla was the most abundant and numerous species. The forest had an average basal area of 47.17 m^2 ha^{-1}, and there were 1572 stems per hectare. According to cluster analysis, Atalantia monophyla, with its large ecological amplitude, was connected with species forming distinct communities and had a broad range. Research has shown that with its unexpectedly high species richness, the Kondapalli Forest can teach us a lot about the forest's structure and floristic variety, which may help with conservation and management initiatives.

Palita, Sharat Kumar et.al. (2023) In the In the Researchers looked at the herpetofauna in the Gupteswar Forest Range in the northern Eastern Ghats in India to determine the species' abundance and habitat. From November 2017 to April 2018, we studied nine different microhabitats. Tropical deciduous forests, sal-dominated woodlands, perennial streams, grasslands, and plantation regions were among the different terrains encountered. The research found 45 herpetofauna species, including 31 reptile species from 11 families and 14 amphibian species. Research has shown that leaf litters are home to a diverse array of herpetofauna. brooks were found to be amphibian species rich in abundance, and the microhabitat of topsoil recorded the highest species assemblage. Mount Gupteswar and the Eastern Ghats Forest Range was highlighted as an important area for herpetofaunal variety in the study. We suggest keeping an eye on herpetofauna in relation to human activities for a long time. The study's findings will be useful for future assessments of herpetofauna conservation efforts

RESEARCH METHODOLOGY

The cluster analyses that follow are based on data collected from a large number of surveys carried out by various researchers all across the Neotropical Region (Fig. 1). In order to achieve a fair level of uniformity, the data were chosen based on these factors: (i) we relied solely on surveys that gathered male orchid bees using bait traps and insect nets or indicated that they were attracted but not collected; (ii) we needed the number of specimens (or percentage) of each species of orchid bees in the area for cluster analyses, so we only used surveys in which this was the case. Hence, lists that just indicated presence or absence were not taken into account; (iii) one of the most appealing baits, cineole (or eucalyptol), had to be utilized; (iv) together with cineole, at least two of the following five baits—vanillin, benzyl acetate, methyl salicylate, eugenol, and skatole—had to be employed It is feasible to attract a high percentage of the orchid bee species at a given site by using cineole and at least two of these baits; (v) in the majority of studies, when multiple sites were sampled in the same region, the results were pooled and the average frequency of these regional samples was used in the evaluations. The Peruvian Tambopata Reserve has two locations, Costa Rica has three (Janzen et al. 1982), and the northeastern state of São Paulo in Brazil has two (Pearson & Dressler 1985). were an exception to this rule, either because of vast distances between them or because of variations in habitat or elevation.

DATA ANALYSIS

The When taking into consideration Between 20.0% and 61.1% (Bray-Curtis Index, mean = 40.7%), there was a large variance in the overall abundance of the 30 most frequent species across the nine bee communities that were evaluated. With the Jaccard index, we found similar results when testing for the existence of all 55 species that have been recorded (mean = 40.3%, range = 17.0-70.3%).

The As a the relationship between both weather conditions ($R = -0.34$, $p = 0.03$) and the distances between locations ($R = -0.53$, $p < 0.001$; Fig 5.4B), the similarity in the species makeup of orchid bees reduced across different combinations of plateaus. When comparing the make-up of different bee assemblages, the most notable variations were noted.

Table 1 presents Based on the degree of species similarity among the orchid bees, the nine collection sites are shown in two dimensions using the non-metric multidimensional scaling (NMDS) ordination scores and Pearson correlations between geographical and environmental factors complete the picture.

Variables	Axis 1	Axis 2
Average Temperature	0,55873**	-0,53571**
Number of dry months	-0,37966	0,49041*
Precipitation	0,13123	-0,57939**

*p<0.05

**p<0.01

Between sets of locations situated 20–30 kilometres apart (Monte Branco and Bacaba). A favourable and statistically significant correlation existed between tree quantity in addition to the variety that are native to orchids ($R2=0.48$, $p = 0.036$).

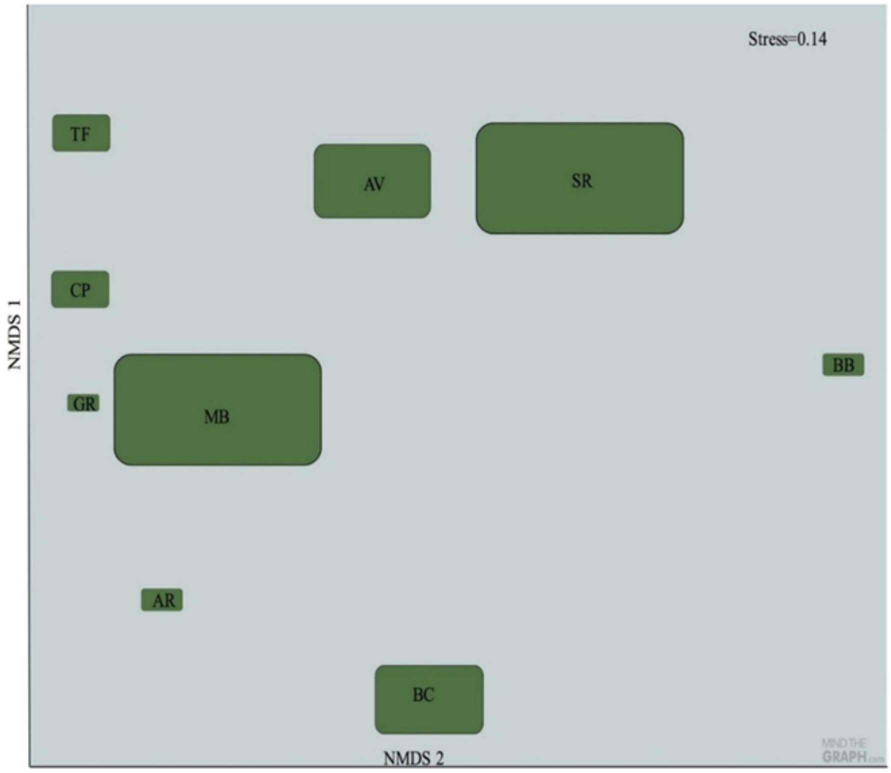

Figure 1. NMDS coordination of the nine locations for the sample based on the species they share makeup of orchid bees, with the Simpson index used for data on presence and absence. Figure 1 and the methods section both include site codes. The formations' relative proportions show how big the plateaus are.

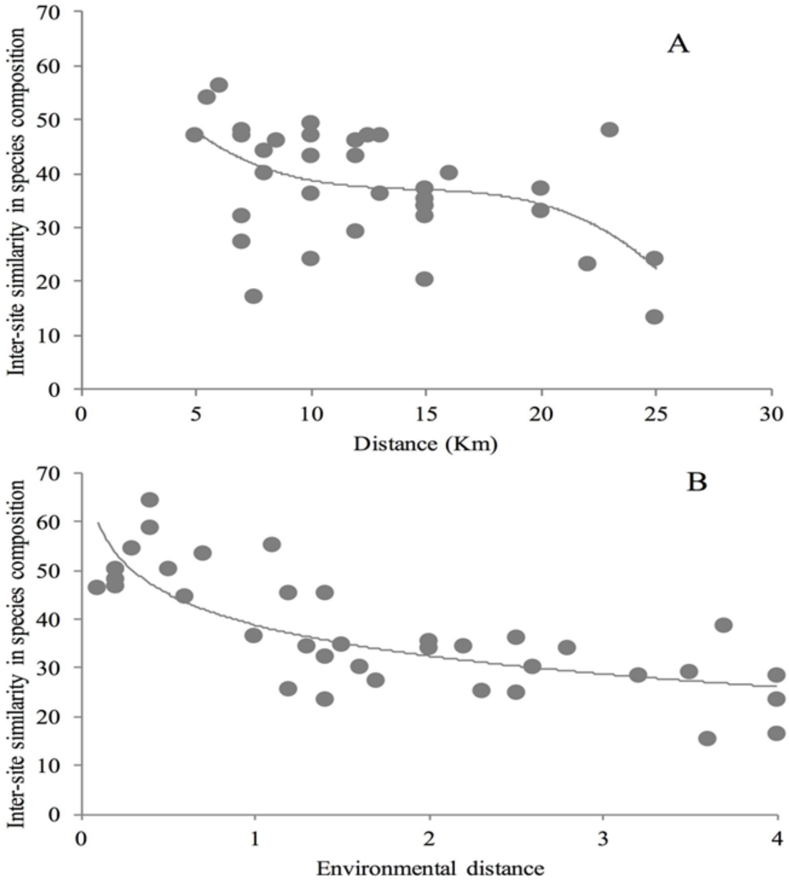

Figure 2. Reduction in correlation between orchid-bee assemblages and environmental or geographical distance between survey sites.

The geographic distance between any two points on Earth is the distance in km that separates them. In terms of three climatic variables—annual mean temperature, annual mean precipitation, and seasonality—the environmental distance between two sites is the geometric gap between them of precipitation. We use the Bray-Curtis Index to find out how similar the orchid-bee species are. The curve for logarithmic regression is shown by the lines.

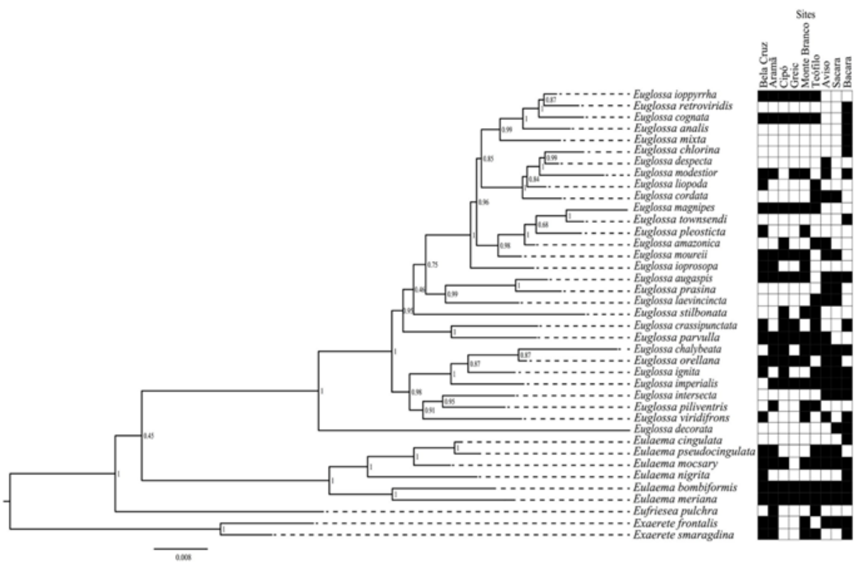

Figure 3. The black square represents the occurrence location for each orchid bee species, while the COI loci in mitochondria and EF1-α, Argk, and Poll-II loci in nuclear DNA provide the basis of the Bayesian phylogenetic analysis.

Node numbers signify posterior probability.

We constructed a An orchid bee phylogenetic tree using Bayesian methods collected in this work using a multigene dataset. The majority of interspecies connections were strongly corroborated and aligned with the previously suggested phylogeny for the group.

We analyzed the variations in diversity patterns in phylogeny across many plateaus. In contrast to the Bacaba plateau's highest PDFaith value of 0.486 and the Monte Branco plateau's highest MPD value of 0.082, the Greig plateau exhibited little phylogenetic diversity (PDFaith and MPD, respectively, at 0.288 and 0.064). The connection between PDFaith patterns and the abundance of bee species was much stronger than that of MPD patterns (R2 = 0.857, $p < 0.001$). Phylogenetic diversity (in both its quantitative and qualitative forms) and plateau size did not correlate significantly.

The variety and quantity of orchid bee species in Amazonian Rainforests

Orchid bees belong to the family Euglossini (Hymenoptera: Apidae), which is endemic to the Neotropics and has the greatest diversity of life in tropical climates, which are both hot and humid (Dressler, 1982). Several accounts indicate that the Cerra do is one of the areas where these corbiculate bees have been seen. Pantanal, Caatinga, gallery forests, and even in higher elevations like the Andes.

In Brazil, you may find more than 200 species of euglossines, which are classified into The five genera are Aglae (Lepelletier and Serville, 1825 = Ag.), Eulaema (Lepelletier and Serville, 1825), and Serville, 1841 = El.), Eufriesea Cockerell, 1908 (= Ef.), Euglossa Latreille, 1802 (= Eg.), and Exaerete Hoffmannsegg, 1817 (= Ex.) (Ramírez et al., 2002; Anjos-Silva, 2007; Anjos-Silva, 2008; Anjos-Silva, 2010).

CONCLUSION

Geographical, demographic, and genetic connections among populations were affected by climate and geological forces that worked across evolutionary time spans ranging from hundreds to millions of years. Soil and water chemistry profiles were found to be diverse as a result of these elements' constraints on riverscape and landscape processes. The velocities of change, evolution, and extinction were greatly influenced by these abiotic conditions, which allowed organisms to diversify into different sorts of habitats. But, via autocatalytic feedback processes within the very varied Amazonian ecosystems, biodiversity also adds to the ever-increasing species richness of the Amazon. As a result of these biotic interactions, genetic and phenotypic diversity are increased in Amazonian ecosystems, and novel characteristics are evolved. Additionally, the functional dimensions and structural variability of habitats are increased. Because of the interplay between these biotic and abiotic elements, species are able to reduce their risk of extinction by coexisting in the same areas or habitats The Amazon forest ecosystem is deteriorating and several species are in danger due to the precipitous decline in population in recent years (Escobar 2019). Dynamic and pluralistic conservation methods that take into account the irreplaceability, representativeness, and fragility of ecosystems and species are the most successful (Jézéquel et al. 2020).

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