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Occurrence and Diversity of Lichens in Abraka and Its Environs, Delta State, Nigeria

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ABSTRACT: This study evaluates lichens diversity in Abraka and its environs for the period of six months (January – June, 2017). Data were collected by direct observation and transect walks in and around the study area. Photographs were taken to aid identification of the genera encountered with their hosts. Percentage distribution of the species was calculated. The result revealed the percentage occurrence and diversity of three forms of lichens: crustose (57.1%), foliose (28.6%) and leprose (14.3%). The lichen genera recorded with their percentage occurrence included *Candelariella* (22%), *Chaenotheca* (2%), *Cyphelium* (14%), *Parmelia* (16%), *Lecanora* (18%), *Physcia* (18%) and *Psilolechia* (10%). Monthly distribution showed that month of May had the highest occurrence (30%) of lichens. The weather pattern showed highest temperature in May (30.7°C), highest mean rainfall (442.6mm) and humidity (90.0%) in June. The result showed that the study area has varying lichen diversity which could be employed in bio-monitors of the environment.

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Lichens is a term used to describe a mutualistic existence of two lives (algae and fungi) in the absence of one, the other cannot survive (Panda *et al.,* 2017). They are ecologically obligate, stable mutualistic association of fungi and photo autotrophic microorganisms. The lichen symbiosis is unique since it represents a hybrid life form with a distinct body plan (lichen thallus) and structural and physiological properties that are different from either of the partners (Wang *et al.,* 2010).The algal partner is called photobiont (green agla = phycobiont, cyanoctaria = cyanobiont) while the fungal partner is the mycobiont (Sharma, 1989; Henskens *et al.,* 2012). They grow attached to substrate such as soil, rocks, old walls and plant surfaces (stem, bark and leaves) (Ilondu, 2014). Lichens can be grouped according to the type of substrates they grow on such habitat as (i) corticolous lichens that grow on the bark of living plants as epiphytes, (ii) terricolous lichens that grow on soil, (iii) saxicolous lichens that grow on rock and (iv) lignacolous lichens growing directly on wood (Sharma, 1989; Tiwari and Pirajapiti, 2015).

Lichens have been used as a source of food for man for example *Umbilicaria esculenta* (Miyoshi) Minks is eaten in Japan as a delicacy, while *Byoria fremontii* (Tuck.) were eaten by the native people in America. In temperate regions lichens are an important source of food for mammals, they offer shelter for birds, invertebrates and other microorganisms while man has over centuries used them for food, poisons, medicine, clothing, fibre, decorations, tannins and dyes (Brodo *et al.,* 2001; Nash, 2008). Lichen species such as *Letharia vulpina* (L.) has been used traditionally as poison for foxes and wolves in Europe (Nash, 2008). This is because it contains vulpinic acid which is responsible for its poisonous nature (Sharma, 1989).They are sensitive to atmospheric changes and micro-climatic conditions hence have been employed as bio indicators for environmental stress in tropical and temperate regions (Da Silva and Senanayake, 2015). Their diversity can be an effective early warning device for air quality deterioration in an environment (Aptroot and vanHerk, 2007; Asma *et al.,* 2013).

Information is lacking on the occurrence and diversity of lichens in Abraka environment. In this study therefore, an attempt is being made by the researcher to identity and describe the various kinds of lichens and determine their diversity in Abraka, Delta State.

MATERIALS AND METHODS

Study Area: A field work was carried out in Abraka and its environs in Ethiope East Local Government Area of Delta State (Figure 1). Abraka is located within latitudes 5°45´ and 5° 50´ N of the equator and longitude 6°and 6° 15´E of the Greenwich meridian. It has a tropical type of climate with mean temperature of 30°C and annual rainfall amount of 3,098mm

ranging from 25.8mm in December to 628.9mmin September (Ojeh and Origho, 2012).

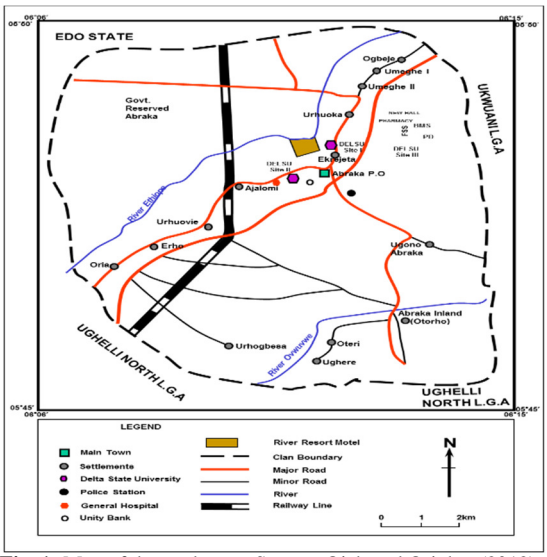

Fig. 1: Map of the study area Source: Ojeh and Origho, (2012)

Data Collection and Identification of Lichens

A 6-month (Jan – June, 2017) was conducted in the study area. This is done by direct observations and transects walks in and around Abraka with field Assistants knowledgeable about the area. Lichens were searched across various habitats. Trees showing presence of Lichens were recorded. Photographic documentation was done using a digital camera. Voucher specimens were collected into separate polyethylene bags and taken to the laboratory for identification by morphological characteristics using standard literature by Awasthi (2007). Identified samples were preserved and deposited in the Herbarium Section of Department of Botany, Delta State University, Abraka, Nigeria. The frequency of occurrence (FOC) of the Lichen forms as well as genera was calculated using the formula:

$$FOC = \frac{Total\ number\ of\ lichen\ form/genera\ collected}{Total\ number\ of\ samples\ collected} * \frac{100}{1}$$

RESULTS AND DISCUSSION

Of the 50 observations recorded during the survey studies, a total of 7 genera distributed in 7 different families were recorded in this study. Three different Lichen forms which included Crustose, Foliose and Leprose were encountered (Plate 1 – 3).The percentage occurrence and diversity of these Lichen forms showed that crustose (57.1%) was the most dominant, followed by foliose (28.6%) and leprose (14.3%) (Fig. 2). Similarly, various genera identified with their percentage occurrence included *Candelariella* (22%), *Chaenotheca* (2%), *Cyphelium* (14%), *Parmelia* (16%), *Lecanora* (18%), *Physcia* (18%) and *Psilolechia* (10%) (Fig. 3). Monthly distribution of Lichen showed that the month of May (30%) had the highest occurrence of lichens (Fig. 4). The lichens were observed on varied habitats and host plants (Table 1). The climatic conditions varied across months in the study area. Mean rainfall was highest in the month of June, followed by May while January was lowest. Similarly, the humidity was highest in the month of June while the month of May had the highest mean temperature (Table 2). Seven (7) different species of Lichens which included *Candelariella, Chaenotheca, Cyphelium, Parmelia, Lecanora, Physcia*and *Psilolechia* were identified in this study. Some of the Lichens reported in this study such as *Parmelia, Lecanora* and *Physcia* species have been observed in Nsukka area of Eastern Nigeria (Anozie and Maduewesi, 2006). Similarly, species of *Candelaria, Parmelia* and *Physcia* were among the macrolichens found in Ottawa, Canada by Coffey and Fahrig (2012). The only Leprose lichen found in the study area was *Chaenotheca.* This is similar to the findings of Uppadhyay *et al.* (2016) who identified *Leprania* sp. as the only Leprose lichen in the study area. Singh and Sinha (2010), had reported 2400 lichens species among 305 genera and 74 families existing as Crustose, Foliose and Fructicose forms on various substrata. The occurrence of Lichens in the study area was dominated by crustose forms having 57.1% of the lichen forms encountered. Similar observation was made by previous researchers. For instance, Peck (2002) observed that out of 181 Lichen species identified, crustose represented about 55% while Panda *et al.* (2017) noted 57% Crustose in their studies. Crustose forms were found to be crust-like in nature, foliose were flat and leaf-like while leprose appeared as powdery mass on the substratum with no organized structure (Ilondu, 2014). The distribution of lichens and species diversity across the study area in different plants showed that Abraka environment is suitable for lichen establishment possible due to less anthropogenic activities. Tiwary and Prajapati, (2015) made a similar observation in their studies. Nevertheless, complete absence of Fruiticose lichen is noteworthy in this study. This could be due to human interference which according to Rout *et al.* (2010) and Panda *et al.,* (2017) may cause unsuitable environment for their establishment.

Plate 1. Leprose Lichen on orange tree (*Citrus sinensis*)

Plate 2. Foliose Lichen on Palm tree (*Elaeis guineensis*)

Plate 3. Crutose Lichen on rubber tree (*Hevea brasiliensis*)

Substrate preference for colonization of lichens was evident as most of the identified genera were commonly found growing on barks of trees especially African oil palm (*Elaeis guineensis*). Tree bark texture has been found to be an important factor influencing lichen diversity and composition of their communities (Cacares *et al.,* 2007; Ellis, 2012). *Shore arubusta* trees species showed the best host species of lichen as a result of the nature of the bark as observed by Tiwari and Prajapati (2015). Likewise, Panda *et al.,* (2017) observed luxuriant lichen growth on the surface of *Excoecaria agallocha* which was attributed to the peculiar bark texture of the mangrove species. Predominance of lichens may vary from season to season as climatic factors such as temperature, rainfall and relative humidity data varied all through the study period.

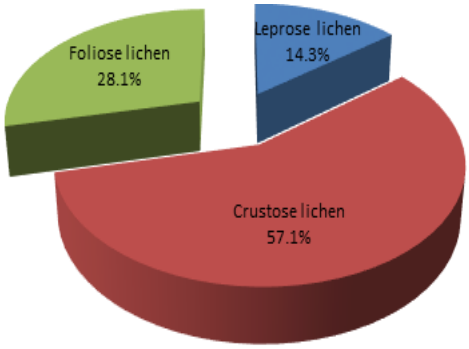

Fig. 2: Percentage of Lichen diversity according to forms identified in the study area

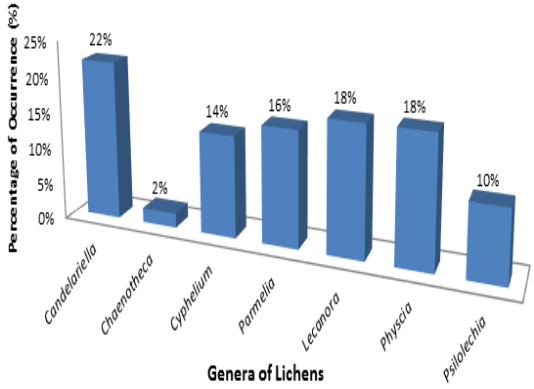

Fig. 3: Percentage occurrence of lichens genera identified in the study area

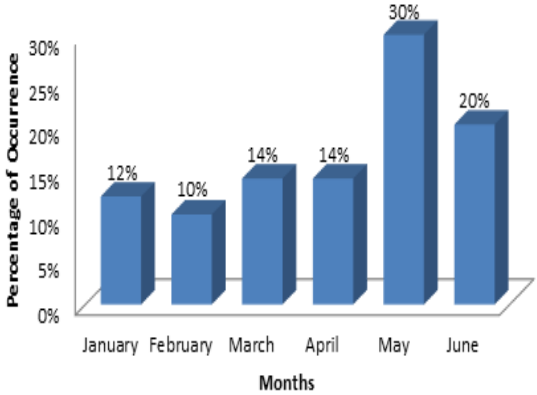

Fig. 4: Monthly distribution of lichens species in the study area

Table 1: Species, forms and host of the lichens collected from the study area

S/N	Lichen Species	No of Sample	Family	Lichen Forms	Habitat	Host Plants
1	*Candelariella*	11	*Candelariaceae*	Crustose	Tree bark	*Citrus sinensis*
2	*Chaenotheca*	1	Coniocybaceae	Leprose	Tree bark	*Elaeis guineensis*
3	*Cyphelium*	7	Caliciaceae	Crustose	Tree bark	*Polyatia longifolia*
4	*Parmelia*	8	Parmeliaceae	Foliose	Tree bark	*Elaeis guineensis*
5	*Lecanora*	9	Lecanoraceae	Crustose	Tree bark	*Elaeis guineensis*
6	*Physcia*	9	Physciaceae	Foliose	Tree bark	*Hevea brasiliensis*
7	*Psilolechia*	5	Pilocarpaceae	Crustose	Fence wall	

Table 2: Monthly variation in weather pattern in the study area

Months	Mean Temperature (^{0}C)	Mean Rainfall (mm)	Mean Humidity (%)
January	30.3	27.0	72.0
February	30.5	32.0	72.0
March	30.4	122.1	77.0
April	30.5	241.5	81.0
May	30.7	295.2	86.0
June	30.1	442.6	90.0

Source: Meteorological Division (Department of Geography, 2017)

Available information indicated that variation of macroclimatic factors including rainfall and temperature affect lichen development in various geographical areas (Da Silva and Senanayake, 2015). Similarly, atmospheric pollution, forest fires and agricultural practices may affect lichen distribution and composition as opined by Ellis (2012). Earlier, Markert *et al.* (2003) indicated that Fruticose and Folliose lichens are always abundant if the air is clean while Crustose species tolerate high level of pollution hence are abundant in a polluted environment. However, Lichens have been reported to be very sensitive to atmospheric changes hence are good indicators of air pollution and an absolute early-warning system (Aptroot and Vanherk, 2007; Nash, 2008). This could be the reason why Crustose species were found to be abundant than Folliose species and Fruticose was completely absent in this study. Therefore Lichens are important biomonitors in the environment.

Conclusion: This study has shown that Abraka and its environs are endowed with an abundance of lichens possibly due to its varying environmental and climatic conditions all through the year. The study will enrich our herbarium and stimulate interest in the students of Ecology, Mycology and Environmental Studies. The study is the first on lichen diversity in Abraka hence, baseline information for further studies of this kind in other parts of the state as lichens could be good biomonitors in the environment. Furthermore, it may serve as an early alarming device for deteriorating air quality in the area.

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