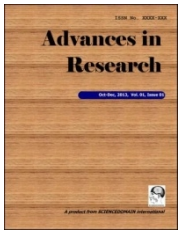

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# Epiphytic Orchids of Kericho Forest, Kenya

**Fanuel Kawaka[1*], Benson Obwanga[2], Daniel Miyawa[3] and Humphrey Gaya[4]**

*[1]Department of Pure and Applied Sciences, Technical University of Mombasa (TUM), P.O. Box 90420, Mombasa, Kenya.*
*[2]Department of Biological and Biomedical Sciences, Laikipia University (LU), P.O. Box 1100, Nyahururu, Kenya.*
*[3]East African Herbarium, National Museums of Kenya (NMK), P.O. Box 45166, 00100, Nairobi, Kenya.*
*[4]Seeds for Life Project, Kenya Forestry Research Institute (KEFRI), P.O. Box 20412 -00100, Nairobi, Kenya.*

***Authors' contributions***

*All the authors collaborated in carrying out this work. Authors FK, BO, DM and HG designed the study and carried out field work. Author DM identified the plant species while author FK, BO and HG processed herbarium samples. Author FK drafted the manuscript. All the authors read and approved the final manuscript.*

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## ABSTRACT

**Aim:** The study assessed the distribution of epiphytic orchids in selected trails of Kericho forest Kenya
**Study Design:** Belt transects and timed random walks.
**Place and Duration of Study:** Field survey was conducted in September, 2013 in Kericho forest, located in Rift Valley next to one of the main water towers in Kenya, the Mau Forest.
**Methodology:** Six belt transects of 10 × 30 m were established at each of the portions along the meandered trails. The belt transects were divided into intervals representing zones and each treated as a plot. The number of individual orchid species were counted and recorded. Apart from transects, timed random walks were also taken to increase the number of orchid species recorded during the survey.
**Results:** A total of eighteen species representing nine genera and one *Habenaria sp* were recorded and collected. The largest number of orchids occurred at an altitude of

**Corresponding author: E-mail: fkawaka@tum.ac.ke;*

2123 m above sea level with over 66% being restricted to a single location. The distribution was affected by logging, charcoal burning, conversion of forest land for agricultural use and quarrying for road construction.
**Conclusion:** Conservation strategies should therefore focus on minimizing loss and fragmentation of orchid habitats particularly the destruction of the moist forest habitats, host and associated indigenous plants.

*Keywords: Random walks; altitude; indigenous; Habenaria sp.*

## 1. INTRODUCTION

The Orchidaceae family accounts for 10% of plant biodiversity and is of great economic importance in the global horticultural and food industries [1]. There are over 75 genera and 500 species in East Africa, among which 143 species are endemic to the region [2]. Orchids are predominantly distributed in tropical regions with some representatives found in temperate and arctic habitats [3]. Most tropical orchids are found exclusively in primary forests that are largely undisturbed, although a lesser number of species thrive in marginal or disturbed sites, such as forest edges or 'gaps' [4]. The occurrence and distribution of orchid species are influenced by factors such as latitude, altitude, soil types, climatic conditions, atmospheric humidity and temperatures [5]. Increased population growth, economic development, and financial pressures have led to increased rates of deforestation in many parts of the world [6]. Indeed, destruction and fragmentation of habitat is the leading threat to orchid biodiversity worldwide [4]. Due to habitat loss, climate change and over-exploitation, many species are threatened with extinction [7]. Most species are classified in the IUCN red listing as Critically Endangered, Vulnerable, or Threatened. In many countries including Kenya, forest burning is associated with loss of orchid species and consequently poses a threat to other living organisms. Orchids are keystone species for monitoring the general health of a wide range of habitats and also serve as flagship group that can successfully be used to educate the general public on a variety of conservation issues [8]. However, in Kericho forest, there is insufficient published information on the distribution and ecological status of orchids. Therefore in response to these challenges, this project aimed at assessing the distribution of epiphytic orchids in Kericho forest.

## 2. MATERIALS AND METHODS

### 2.1 Study Site and Sampling

The study was carried out in Kericho forest, located in Rift Valley next to one of the main water tower in Kenya, the Mau Forest. The forest is within the K5 ecological region in Kenya. This is one of the less disturbed forests, the richest and least studied in terms of orchid diversity. Intensive field survey was conducted in September, 2013 in selected portions of the expansive Kericho Forest approximately 5 km section of two adjoining trails of Kenya Tea Research Foundation and Finlay's Tea plantation. Six belt transects of 10 × 30 m were established at each of the portions along the meandered trails and divided into intervals representing zones and each treated as a plot. The number of individual orchid species were counted and recorded. Apart from transects, timed random walks were also taken to increase the number of orchid species recorded during the survey. All the wild orchid species found in the plots were recorded and representative voucher specimen collected. High quality photographs, habitat description, GPS coordinates, host plants, associated

plants species and field notes on morphological characteristics of orchids were also taken. After collection, the specimen were tagged with collection numbers, field-identified by a taxonomist and cross-referenced with the aid of the checklist based on the Flora of Tropical East Africa (FTEA). Finally, the specimen was matched with herbarium collections of the targeted areas. The collected specimens were then made into standard mounted herbarium sheets [9] and deposited in the herbarium. Under special circumstances, orchid species were rescued from fallen dead trees. These rescued species were kept as live specimen in the orchid house based at the NMK. In addition, representative leaf samples were collected and preserved in silica gel for further molecular identification.

## 3. RESULTS AND DISCUSSION

A total of eighteen species representing nine genera and one *Habenaria sp* were recorded and collected (Table 1).

**Table 1. Orchids collected at different altitudes in Kericho Forest**

| Code | Site | Orchid species | Frequency | Altitude range in meters (a.s.l.) |
|---|---|---|---|---|
| 001 | K5 | *Cynorkis kassneriana* | Rare | 1704 |
| 002 | K5 | *Polystachya cultriformis* | Occasional | 2162 |
| 003 | K5 | *Rangaeris muscicola* | Occasional | 2162 |
| 004 | K5 | *Satyrium crassicaule* | Occasional | 2131 |
| 005 | K5 | *Cribbia bachycerus* | Rare | 2131 |
| 006 | K5 | *Tridactyle bicaudata* | Common | 2123 |
| 007 | K5 | *Tridactyle scottellii* | Occasional | 2123 |
| 008 | K5 | *Tridactyle furcistipes* | Common | 2123 |
| 009 | K5 | *Bulbophyllum cochleatum* | Common | 2123 |
| 010 | K5 | *Polystachya tessellata* | Occasional | 2123 |
| 011 | K5 | *Polystachya bennettiana* | Occasional | 2123 |
| 012 | K5 | *Bolusiella maudiae* | Occasional | 2123 |
| 013 | K5 | *Angraecum sacciferum* | Occasional | 2123 |
| 014 | K5 | *Bulbophyllum bidenticulatum* | Common | 2123 |
| 015 | K5 | *Polystachya eurygnantha* | Occasional | 2123 |
| 016 | K5 | *Polystachya bella* | Occasional | 2123 |
| 017 | K5 | *Bulbophyllum bequaertii* | Rare | 2123 |
| 018 | K5 | *Habenaria sp* | Rare | 1704 |

*Collectors: Miyawa, DO; Obwanga, BO; Gaya, HC and Kawaka, JF*

Over 66% of the species were found at a single location, an indication of reduced population distribution within the forest. Since the study was carried out immediately after the rainy season, occurrence of many species at one location could be as a result of regrowth from dormant bulbs and pseudo-bulbs buried in the soil from the previous season [10]. Most orchids encountered were epiphytes growing on the smaller to medium branches of forest indigenous trees and woodlands. High orchid diversity has been found on smaller branches of West African and Belize forests with lower diversity on the outer branches [11]. Reduced occurrence of orchid on the tree trunks could also be attributed to minimum exposure to light and moisture that is needed by epiphytic orchids. The occurrence of the orchids in surveyed trails of the forest varied from an altitude of 1704 m to 2162 m above sea level. Out of the species collected, 11% were found clustered at 1704 m, 2131 m and 2162 m a.s.l. while 67% were collected at 2123 m a.s.l. (Fig. 1).

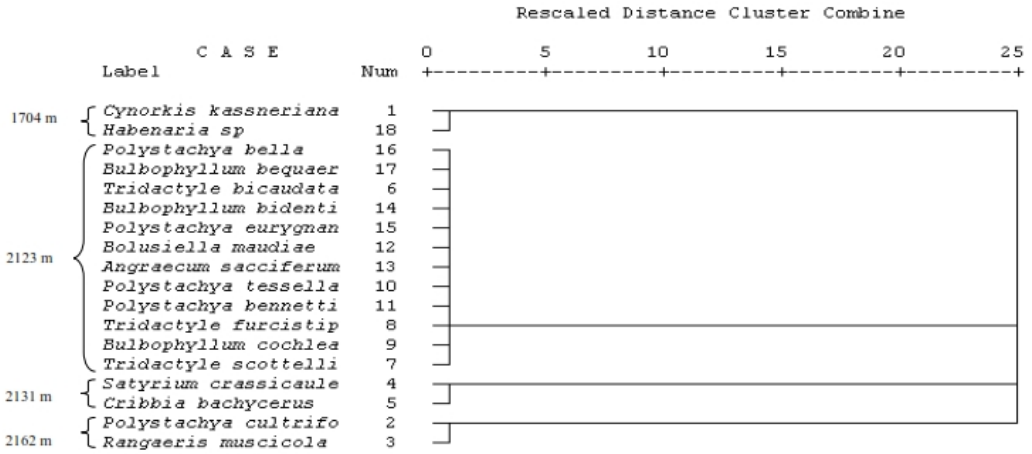


**Fig. 1. Clustering of orchid species at different altitudes**

Based on the number of times an orchid was seen, the collected wild orchids were designated on a scale of 1-10 as rare (1-3), occasional (4-6), and common (7-10). The most frequently encountered genus was *Polystachya* sp (27%) followed by *Bulbophyllum* sp and *Tridactyle* sp (17%) while *Satyrium crassicaule, Rangaeris muscicola, Cynorkis kassneriana, Angraecum sacciferum, Bolusiella maudiae, Cribbia bachycerus, Habenaria* sp were the least encountered at 6% (Fig. 2).

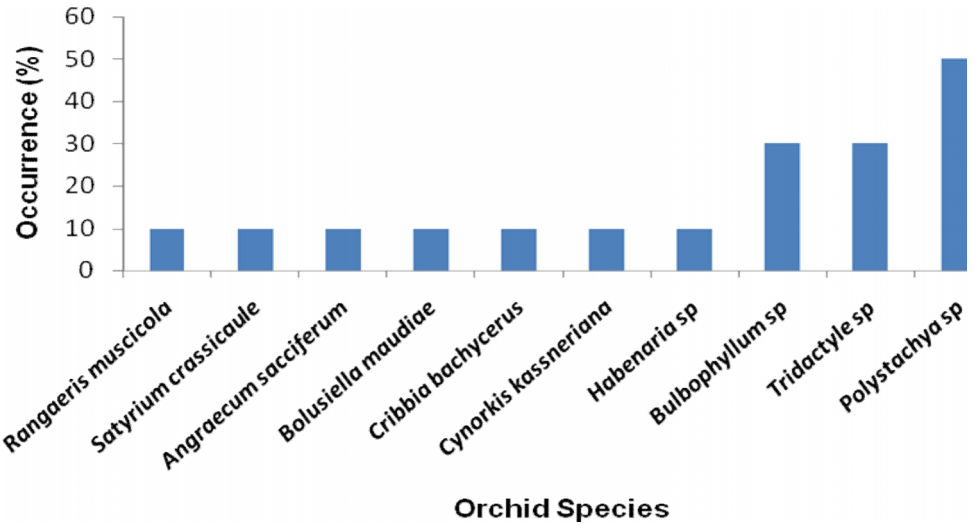


**Fig. 2. Frequency of occurrence of orchids in different genera**

Human activities such as logging, charcoal burning and quarrying during road construction could have contributed to the decline of most orchid species. Altitude and genus were found to be the key factors that influenced the occurrence and distribution of orchids. Among the three rarest species, *Cynorkis kassneriana* and *Habenaria* sp were collected at an altitude of

1704 m, *Cribbia bachycerus* at 2131 m and *Bulbophyllum bequaertii* at 2123 m above sea level. The occasional species were found between a range of 2123-2126 m and 2123-2162 m a.s.l. This observation could be an indication that factors such as altitude affect the diversity of wild orchids and confirms other studies showing that vegetation affect the composition of wild orchids [10]. There was reduced species diversity at lower altitudes as compared to moderately elevated altitudes. Similar studies in Chiapas, México showed a high concentration of orchid species at mid altitudes [12]. Lower altitude is always associated with increased temperatures and reduced moisture which could negatively affect survival of epiphytic orchids. The occurrence and distribution of orchids in the forest were found to be associated with certain indigenous plants (Table 2). These associated plants could be used as indicators for the conservation of orchids with conservation efforts focusing on the plants as well.

**Table 2. Indigenous plants associated with different orchid species**

| Orchid species | Associated indigenous plants |
|---|---|
| *Cynorkis kassneriana* | *Sonchus asper, Biden spilosa, Solanum nigrum, Solanum incunum* |
| *Polystachya cultriformis* | *Psychotria petersii, Erythrina abyssinica, Croton macrostachys* |
| *Rangaeris muscicola* | *Psychotria petersii, Erythrina abyssinica, Croton macrostachys* |
| *Satyrium crassicaule* | *Ferns* |
| *Cribbia bachycerus* | *Psychotria petersii, Erythrina abyssinica, Croton macrostachys, Croton megalocarpus* |
| *Tridactyle bicaudata* | *Psychotria petersii, Erythrina abyssinica, Croton macrostachys, Croton megalocarpus* |
| *Tridactyle scottellii* | *Psychotria petersii, Erythrina abyssinica, Croton macrostachys, Croton megalocarpus* |
| *Tridactyle furcistipes* | *Psychotria petersii, Erythrina abyssinica, Croton macrostachys, Croton megalocarpus* |
| *Bulbophyllum cochleatum* | *Psychotria petersii, Erythrina abyssinica, Croton macrostachys, Croton megalocarpus, Syzygium guineense ssp. afromontanum* |
| *Polystachya tessellata* | *Psychotria petersii, Erythrina abyssinica, Croton macrostachys, Croton megalocarpus, Syzygium guineense ssp. afromontanum* |
| *Polystachya bennettiana* | *Psychotria petersii, Erythrina abyssinica, Croton macrostachys, Croton megalocarpus, Syzygium guineense ssp. afromontanum* |
| *Bolusiella maudiae* | *Psychotria petersii, Erythrina abyssinica, Croton macrostachys, Croton megalocarpus, Syzygium guineense ssp. afromontanum* |
| *Angraecum sacciferum* | *Psychotria petersii, Erythrina abyssinica, Croton macrostachys, Croton megalocarpus, Syzygium guineense ssp. afromontanum* |
| *Bulbophyllum bidenticulatum* | *Psychotria petersii, Erythrina abyssinica, Croton macrostachys, Croton megalocarpus, Syzygium guineense ssp. afromontanum* |
| *Polystachya eurygnantha* | *Psychotria petersii, Erythrina abyssinica, Croton macrostachys, Croton megalocarpus, Syzygium guineense ssp. afromontanum* |
| *Polystachya bella* | *Psychotria petersii, Erythrina abyssinica, Croton macrostachys, Croton megalocarpus, Syzygium guineense ssp. afromontanum,* |
| *Bulbophyllum bequaertii* | *Psychotria petersii, Erythrina abyssinica, Croton macrostachys, Croton megalocarpus, Syzygium guineense ssp. afromontanum* |
| *Bulbophyllum cochleatum* | *Psychotria petersii, Erythrina abyssinica, Croton macrostachys, Croton megalocarpus, Syzygium guineense ssp. afromontanum* |
| *Habenaria* sp | *Psychotria petersii, Erythrina abyssinica, Croton macrostachys, Croton megalocarpus, Syzygium guineense ssp. afromontanum* |

## 4. CONCLUSION

There is clear evidence that orchids are threatened by loss and fragmentation of their habitats particularly the destruction of the moist forest habitats and indigenous host plants. Based on these challenges, there is an urgent need to carry out a more comprehensive survey of the adjacent and neighboring trails of Kericho forest for possible salvage of the critically endangered and rare species such as *Bulbophyllum bidenticulatum.* In addition, conservation efforts should take into account the associated plants which could serve as indicators for the ecological status of native orchids. There should be deliberate effort to sensitize relevant stakeholders including communities living around the forests on importance of conserving the primary indigenous forests for the benefit of all.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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