Journal of Research in Ecology

An International Scientific Research Journal

ISSN No: Print: 2319 –1546; Online: 2319– 1554

**Original Research**

# Application of botanical foliar spray on the control of fungal diseases of *Vigna radiata* (mung bean) in Uyo, South-South Nigeria

**Authors:**
**Akpan EA[1] and Andrew DE[2]**

**Institution:**
1. Department of Crop Science, Faculty of Agriculture, Akwa Ibom State University, Obio Akpa.

2. Department of Crop Science, Faculty of Agriculture, University of Uyo.

**Corresponding author:**
**Akpan EA**

**ABSTRACT:**

A field trial was conducted at the University of Uyo Teaching and Research farm, Use-offot, during 2015 at various seasons to assess the fungicidal potentials of some plants as foliar sprays in the control of fungal diseases associated with (*Vigna radiata L.*) mung bean which include: *Cercospora* leaf spot caused by *Cercospora canescens and C. cruenta*, powdery mildew by *Erysiphe polygoni* and anthracnose by *Colletotrichum lindemuthianum*. Plants extracts that served as foliar spray in the control of these fungal diseases were: neem leaves (*A. indica*), tassel flower (*E. coccinea*), drum stick *(Moringa oleifera*), and candle stick (*S. alata*) with sterile distilled water was used as the control. The experiment was arranged in a Randomized Complete Block Design (RCBD) and replicated three times. The results obtained showed that *Moringa oleifera* performed the best in increasing growth (vine length), more than all other extracts. *Emilia coccinea* performed best in terms of pod increase per plant, while *Senna alata* enhanced yield (seed weight) and so the high biomass. The result also indicated that neem showed the most effective response in reducing disease incidence and severity of mung bean disease more than all other plant extracts used in this study.

**Keywords:**

Mung bean, Plant extracts, Diseases, Botanicals, Antifungal activity.

**Email ID:**

ednaakpan@yahoo.com

**Article Citation:**
**Akpan EA and Andrew DE**
Application of botanical foliar spray on the control of fungal diseases of *Vigna radiata* (mung bean) in Uyo, South-South Nigeria
**Journal of Research in Ecology (2018) 6(1): 1377-1383**

**Dates:**

**Received:** 08 Dec 2017 **Accepted:** 18 Jan 2018 **Published:** 03 Feb 2018



**Web Address:**
http://ecologyresearch.info/documents/EC0519.pdf



Journal of Research in Ecology

## INTRODUCTION

*Vigna radiata* (mung bean) is one of the important pulse crops of Asia which is gradually and widely cultivated in Nigeria especially in the humid ecology region of the country. Mung bean is consumed as a seed sprout or processed forms that include cold jellies, noodles, cake and brew; it could also be eaten roasted, fried or boiled (AVRDC, 2002). Mung bean is a food legume rich in protein and other essential amino acids, except that sulphur amino acids, cysteine and methionine maybe limited nutritionally. It contains high amount of crude fiber and hence a good source of carbohydrate. (Duke, 1983). Sadly, this all important food crop is beset by a number of fungal diseases such as; *Cercospora* leaf spot caused by *Cercospora canescens* and *C. cruenta*, powdery mildew (*Erysiphe polygoni*), scab (*Elsinoe iwatae*), anthracnose (*Colletotrichum lindemuthianum*) and rust (Uromyces species) Figure 2.

The fungus *Cercospora* is a seed borne pathogen and also survives in infected plant debris. The fungus *Cercospora*, survives in several other legumes which serve as a means of the pathogen survival (Figure 2). Upon germination, the conidia produce a germ tube, which penetrates the host tissue and initiates the process of infection. Spores formation and spread of the pathogen are favoured by humid and wet weather conditions. The conidia are dispersed by splashing rain, rain water and wind (Berger, 1977). Anthracnose caused by *Colletotrichum lindemuthianum* is a seed borne disease and also penetrate the host through sexual fruiting bodies called perithecia. It has wide host ranges and it attacks all the aerial parts of the plant. The infection caused by *Colletotrichum lindemuthianun* produces dark brown eye shape and longitudinal lesions on the cotyledon and hypocotyl. During favourable conditions, the lesions may enlarge and break the stem which produces the brown spot on the under surface of the leaves at a later stage of the infection (Figure 2) (Agrios, 1997).

These fungal disease causes leaf spot and have become a major constraint in mung bean production in the humid ecology of Nigeria (Thakur *et al*., 1997). Although fungal disease incidence and severity can be reduced using integrated pest management strategy through the incorporation of crop rotation, crop hygiene, adequate spacing, adjustment in sowing date, use of pathogen free seeds, application of foliar fungicides and use of chemical seed treatment (Mayeux, 1990). This work aims at using some available botanical foliar sprays in reducing the incidence and severity of fungal diseases of mung bean in Uyo, South – South, Nigeria.

## MATERIALS AND METHODS

### Land preparation

A trial experiment was conducted during the month of April and July 2015 in Use-offot farm at the

**Table 1. Analysis and characterization of the experimental site**

| S.No. | Soil depth | 0 – 15cm | 15 – 30cm |
|---|---|---|---|
| 1 | Soil pH | 5.20 | 5.18 |
| 2 | Organic matter (%) | 2.69 | 2.18 |
| 3 | Total nitrogen (%) | 0.18 | 0.04 |
| 4 | Available phosphorus (mg/kg) | 339.99 | 285.62 |
| 5 | Electrical conductivity (Ec(cmol/kg) | 0.09 | 0.07 |
| 6 | Exchangeable base (Cmol/kg) | - | - |
| 7 | Calcium (Ca) | 0.72 | 0.62 |
| 8 | Sodium (Na) | 0.14 | 0.12 |
| 9 | Potassium (K) | 0.21 | 0.19 |
| 10 | Exchange acidity | 2.40 | 2.40 |
| 11 | Effective Cation Exchange Capacity (ECEC) | 5.40 | 5.72 |
| 12 | Base saturation (%) | 67.47 | 66.30 |
| 13 | Particle size analysis (%) | Loamy sand | Sandy loam |
| 14 | Sand | 76.40 | 62.10 |
| 15 | Silt | 9.20 | 10.80 |
| 16 | Clay | 14.40 | 27.10 |

**Table 2. Effect of botanical sprays on the growth parameters of mung bean at two WAT (Weeks After Treatment)**

| S.No. | Treatment | Number of branches/plant | Vine length/plant (cm) | Number of pods/plant |
|---|---|---|---|---|
| 1 | *S. alata* | 6.28±1.05 | 36.20±1.61 | 6.20±0.88 |
| 2 | *E. coccinea* | 8.64±0.08 | 28.45±1.22 | 9.10±1.01 |
| 3 | *A. indica* | 6.74±1.12 | 23.42±0.81 | 7.10±0.92 |
| 4 | *M. oleifera* | 6.29±0.19 | 38.51±1.33 | 5.20±0.78 |
| 5 | Control | 7.27±0.22 | 25.32±1.02 | 4.60±1.03 |
| 6 | LSD (P>0.05) | NS | 2.30 | 2.01 |

University of Uyo, Uyo, which is located between latitude 4º33' N and longitude 7º35' E and 8º25' E (Akwa Ibom State Government, 2001). Before the land preparation analysis and characterization of the soil were done, the soil samples were collected randomly from the experimental field and the samples were taken to soil science laboratory of the university to determine the properties and composition of the soil. The land was later cleared and bed manually. In all the experiments three replica were maintained and the test results were obtained and recorded as means.

**Figure 1. Healthy mung bean plant**

**Soil analysis**

The soil samples collected from the experimental site were taken to the laboratory as soon as it was collected to minimize changes in the concentrated extractable nutrients and some organic constituents. The samples were a dried warm by spreading out thin in a dry warm and highly ventilated room. Turning was done occasionally to expose new surface with a view to facilitate the drying process. Mortar and pestle was used to ground the sample. Also 2 mm sieve was used to sieve the samples and the sieved sample was stored for physicochemical analysis. 1g of 2mm mesh soil was measured and placed in a conical flask. 10ml of $HCLO_4$ and 20ml of nitric acid was added. It was digested at 1300c in a fume cupboard until the solution appeared colorless, with a slight increase in temperature. When the digestion was completed; it was taken to dryness. The flask was allowed to cool sufficiently to avoid spattering. 50ml of distilled water was added and filtered with Whatman filter paper. The digest was stored for the

**Table 3. Effect of botanical sprays on the growth parameters of mung bean at four WAT (Weeks After Treatment)**

| S.No. | Treatment | Number of branches/plant | Vine length/plant (cm) | Number of pods/plant |
|---|---|---|---|---|
| 1 | *S. alata* | 12.23±0.33 | 50.42±0.58 | 13.42±0.25 |
| 2 | *E. coccinea* | 18.62±0.80 | 45.0±0.11 | 19.20±0.39 |
| 3 | *A. indica* | 11.48±1.12 | 40.35±0.23 | 11.23±0.40 |
| 4 | *M. oleifera* | 13.38±0.45 | 51.22±0.43 | 12.82±0.08 |
| 5 | Control | 10.53±0.73 | 41.60±0.39 | 8.28±0.14 |
| 6 | LSD (P>0.05) | 1.0 | 4.30 | 2.10 |

**Table 4. Effect of plant botanicals on seed weight of mung bean at harvest**

| S. No | Treatment | Weight of seeds with pods (g) | Seed weight (without pod) (g) | Seed weight (t/ha) |
|---|---|---|---|---|
| 1 | *S. alata* | 344.53±1.02 | 209.33±0.99 | 1.05±0.05 |
| 2 | *E. coccinea* | 294.06±1.39 | 165.96±1.24 | 0.83±0.01 |
| 3 | *A. indica* | 218.53±1.77 | 126.73±1.16 | 0.635±0.07 |
| 4 | *M. oleifera* | 694.9±2.09 | 135.13±1.48 | 0.675±0.10 |
| 5 | Control | 225.56±1.85 | 135.5±0.74 | 0.68±0.11 |
| 6 | LSD (P<0.05) | 24.80 | 14.95 | 0.23 |

**Table 5. Effect of botanical foliar spray on the disease incidence of mung bean (2-8 WAT)**

| S. No | Treatments | 2 WAT | 4 WAT | 6 WAT | 8 WAT | Mean disease incidence (%) |
|---|---|---|---|---|---|---|
| 1 | *S. alata* | 2.22±0.19 | 5.18±0.33 | 18.25±0.10 | 28.62±0.44 | 13.56±0.01 |
| 2 | *E. coccinea* | 2.40±0.08 | 8.23±0.14 | 20.29±0.50 | 39.25±0.13 | 17.54±0.20 |
| 3 | *A. indica* | 0.00±0.01 | 2.42±0.22 | 6.80±0.31 | 15.29±0.06 | 6.12±0.08 |
| 4 | *M. oleifera* | 1.11±0.51 | 2.96±0.14 | 8.84±0.40 | 20.35±0.56 | 8.31±0.01 |
| 5 | Control | 8.74±0.22 | 28.44±0.09 | 40.36±0.11 | 63.65±0.17 | 35.30±0.40 |
| 6 | LSD (P>0.005) | 2.10 | 2.30 | 1.20 | 2.02 | - |

WAT = Weeks after treatment; Disease incidence = %

**Figure 2. Leaf spot of mung bean caused by fungi**

determination of soil physicochemical properties.

**Seed planting and agronomic practices**

Each bed measured 1m x 2m with a population of 54 seedlings treatment. Seeds were planted three per hole with the spacing of 30cm x 30cm between seeds and 1m between beds. The seedlings were later thinned down to one per stand for two weeks after emergence (Cheng, 1990). Other routine agronomic practices were also observed (Agugo and Opara, 2008).

**Preparation of the plant extracts**

Aqueous plant extracts were taken from neem leaves (*A. indica*), drum stick (*M. oleifera*), tassel flower (*E. coccinea*), and candle stick (*S. alata*) and the control used is a sterile distilled water. The leaves were

**Table 6. Effect of botanical spray on the disease severity of mung bean (2-8 WAT)**

| S. No | Treatments | 2 WAT | 4 WAT | 6 WAT | 8 WAT | Mean disease severity (%) |
|---|---|---|---|---|---|---|
| 1 | *S. alata* | 1 | 1 | 2 | 2 | 1.50 |
| 2 | *E. coccinea* | 1 | 1 | 2 | 3 | 1.75 |
| 3 | *A. indica* | 0.00 | 1 | 1 | 2 | 1 |
| 4 | *M. oleifera* | 1 | 1 | 1 | 2 | 1.25 |
| 5 | Control | 2 | 3 | 3 | 5 | 3.25 |

**Table 7. Effect of botanicals on fresh and dry biomass of mung bean**

| S. No | Treatments | Fresh biomass (g) | Dry biomass (g) |
|---|---|---|---|
| 1 | *S. alata* | 480.43±1.17 | 290.7±1.50 |
| 2 | *E. coccinea* | 367.23±1.88 | 131.16±1.22 |
| 3 | *A. indica* | 263.83±2.66 | 151.86±1.91 |
| 4 | *M. oleifera* | 341.73±1.95 | 195.43±2.00 |
| 5 | Control | 294.6±12.11 | 128.66±1.31 |
| 6 | LSD (P<0.05) | 28.44 | 13.91 |

washed, and air dried, they were later ground into powder using pestle and mortar. 70g of the grounded powder each was dissolved in 100ml of sterile distilled water separately in a conical flask and was left for 48hrs. Suspension of each of the plant extract was filtered using fold cheese cloth and the filtrate was used as foliar sprays (Wokocha, 1986). Application of the botanical foliar sprays were done by means of spraying the aqueous plant extracts with a hand sprayer on the leaves of mung bean until there was a run- off.

**Data collection and analysis**

Data were composed at two weeks halt after the assertion of treatment. This was finalized based on the following restraints; vine length (cm), number of branches per plant, number of pods per plant, weight of pods (g) and weight of seed per hectare (kg) Disease severity ratings were noted on a 0 – 5 scale:

0 = No disease symptoms

1 = Two or few spots are scattered on the leaf

2 = about ¼(25%) of the leaf is affected

3 = about ½(50%) of the leaf is affected

4 = about ¾(75%) of the leaf is affected

5 = Entire leaf surface is affected or leaf is almost dead (Opara and Agugo, 2014)

Data were collected after application of treatment at two weeks interval and this was done by obtaining the number of plants that were affected by the disease over the total number of sampled plant, multiplied by 100;

Using the formula:

$$\text{Percentage (\%)Disease incidence} = \frac{\text{Number of plant affected}}{\text{Total number of plant sampled}} \text{x } 100$$

(Wokocha (1986); Opara and Agugo (2014))

All data collected were scrutinized using analysis of variance (ANOVA), while cure means were divided using Fishers least significant difference (LSD) at 5% probability. Steel and Torre, (1981)

**RESULTS**

The result of soil analysis and characterization of the experimental site showed that, the overall fertility of the soil was low, pH was slightly acidic, nitrogen and potassium level was low. The particle size classification showed that the experimental site had sandy loam soil. (Table 1). The result in (Table 2) showed that *Moringa oleifera* (P>0.05) significantly increased the vine length of mung bean (38.51cm) when compared to the control treatment (25.32 cm), while *E. coccinea* increased pods number significantly (9.10) when compared to (4.60) recorded by the control treatment two weeks after the application of treatment. As sampled days increased (Table 3), *Emilia coccinea* was found to have produced the highest number of branches (18.62 cm) and the highest number of pods (19.20) when compared to (10.53cm) branches recorded by the control treatment and (8.28) number of pods respectively at four week after treatment.

The result of the effect of plant botanicals on the seed weight of mung bean harvest (Table 4) showed that *Senna alata* produce the highest seed weight (1 .05 t/ha)

**Figure 3. Mung bean spread with *A. indica***

followed by *Emilia coccinea* (0.83 t/ha). Table 4 also showed that the neem extract produced the least seed weight (0.635 t/ha). Table 5 showed that the neem extract performed better than all other extract used in this study with the mean disease incidence (6.12) when compared to the mean disease incidence of the control treatment (35.30). However, the results Table 5) also showed that all extracts used in this study were able to reduce the disease incidence and severity of mung bean in variable ways (Table 6) when compared to the control treatment. The result of the effect of botanicals sprays on fresh and dry biomass of mung bean plant showed that *S. alata* had the highest biomass (480.43g) and (290.7g) at fresh and dry biomass respectively (Table 7)

## DISCUSSION

From the results, it is proved that all the plant extracts used as foliar sprays in this study had the potential to reduce disease incidence and severity of fungal disease of *V. radiata* when compared to the control. *A. indica* leaves proved to be the most superior because it inhibited the fungal leaf spot of mung bean. This confirmed the antifungal potential of *A. indica* in the work done by Koki and Tajul (2003) where extracts of *A. indica* was used to prevent the growth of *Aspergillus niger* in grapes. *A. indica* has proven to be one of the most promising plants for consideration as potential grain protectant and the oil spray can help preventing fungal and bacterial diseases of crops (William, 2005) (Figure 3). However, according to William (2005), plant extract produce systemic action like some known fungicides and bactericides and had significant effect on the pathogen which in turns lead significantly increased plant growth parameters and improved yield. Balm, (2003); Koki and Tajul, (2003) demonstrated the inhibition of bacteria disease and control of the pathogen in the potted *V. radiata*. This work also agreed with the work of Opara and Agugo (2014) that *A. indica* proved to be superior in controlling bacterial disease incidence and severity of *V. radiata*.

Various earlier researchers have also emphasized on the advantage band fungicidal potentials of botanicals in controlling plant diseases (Opara and Agugo, 2014). Although chemical fungicides may produce dramatic and effective control in fungal diseases, but the hazards which they pose to the environment and their bio-accumulation in food chain tends to discourage farmers (Pflerger, 2008). Thus, to ensure pollution free environment, the use of plant extracts as the cheaper and readily available control measures should be encouraged by resource poor farmers.

## CONCLUSION

Mung bean unlike many other legumes is subjected to myriad of fungal diseases which reduce its nutritional and market value and thus makes the crop less appreciated by its consumers. From our findings, all the extract used as foliar sprays in this study possesses antifungal potential in reducing the diseased incidence of *Vigina radiata*. *A. indica* proved to be the most superior by expressing its legendary effects in inhibiting the fungal disease of mung bean more than any other extract used in the study. The use of synthetic fungicides may produce an immediate or dramatic effects, but the threat it poses to the environment and its bioaccumulation in food chain in a process called biological magnification leads to a search and research into an alternative means of plant disease control by farmers and researchers; a means that is cheap, available and pollution free environment. These extracts should be used by researchers and resource poor farmers to justify the antifungal potentials of these extract which will encourage the general acceptability of botanicals over the synthetic fungicides.

## REFERENCES

**Agrios GN. 1997.** Plant pathology. 4th ed. Academic

press San Diego, CA. 635 p.

**Agugo BAC and Opara EU. 2008.** Agro-ecological suitability assessment of the lowland rain forest belt of south Eastern Nigeria for mung bean production II temperature, Relative humidity and wind. *Green Farming Journal,* 2(4): 206-210.

**Akwa Ibom State Government. 2001.** A Publication of Ministry of Information Uyo. Akwa Ibom State.

**[AVRDC] Asian Vegetable Research and Development Centre. 2002.** High Yielding MYMV- resistant mung bean times for South Asia. AVRDC Publications. No.02, 542 p.

**Balm A. 2003.** Neem; a therapeutic for all seasons. *Current Science,* 82(11): 1304-1312.

**Berger RD. 1977.** Application of Epidemiological principles to achieve plant disease control. *Animal Review of Phytopathology,* 15: 165-183.

**Cheng X. 1990.** The 17th international mung bean nursery in: training report 9th regional course in mung bean production and research, Kasefart University Bangkok, Thailand. 11-16 p.

**Duke JA. 1983.** Handbook of legumes of World Economic Important. Prenum press, New York. 221 p.`

**Koki T and Tajul MD. 2003.** The study of bacterial wilts of tomato suppressed by poultry and farmyard manure and their high microbial activities. Vegetable Garden: 144-152 p.

**Mayeux A. 1990.** Mung bean prospect for cultivation in Botswana. *The Bulletin of Agricultural Research in Botswana,* 8: 5-9 p.

**Opara EU and Agugo BAC. 2014.** Application of organic amendment and botanical foliar sprays against bacterial diseases of mung bean (*Vigna radiata* L.) in South Eastern Nigeria. *Greener Journal of Agricultural Sciences,* 4(2): 052-057.

**Pflerger FL. 2008.** Bacterial leaf diseases of foliage plants, plant pathology, Regents of the University of Minnesota Extension. Available from: https://www.extension.umn.edu/garden/yard-garden/houseplants/bacterial-leaf-diseases-of-foliage-plants/

**Steel RC and Torre TH. 1981.** Principles and procedures for statistics. Macmillian press, New york. 34 p.

**Thakur PR, Patel PN and Verma JP. 1997.** Genetic relationship between reactions to bacterial leaf spot diseases of mung bean (*V. radiata* L.). *Euphytica,* 26: 765–774.

**Williams Q. 2005.** Control of soil borne pathogens, Bio-integral Resource Centre (BIRC) Berkely. California. 215-220.

**Wokocha RC, Ebenebe AC and Erinle ID. 1986.** Biological control of the basal stem rot of disease of tomato caused by *Coticium rolfsii*. (Sacc) Curzi in Northern Nigeria. *Tropical Pest Management,* 32(1): 35 -39.