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Screening of 20 Accessions of Sesame (*Sesamum indicum*) for Resistance to *Cercospora* Leaf Spot Disease

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Authors' contributions

This work was carried out in collaboration between all authors. Both authors SEU and EAO designed the study. Authors SEU and EAO performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors TOA and SEU managed the analyses of the study. Authors TOA, HEE and EOP managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Twenty accessions of sesame (*Sesamum indicum*) were screened for resistance to *Cercospora* leaf spot disease.
Sample: Twenty accessions of *Sesamum indicum* were used for the study. The sesame accessions were obtained from various localities and raised in a green house.
Study Design: Three to four seedlings were initially transplanted per hole and later thinned to two after establishment and arranged in a complete randomized design (CRD).
Place and Duration of Study: Cultivation of seedlings and transplantation were all carried out at a standard green house of the Molecular Biology Laboratory located at 124 MCC Road, Calabar, Cross River State of Nigeria in August, 2013.
Methodology: Isolation was made from leaves of diseased host plants. Test plants infected leaves with characteristic anthracnose symptoms were collected from the field. They were thereafter, subjected to pathogenicity test with *Cercospora sesami* to determine their levels of resistance to this debilitating pathogen.

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Results: Plant height was strongly positively related to seed size (r = 0.85) and number of branches (r = 0.72) and had a significant correlation with the number of seeds per plant (r = 8.60). Correlation coefficient studies revealed that six out of the eight parameters were significantly (P = 0.05) correlated.

Conclusion: The results obtained indicate that accessions from Adagum and Ndok were immuned or highly resistant to Cercospora leaf spot (CLS) disease with disease severity of 0 (zero). Also, collections from Ogoja, Akim Market and Watt Market were resistant to CLS diseases with disease severity of 1.621, 1.820 and 1.545 respectively. Nwang, Mbube East, Bansara, Obudu Market, Obanliku Market, Gboko Market, Ukpa Market, Yahe Market and Ekpugrinya Market and Okpoma Market were either moderately susceptible or susceptible to CLS disease according to their mean disease severities.

Keywords: Sesame accessions; Cercospora leaf spot disease (CLS); pathogenicity test; disease severity; morphological characters; correlation coefficient.

1. INTRODUCTION

Sesame *(Sesamum indicum*) is one of the oldest cultivated plants in the world. It is commonly known as sesame. Sesame is a flowering plant in the genus *Sesamum*. This annual crop which is classified under the family of *Pedaliaceace*, is popularly called beniseed. The native name depends on locality. It is called 'Ri'idi' in Hausa, 'Igogo' in Igbo and 'Yanmoti' in Yoruba. In Cross River North Senatorial District where the seeds serve as a delicacy, the natives call it "Anang" in Bekwarra, "Ishuo" in Afrike (Bekwarra) and "Iso" in Mbube – all Ekoi speaking people of upper Cross River.

It is probably the most ancient oil seed known and used by man. Sesame is the common name used in international professional journals; while it is called 'beniseed' in West Africa and 'simsim' in East Africa [1]. Sesame is widely grown in the Northern and central part of the country initially as a minor crop until in 1974, when it became one of the major cash earner in many northern states such as Jigawa, Benue, Taraba, Nassarawa, Kwara, Kogi, Niger, Plateau, Kaduna, Adamawa, Bauchi, Gombe, Kaduna, Adamawa, Bauchi, Gombe, Kano and Kebbi States. The crop is produced both for export [2] and local consumption in 21 states of the Nigerian Federation.

Sesamum indicum is widely naturalized in tropical regions around the world and is cultivated for its edible seeds, which grow in pods and for its highly prized oil [3]. It is considered to be the oldest of the oilseed plants and has been under cultivation in Asia for over 5000 years [4]. Nowadays, it is widely cultivated as an oil-crop in tropical and subtropical climates. Renowned for its high oil content with seeds that can contain up to 60% oil, sesame is known as the king of oil seeds in Vietnam. The oil has a composition that provides good health benefits including high levels of unsaturated fatty acids (80%) and antioxidants. Possibly for this reason, sesame oil is widely considered to prevent diseases of different kinds. Numerous wild relatives of *Sesamum indicum* occur in Africa and a smaller number in India.

Leaf spot disease caused by *Cercospora sesami* Zimm, however, is a major problem in the cultivation of this crop [5]. Moreover, this disease is prevalent in most sesame growing areas of Nigeria and in other parts of Africa [6]. It is particularly severe in the forest/savannah transitional zone of South-West Nigeria, to which the crop has been recently introduced [7]. The disease, which affects leaves of plants as early as 4 weeks after planting (WAP), starts as small pinhead-sized spots which extend up to 4 mm in diameter. Extensive infection of foliage and capsule leads to defoliation and damage of sesame capsules and yield losses may range from 22 to 53% [7].

Sesamum indica is plagued by several fungal, bacterial and viral diseases. The most devastating of these is Cercospora leaf spot, a fungal disease. The effects of this disease on the growth and by extension, the yield of *Sesamum indicum* have been devastating. Cercospora sesame zimm affects leaves of plants as early as 4 weeks after planting.

There is very high demand for this tropical crop which has found application in grocery and other food processing industries due to its high oil and protein contents.

Personal interviews with farmers on the production of this crop plant have revealed that very low yield is always recorded due to this disease attack. Farmers have not also been able to purchase recommended fungicides for this disease due to poverty. There is, therefore, urgent need to place premium on mass production of this crop which has a global demand. Disease resistant species would complement efforts geared towards this mass production of sesame. This, therefore, is the trust of this research.

In view of health and environmental concerns, a determined effort has been made in the last years to reduce the use of chemicals (pesticides, fungicides, nematocides etc.) worldwide, in order to manage pests/pathogens more effectively. This study aimed at identifying resistance source to leaf spot will serve as a useful technique in the integrated disease management/ integrated pests management (IDM/IPM) of Cercospora leaf spot (CLS) disease.

The identification of resistance sources for disease pests is vital for varietal improvement [8]. Thus, there is an indication that screening 20 accessions of *Sesamum indicum* for resistance to Cercospora leaf spot disease could yield strains that are resistant to this debilitating fungal disease.

2. MATERIALS AND METHODS

2.1 Collection of Accessions and Study Site

Twenty accessions of *Sesamum indicum* were used for the study. The accessions were collected from the following communities (Table 1).

Areas where accessions were collected fall within two distinct climatic zones characterized by short and long rainy seasons. Average monthly temperature in these zones ranged from 20 – 30℃.

2.2 Propagation Procedures

Raising of seedlings and transplantation were all carried out at a standard green house of the molecular biology laboratory located at 124 MCC Road, Calabar, Cross River State of Nigeria.

Healthy seeds from various accessions were soaked in sterile distilled water for five minutes and unviable sesame seeds filtered out. Healthy seeds were thereafter pre-treated by soaking in 95% ethanol for 1 minute for sterilization before being broadcast into specialized bowls which were centrally piped for supply of water and nutrients.

Table 1. Accessions and their sources

Accessions	Sources
Accession 1	Gakem, Bekwarra
Accession 2	Ochagbe, Bekwarra
Accession 3	Adagom, Ogoja
Accession 4	Ndok, Ogoja
Accession 5	Nwang, Ogoja
Accession 6	Ojerim, Ogoja
Accession 7	Bansara, Ogoja
Accession 8	Ishibori, Ogoja
Accession 9	Utugwang, Obudu
Accession 10	Alifokpa, Yala
Accession 11	Gboko, Benue
Accession 12	Ukpah, Bekwarra
Accession 13	Ogboja, Ogoja
Accession 14	Okpoma, Yala
Accession 15	Ubabai-Iye, Bekwarra
Accession 16	Yahe, Yala
Accession 17	Akim, Calabar Municipality
Accession 18	Ekpugrinya, Ogoja
Accession 19	Watt Market, Calabar South
47Accession 20	Okuku, Yala

Source: Field Survey, 2015

The use of a greenhouse for the experiment was to control water supply as sesame is a highly tropical and drought resistant crop. Also, the use of the greenhouse was to prevent possible disease interaction(s) as well as other weather variables such as pH and humidity.

The seeds were planted on August 28, 2013 in a mixture of soil (sand and humus) with poultry droppings. The seedlings were transplanted after three weeks into 80 rubber trays specially designed to absorb water and nutrient minerals centrally.

Three to four seedlings were initially transplanted per hole and latter thinned to two after establishment.

2.3 Isolation of Fungal Pathogen and Purification

Isolation was made from leaves of diseased host plants. Test plants infected leaves with characteristic anthracnose symptoms were collected from the field. A typical leaf with

symptoms of Cercospora leaf spot were carefully transferred into humid chambers made up of petridishes that were under laid with filter papers at both covers with the aid of forceps flamed and cooled in methylated spirit and wetted thoroughly (8). The lesions on leaf materials were, therefore, incubated in these humid chambers at room temperature for 72 hours, and examined for sporulation under the microscope. After 72 hours pieces of leaves around the spot areas were cut using sterile needles and transferred into glass slides containing cotton blue stain. The slides were then covered with lids, pressed tightly with fingers to eliminate air bubbles and mounted on a microscope. Observed conidia from separate conidiophores were picked using glass needle and transferred aseptically into petridishes containing gelled potato dextrose agar (with pectin added as the carbon source) and incubated at 25 ± 1ºC until growth was observed. The plates were placed in an incubator for 7 days. Thereafter the plates were placed in a previously fumigated clean room where they could access sunlight at room temperature for 3 weeks and the morphological characteristics of the fungus were observed daily until the time of sporulation. Through series of sub-culturing pure cultures were obtained and maintained in a refrigerator on agar slant in McCartney bottles as part of the culture purification process [9–11]. Detailed microscopic examinations were carried out during the growing stages to reveal the organism. In each case, temporary slides were prepared and viewed under x 45 objective lens of microscope.

2.4 Identification of *Cercospora sesame*

Morphological examination of *Cercospora sesami* was made at Biology laboratory of the Department of Biological Sciences, Cross River University of Technology, Calabar, according to the methods described by [10,112]. Naturally infected sesame leaves were washed several times with sterilized distilled water, and then placed in a humid chamber at room temperature for 48 hours. After that, pieces of leaves around visible spots were cut and placed on glass slides and macerated in drops of cotton blue and tightly covered with lids to avoid air bubbles and observed using the microscope. Spore size measurement was done using an ocular (eye piece) micrometer previously calibrated with a stage micrometer.

In all, 15 spores were selected randomly and measured for the length, width and type of septation to obtain the size of the spores as described by [12–14] (Table 2).

2.5 Pathogenicity Test

Spore suspension was produced as described by [15]. This was carried out by scrapping fungal spores (with a 0.6cm artist's brush) from culture in petridishes into centrifuge tubes containing sterile distilled water. The tubes were swirled gently in the centrifuge at 6,600xg for 5 minutes to obtain a spore suspension. The suspension was diluted (1:9 ml of distilled water) for subsequent inoculation.

Table 2. Dimension of conidiosphores and number of septation of *Cercospora sesami* from specimens obtained from the field

S/N	Conidial length (µm)	Conidial width (µm)	No. of septate
1	78.50	3.30	6
2	42.50	4.40	4
3	66.50	4.50	5
4	77.50	4.60	6
5	55.00	3.75	4
6	75.60	5.50	5
7	71.50	4.25	6
8	77.00	5.75	4
9	66.00	3.75	6
10	60.00	3.60	3
11	55.00	3.75	4
12	45.50	3.50	3
13	47.50	4.50	4
14	85.60	5.00	6
15	82.00	5.00	6
Total	931.7	65.15	72

2.6 Inoculation of Pathogen

Aliquots of the spore suspension (5 ml) containing approximately $5x10^5$ spores/ml was inoculated on the abaxial surface of wet, healthy host leaves by spraying to run-off level after 3 weeks of good establishment of the seedlings. This was done using a sterile hypodermic syringe equipped with a 20 gauge needle. The leaves were covered with transparent polythene bags and allowed to stay for 24 hours [16]. The plants were watered regularly and observations were made for the appearance and development of symptoms. Symptoms of Cercospora leaf spot were observed as from 4 weeks after planting. The fungus was re-isolated from the leaves that exhibited symptoms and the cultures obtained were compared with the original to confirm the identity according to Koch's postulates. This

Table 3. Overall means for morphological characters studied in 20 accessions of Sesame

	Vegetative attributes					Reproductive attributes				
Accessions	**Plant height (cm)**	**No. branches per plant**	**Leaf area (cm)**	**No. of Spots per leaf**	**Days to 50% flowering**	**Diameter of spot per leaf (cm)**	**Pod No per plant**	**No. of seeds per pod**	**Seed size (1000 seed in weight) (g)**	**No. of seeds per plant**
Accession 1 (Gakem Mk)	5.35	11.00	89.00	3.00	30.00	2.00	25.00	51.00	1.80	2758.00
Accession 2 (Ochagbe Mk)	5.48	10.00	76.00	2.00	29.00	3.00	29.00	68.00	2.70	2765.00
Accession 3 (Adagum)	5.26	10.00	104.00	Nil	28.00	Nil	34.00	84.00	4.30	3720.00
Accession 4 (Ndok)	4.62	15.00	65.00	Nil	29.00	Nil	35.00	82.00	4.20	3441.00
Accession 5 (Nwang)	4.69	7.00	137.00	4.00	31.00	1.00	11.00	43.00	1.30	1786.00
Accession 6 (Mbube East)	3.16	7.00	88.00	3.00	29.00	2.00	17.00	49.00	1.50	1654.00
Accession 7 (Bansara Mk)	3.27	6.00	67.00	4.00	31.00	1.00	13.00	42.00	1.00	1211.00
Accession 8 (Isbori Mk)	4.78	5.00	75.00	3.00	29.00	2.00	19.00	54.00	1.60	1321.00
Accession 9 (Obudu Mk)	5.26	10.00	89.00	3.00	28.00	2.00	20.00	53.00	1.50	1071.00
Accession 10 (Obanliku Mk)	5.37	10.00	90.00	3.00	29.00	2.00	18.00	55.00	1.70	1001.00
Accession 11 (Gboko Mk)	4.69	7.00	81.00	4.00	30.000	1.00	11.00	40.00	1.00	786.00
Accession 12 (Marian Mk)	5.69	8.00	65.00	2.00	28.00	3.00	25.00	64.00	2.60	2862.00
Accession 13 (Ogoja)	4.96	15.00	30.00	1.00	28.00	4.00	27.00	76.00	3.60	2921.00
ccession 14 (Okpoma Mk)	3.68	4.00	77.00	3.00	29.00	2.00	15.00	54.00	1.40	1987.00
Accession 15 (Ukpa Mk)	4.69	7.00	104.00	4.00	30.00	1.00	10.00	39.00	1.00	1201.00

	Vegetative attributes						Reproductive attributes			
Accessions	**Plant height (cm)**	**No. branches per plant**	**Leaf area (cm)**	**No. of Spots per leaf**	**Days to 50% flowering**	**Diameter of spot per leaf (cm)**	**Pod No per plant**	**No. of seeds per pod**	**Seed size (1000 seed in weight) (g)**	**No. of seeds per plant**
Accession 16 Yahe	3.78	8.00	75.00	4.00	30.00	1.00	12.00	40.00	1.10	756.00
Accession 17 (Akim Mk)	3.16	7.00	88.00	1.00	28.00	4.00	27.00	78.00	3.90	821.00
Accession 18 (Ekpugrinya Mk)	4.77	15.00	65.00	3.00	29.00	2.00	16.00	53.00	1.30	1231.00
Accession 19 (Watt Mk)	4.77	5.00	75.00	1.00	28.00	4.00	28.00	79.00	1.90	2564.00
Accession 20 (Okuku Mk)	3.68	4.00	77.00	3.00	29.00	2.00	16.00	52.00	1.30	879.00

confirmation was done before inoculation of the isolated pathogen for the experiments.

2.7 Data Collection after Inoculation

After administering pathogenicity test, the following growth parameters were recorded after 9 weeks of growth, which is a period when sesame is most susceptible to Cercospora leaf spot disease [17] (Table 3).

3. RESULTS AND DISCUSSION

3.1 Results

The results for all parameters studied including plant height, days to 50% flowering etc. are given in Table 3. There were significant differences in the height of the twenty accessions (P = 0.05) of sesame studied. Table 4 gives the correlation matrix between seed yield and seven morphological attributes studied. Regression coefficient and t-test for significance are given in Table 6. Three of the eight characters were significant (P = 0.05).

3.2 Discussion

In this study, twenty accessions of sesame were sampled from different locations and each accession was subjected to *Cercospora sesami* attack. Ten useful morphological characteristics were used to determine disease resistance and subsequent seed yield of the sesame accessions (Table 3). In general, they showed interesting tendencies that can be exploited for adaptability in rain forest environment like Cross River State and its environs.

Morphological parameters like plant height, leaf area, days to 50% flowering and number of seeds per plant showed great significance in the sense that the highest accession came from Obanliku Market (5.37 cm). However, in terms of seed yield the best varieties were collected from Adagum and Ndok Markets, while accessions from Yahe and Okuku Markets had the lowest number of seeds produced per plant (Table 5). These important characters could be exploited in improvement programmmes of sesame. Accessions or genotypes that habour genes for various desired traits can be cross-bred to ensure the transfer and preservation of such traits amongst varieties. This way, such desirable varieties can be adapted and the ones with poor and undesirable traits discarded or tried in other ecological climes, since environmental factors affect the performance of sesame phenotypes. Temperature and humidity are the most important environmental variables, with humidity being particularly crucial for shoot disease [18].

Table 4. Correlation matrix between seven independent morphological variables and seed yield

Traits / Traits	No. of seed per plant	Seed weight	Plant height	No. of branches per plant	Leaf area	No. of spots per leaf	No. of pods per plant	Days of 50% flowering
No. of seed per plant	8							
Seed weight	0.455 0.473	8						
Plant height	0.775 0.032	0.858 0.005 -0.036	8 0.106					
No. of branches per plant	0.805 0.442	0.536	-0.892	8				
Leaf area	0.060 0.088	0.389 0.446	-0.084	0.170 0.724	8			
No. of spots per leaf	0.929 0.045	0.043	0.061	0.423 0.724	-0.356 0.054	8		
No. of pods per plant	0.954 0.031	0.897	0.633 0.702	0.934 0.521	0.033	0.344 -0.086	8	
Days of 50% flowering	0.062 0.867	-0.787 0.083	-0.680 0.085	0.526	0.251	0.942	0.832	8

Table 5. Overall means for seed attributes

Accession	Grain size (1000 seed weight) (g) ± 1.00	Yield per plant
Accession 1 (Gakem Mk)	1.80	418.00
Accession 2 (Ochagbe Mk)	2.70	567.00
Accession 3 (Adagum)	4.30	987.00
Accession 4 (Ndok)	4.20	898.00
Accession 5 (Nwang)	1.30	238.00
Accession 6 (Mbube East)	1.50	502.00
Accession 7 (Bansara Mk)	1.00	212.00
Accession 8 (Isbori Mk)	1.60	467.00
Accession 9 (Obudu Mk)	1.50	421.00
Accession 10 (Obanliku Mk)	1.70	501.00
Accession 11 (Gboko Mk)	1.00	192.00
Accession 12 (Marian Mk)	2.60	584.00
Accession 13 (Ogoja)	3.60	782.00
Accession 14 (Okpoma Mk)	1.40	208.00
Accession 15 (Ukpa Mk)	1.00	189.00
Accession 16 (Yahe)	1.10	271.00
Accession 17 (Akim Mk)	3.90	795.00
Accession 18 (Ekpugrinya Mk)	1.30	295.00
Accession 19(Watt Mk)	1.90	434.00
Accession 20 (Okuku Mk)	1.30	253.00

Table 6. Regression coefficient and t-test for significance

S/N	Attribute	T	Level of significance
1	Plant height	0.12	0.49 (NS)
2	No. of branches per plant	10.18	4.26 (S)
3	Leaf area per plant	-18.93	-4.24 (NS)
4	No. of spots per leaf	79.60	3.96 (S)
5	Days of 50% flowering	-18.29	-4.24 (NS)
6	Diameter of spot per leaf	0.02	0.09 (NS)
7	No. of pods per plant	0.52	2.55 (S)
8	Seed size	0.04	0.15 (NS)

NS = Not significant; S = Significant

Some accessions did well even though they were not significantly (P = 0.05) different amongst the twenty varieties in terms of seed size (1000 seed in weight), number of branches per plant, number of spot per leaf, number of pods per plant and number of seeds per pod (Table 4). The environment conditions under which these plants were grown probably affected these results [17].

Correlation and regression coefficients shown in Tables 6 and 7 only gave positive significance between number of seeds per plant and plant height, number of branches per plant, number of spots per leaf and number of pods per plant. Plant height was strongly positively related to seed size (r=0.85) and number of branches per plant (r = 0.72); and had a significant positive correlation with the number of seeds per plant (r = 8.60) (Table 4). Therefore, the combination of these indexes is desirable as it encouraged increased seed yield. In line with this, it is recommended that breeding should continue in future for the elimination of unwanted indexes and parameters and improvement of plant structure for its complete adaptation to the requirements of increased yield. This is in agreement with the report of [19] who worked on in vivo evaluation of some plant extracts on the control of Cercospora leaf spot disease on four sesame varieties in Taraba, Nigeria.

Correlation coefficient results revealed that six out the eight parameters were significantly (P = 0.05) correlated (Table 7). This implies that the direct effect or contributions of these parameters to seed yield are significant.

As aforementioned above, the experiments set in place to assess the behavior of different sesame accessions against Cercospora leaf spot disease under controlled conditions of infection. The results indicate that severity of *Cercospora* leaf spots also varied among the 20 sesame accessions at 4 weeks up to the expiration of one year (Table 8). This progression of the disease with time could probably be due to systematic epidemic build up in a polycyclic process being apparently aided by massive conidial production and spread within the cropping season. This inference is in agreement with (18) concept of infection sequence i.e. infections, sporulation and dispersal of pathogen. Disease severity was absent in accessions Adagum and Ndok and significantly lower in Ogoja, Akim Market and Watt Market varieties than the other varieties, probably due its inherent resistance to attack by the pathogens than the other varieties. This result agrees with [20] who in a study to determine the level of variability of crop to Cercospora leaf spot concluded that variability existed among varieties in all characters, probably due to their inherent level of resistance to attack by the pathogens.

However, interesting significant genetic variations were also detected among sesame genotypes for resistance to Cercospora leaf spot disease. The presence of immuned plants (Adagum and Ndok accessions) among tested sesame genotypes disagrees with earlier reports by [21] during their evaluation of 2229

Table 7. Correlation coefficient between eight morphological attributes and Number of seed per plant

S/N	Attribute	Correlation coefficient	Probability (P)
1	Plant height	4.96	Significant
2	No. of branches per plant	4.94	Significant
3	Leaf area per plant	42.40	Significant
4	No. of spots per leaf	14.74	Significant
5	Days of 50% flowering	2.00	Not Significant
6	Diameter of spot per leaf	2.97	Not Significant
7	No. of pods per plant	4.80	Significant
8	Seed size	7.30	Significant

Table 8. Mean severity of 20 sesame accessions in final disease screening trial using *Cercospora sesame*

Accession	Disease severity	Resistant category
Accession 1 (Gakem Mk)	3.300	MS
Accession 2 (Ochagbe Mk)	2.829	MS
Accession 3 (Adagum)	0.000	HR
Accession 4 (Ndok)	0.000	HR
Accession 5 (Nwng)	4.873	S
Accession 6 (Mbube East)	4.123	S
Accession 7 (Bansara Mk)	4.736	S
Accession 8 (Isbori Mk)	3.721	MS
Accession 9 (Obudu Mk)	4.529	S
Accession 10 (Obanliku Mk)	4.660	S
Accession 11 (Gboko Mk)	4.701	S
Accession 12 (Marian Mk)	2.955	MR
Accession 13 (Ogoja)	1.621	R
Accession 14 (Okpoma Mk)	3.011	MR
Accession 15 (Ukpa Mk)	4.832	S
Accession 16 (Yahe Mk)	4.690	S
Accession 17 (Akim Mk)	1.820	R
Accession 18 (Ekpugriya Mk)	4.214	S
Accession 19 (Watt Mk)	1.545	R
Accession 20 (Okuku Mk)	3.930	MS

MS = Moderately Susceptible; HR = Highly Resistant; HS = Highly Susceptible
S = Susceptible; MR = Moderately Resistant; R = Resistant

accessions of sesame originating from 6 ecological regions in China and 116 accessions from 14 other countries and [22] which documented the evaluation for leaf spot disease and gall midge among newly developed sesame inbred lines and the bulk germplasm materials at Yandev in 1985, which showed that most of sesame lines were moderately resistant to leaf spot disease caused by *Cercospora sesami.*

The present results also showed some interesting points. For instance, none of the tested sesame genotypes was highly susceptible (HS) to Cercospora leaf spot disease. Such accessions maintained their resistance for longer periods. Such genotypes might be helpful for breeding programmes due to stability of both characters (resistance and seed yield). It should also be noted that overall growth parameters improved with increasing degree of resistance to Cercospora leaf spot disease including yield turnover.

4. CONCLUSION

The study has demonstrated that accessions from Adagum, Ndok, Akim Market were the best in terms of seed yield and there was significant differences amongst the twenty accessions of sesame in terms of yield. These accessions therefore seem to be well adapted to the rainforest of Cross River State and other suitable ecological zones. In terms of correlation and regression evaluations, the morphological variables had impressive relationships among themselves that could be exploited advantageously.

While disease symptoms, disease effect on some important plant traits, morphology of the pathogen were characterized in this study; these traits may serve as a reference for future studies regarding sesame and its reaction to *Cercospora sesami.* Since not all inoculated accessions developed symptoms, it is postulated that the resistance to Cercospora leaf spot in sesame may not be quantitatively inherited.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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