Incidence of cassava mosaic disease and associated whitefly vectors in South West and North Central Nigeria: Data exploration

Angela O. Eni, Oghenevwairhe P. Efekemo, Mojisola G. Soluade, Segun I. Popoola, Aderemi A. Atayero

Department of Biological Sciences, Covenant University, Ota, Nigeria
West African Virus Epidemiology (WAVE) for root and tuber crops, Covenant University Hub, Ota, Nigeria
Department of Electrical and Information Engineering, Covenant University, Ota, Nigeria
IoT-Enabled Smart and Connected Communities (SmartCU) Research Cluster, Covenant University, Ota, Nigeria

Abstract

Cassava mosaic disease (CMD) is one of the most economically important viral diseases of cassava, an important staple food for over 800 million people in the tropics. Although several Cassava mosaic virus species associated with CMD have been isolated and characterized over the years, several new super virulent strains of these viruses have evolved due to genetic recombination between diverse species. In this data article, field survey data collected from 184 cassava farms in 12 South Western and North Central States of Nigeria in 2015 are presented and extensively explored. In each State, one cassava farm was randomly selected as the first farm and subsequent farms were selected at 10 km intervals, except in locations where cassava farms are sporadically located. In each selected farm, 30 cassava plants were sampled along two diagonals and all selected plant was scored for the presence or absence of CMD symptoms. Cassava mosaic disease incidence and associated whitefly vectors in South West and North Central Nigeria are explored using relevant descriptive statistics, box plots, bar charts, line graphs, and pie charts. In addition, correlation analysis, Analysis of Variance (ANOVA), and multiple comparison post-hoc tests are performed to understand the relationship between the numbers of...
whiteflies counted, uninfected farms, infected farms, and the mean of symptom severity in and across the States under investigation. The data exploration provided in this data article is considered adequate for objective assessment of the incidence and symptom severity of cassava mosaic disease and associated whitefly vectors in farmers’ fields in these parts of Nigeria where cassava is heavily cultivated.

© 2018 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).

Specifications Table

| Subject area                              | Biological Science |
|-------------------------------------------|--------------------|
| More specific subject area                | Cassava Virus Epidemiology |
| Type of data                              | Tables, graphs, figures, and spreadsheet file |
| How data was acquired                     | Cassava farms located along major and intermediate roads in all the State in the South West and North Central Nigeria were surveyed. In each State, one cassava farm was randomly selected as the first farm and subsequent farms were selected at 10 km intervals, except in locations where cassava farms are sporadically located. In each selected farm, 30 cassava plants were sampled along two diagonals and all selected plant was scored for the presence or absence of CMD symptoms. |
| Data format                               | Raw, analyzed |
| Experimental factors                      | Field survey data collected from 184 cassava farms in 12 South Western and North Central States of Nigeria in 2015 are presented and extensively explored |
| Experimental features                     | Cassava mosaic disease incidence and associated whitefly vectors in South West and North Central Nigeria are explored using relevant descriptive statistics, box plots, bar charts, line graphs, and pie charts. In addition, correlation analysis, ANOVA, and multiple comparison post-hoc tests are performed. |
| Data source location                      | 184 cassava farms in 12 South Western and North Central States of Nigeria |
| Data accessibility                        | A comprehensive dataset is presented in Microsoft Excel spreadsheet and attached to this data article as supplementary material |

Value of the data

- In addition to its significance as source of food and animal feed, cassava is increasingly becoming an important raw material for several industries including biofuel producing industries [1,2]. Therefore, addressing the incidence of cassava mosaic disease and associated whitefly vectors is considered pivotal to the realization of the Sustainable Development Goals (SDGs) numbers 1–3 (i.e. no poverty, zero hunger, and good health and well-being) by 2030 [3,4].
- Nigeria is the highest producer of cassava globally and the plant is heavily cultivated in the South Western and North Central States of Nigeria [5,6]. The data provided in this data article will help in tackling the challenges of cassava mosaic disease and associated whitefly vectors in South West and North Central Nigeria. This solution will help the country to harness the potentials of cassava as an important source of foreign exchange.
- The data exploration and the statistical analyses provided in this data article are considered adequate for objective assessment of the incidence and symptom severity of cassava mosaic disease and associated whitefly vectors in farmers’ fields in these parts of Nigeria where cassava is heavily cultivated [7–9].
- The data presented in this article will encourage reproducible research and open new doors of research collaborations towards finding effective solutions to deal with the evolution of new super virulent strains of cassava mosaic viruses.
Table 1
Descriptive statistics of counted whiteflies in 184 farms in 12 Nigerian States.

| State  | Mean | Median | Mode | Standard deviation | Variance | Kurtosis | Skewness | Range | Min | Max | Sum |
|--------|------|--------|------|-------------------|----------|----------|----------|-------|-----|-----|-----|
| Benue  | 0.67 | 0.00   | 0    | 2.19              | 4.78     | 18.35    | 3.96     | 11    | 0   | 11  | 20  |
| Ekiti  | 5.45 | 5.00   | 0    | 6.02              | 36.27    | 2.13     | 0.66     | 17    | 0   | 17  | 60  |
| Kogi   | 0.00 | 0.00   | 0    | 0.00              | 0.00     | N/A      | N/A      | 0     | 0   | 0   | 0   |
| Kwara  | 7.75 | 2.00   | 0    | 10.02             | 100.39   | 2.84     | 1.00     | 30    | 0   | 30  | 93  |
| Lagos  | 14.67| 0.00   | 0    | 25.40             | 645.33   | 1.50     | 0.71     | 44    | 0   | 44  | 44  |
| Nassarawa | 0.20 | 0.00   | 0    | 0.42              | 0.18     | 3.25     | 1.50     | 1     | 0   | 1   | 2   |
| Niger  | 0.23 | 0.00   | 0    | 0.44              | 0.19     | 2.63     | 1.28     | 1     | 0   | 1   | 3   |
| Ogun   | 10.29| 1.50   | 0    | 16.80             | 282.29   | 5.40     | 1.86     | 62    | 0   | 62  | 288 |
| Ondo   | 9.67 | 7.00   | 0    | 9.71              | 94.38    | 2.65     | 0.94     | 29    | 0   | 29  | 145 |
| Osun   | 2.75 | 2.00   | 0    | 3.08              | 9.48     | 2.40     | 0.75     | 9     | 0   | 9   | 33  |
| Oyo    | 3.67 | 0.00   | 0    | 8.44              | 71.19    | 10.21    | 2.74     | 36    | 0   | 36  | 88  |
| Plateau| 0.00 | 0.00   | 0    | 0.00              | 0.00     | N/A      | N/A      | 0     | 0   | 0   | 0   |

Table 2
Descriptive statistics of uninfected cassava plants cassava plants in 184 farms in 12 Nigerian States.

| State  | Mean | Median | Mode | Standard deviation | Variance | Kurtosis | Skewness | Range | Min | Max | Sum |
|--------|------|--------|------|-------------------|----------|----------|----------|-------|-----|-----|-----|
| Benue  | 12.33| 12.50  | 17   | 6.09              | 37.13    | 3.22     | 0.42     | 27    | 2   | 29  | 370 |
| Ekiti  | 16.55| 16.00  | 12   | 5.35              | 28.67    | 2.11     | 0.18     | 18    | 8   | 26  | 182 |
| Kogi   | 21.19| 26.00  | 28   | 9.60              | 92.16    | 3.08     | -1.07    | 30    | 0   | 30  | 339 |
| Kwara  | 15.58| 14.50  | 6    | 7.77              | 60.45    | 2.42     | 0.59     | 24    | 6   | 30  | 187 |
| Lagos  | 22.67| 22.00  | 22   | 1.15              | 1.33     | 1.50     | 0.71     | 2     | 22  | 24  | 68  |
| Nassarawa | 20.90| 21.00  | 20   | 8.37              | 70.10    | 2.53     | -0.75    | 25    | 5   | 30  | 209 |
| Niger  | 18.69| 20.00  | 30   | 9.74              | 94.90    | 1.62     | -0.31    | 25    | 5   | 30  | 243 |
| Ogun   | 15.11| 14.50  | 10   | 6.64              | 44.03    | 2.46     | 0.32     | 27    | 3   | 30  | 423 |
| Ondo   | 17.13| 16.00  | 16   | 7.36              | 54.12    | 2.23     | 0.67     | 22    | 8   | 30  | 257 |
| Osun   | 19.33| 18.50  | 15   | 4.87              | 23.70    | 2.46     | 0.73     | 15    | 13  | 28  | 232 |
| Oyo    | 15.25| 15.50  | 1    | 9.56              | 91.41    | 1.86     | -0.09    | 30    | 0   | 30  | 366 |
| Plateau| 25.78| 30.00  | 30   | 6.04              | 36.44    | 2.23     | -0.95    | 15    | 15  | 30  | 232 |

Fig. 1. Distribution of 184 cassava farms surveyed in 12 South Western and North Central States of Nigeria in 2015.
Cassava is a major staple food for millions of people in Nigeria and Africa at large. The plant is drought tolerant, grows in all agro-ecological zones in Nigeria and is one of the highest producing crops in terms of carbohydrate produced per hectare [10]. Beyond its use for food and animal feed, cassava is increasingly becoming a crucial raw material for several industries including biofuel producing industries. Cassava therefore has the potentials to become an important source of foreign exchange for Nigeria which is the highest producer of cassava globally [11]. This important plant is however plagued by several viral diseases which threaten its production and productivity. Cassava mosaic disease (CMD), one of the most economically important cassava virus disease, is wide spread in all areas where cassava is grown [12]. The virus is either seed

1. Data

Cassava is a major staple food for millions of people in Nigeria and Africa at large. The plant is drought tolerant, grows in all agro-ecological zones in Nigeria and is one of the highest producing crops in terms of carbohydrate produced per hectare [10]. Beyond its use for food and animal feed, cassava is increasingly becoming a crucial raw material for several industries including biofuel producing industries. Cassava therefore has the potentials to become an important source of foreign exchange for Nigeria which is the highest producer of cassava globally [11]. This important plant is however plagued by several viral diseases which threaten its production and productivity. Cassava mosaic disease (CMD), one of the most economically important cassava virus disease, is wide spread in all areas where cassava is grown [12]. The virus is either seed

Table 3
Descriptive statistics of infected cassava plants.

| State   | Mean | Median | Mode | Standard deviation | Variance | Kurtosis | Skewness | Range | Min | Max | Sum |
|---------|------|--------|------|-------------------|----------|----------|----------|-------|-----|-----|-----|
| Benue   | 17.67| 17.50  | 13   | 6.09              | 37.13    | 3.22     | −0.42    | 27    | 1   | 28  | 530 |
| Ekiti   | 13.45| 14.00  | 18   | 5.35              | 28.67    | 2.11     | −0.18    | 18    | 4   | 22  | 148 |
| Kogi    | 8.81 | 4.00   | 0    | 9.60              | 92.16    | 3.08     | 1.07     | 30    | 0   | 30  | 141 |
| Kwara   | 14.42| 15.50  | 15   | 7.77              | 60.45    | 2.42     | −0.59    | 24    | 0   | 24  | 173 |
| Lagos   | 7.33 | 8.00   | 8    | 1.15              | 1.33     | 1.50     | −0.71    | 2     | 6   | 8   | 22  |
| Nassarawa | 9.10 | 9.00   | 10   | 8.37              | 70.10    | 2.53     | 0.75     | 25    | 0   | 25  | 91  |
| Niger   | 11.31| 10.00  | 0    | 9.74              | 94.90    | 1.62     | 0.31     | 25    | 0   | 25  | 147 |
| Ogun    | 14.89| 15.50  | 20   | 6.64              | 44.03    | 2.46     | −0.32    | 27    | 0   | 27  | 417 |
| Ondo    | 12.87| 14.00  | 0    | 7.36              | 54.12    | 2.23     | −0.67    | 22    | 0   | 22  | 193 |
| Osun    | 10.67| 11.50  | 2    | 4.87              | 23.70    | 2.46     | −0.73    | 15    | 2   | 17  | 128 |
| Oyo     | 14.79| 14.50  | 9    | 9.60              | 92.09    | 1.84     | 0.09     | 30    | 0   | 30  | 355 |
| Plateau | 4.89 | 0.00   | 0    | 6.21              | 38.61    | 1.69     | 0.59     | 15    | 0   | 15  | 44  |

Fig. 2. Percentage contribution of each states to the 184 cassava farms covered in this study.
transmitted or transmitted by whitefly vectors [13]. A diversity of cassava mosaic virus species associated with CMD have been isolated and characterized over the years. However, several new super virulent strains of these viruses have evolved over the years due to genetic recombination between diverse species [14]. This data article seeks to evaluate the incidence and symptom severity of cassava mosaic disease and associated whitefly vectors in farmers' fields in South West and North Central Nigeria where cassava is heavily cultivated.

2. Experimental design, materials and methods

Cassava farms located along major and intermediate roads in all the State in the South West and North Central Nigeria were surveyed. The distribution of 184 cassava farms surveyed in 12 South Western and North Central States of Nigeria in 2015 is shown in Fig. 1. In each State, one cassava farm was randomly selected as the first farm and subsequent farms were selected at 10 km intervals except in locations where cassava farms are sporadically located. In each selected farm, 30 cassava plants were sampled along two diagonals and all selected plants were scored for the presence or absence of cassava mosaic disease (CMD) symptoms. Where present, CMD symptom severity was then scored on a scale of 2–5, with 2 indicating mild symptom and 5 indicating very severe symptom covering over 75% of the infected plant. A score of 1 was assigned for none symptomatic plants. The whiteflies present in the top five leaves of each sampled plant were also counted and recorded, to determine the abundance of these CMD vector across the States.
3. Data exploration

Tables 1–4 present the descriptive statistics (mean, median, mode, standard deviation, variance, kurtosis, Skewness, range, minimum value, maximum value, and the sum) of whiteflies counted, uninfected cassava plants, infected cassava plants, and mean of symptom severity in 184 cassava farms in 12 South Western and North Central States of Nigeria in 2015. The percentage contribution of each of the 12 States is shown in Fig. 2.

Figs. 3–14 give comprehensive information about the whiteflies counted, uninfected cassava plants, infected cassava plants, and mean of symptom severity in 184 cassava farms in Benue, Ekiti, Kogi, Kwara, Lagos, Nassarawa, Niger, Ogun, Ondo, Osun, Oyo, and Plateau States respectively.

Boxplot representations of the numbers of whiteflies counted, uninfected cassava plants, infected cassava plants, and mean of symptom severity in 184 cassava farms across the 12 States of Nigeria are shown in Figs. 15–18 respectively. The boxplot representations allow visual and statistical comparisons of the data distributions in terms of quartiles.

![Boxplot](image-url)

Fig. 4. Bar chart showing information about the abundance whiteflies on 11 cassava farms in Ekiti State.
Fig. 5. Bar chart showing information about whiteflies on cassava farms in Kogi State.

Fig. 6. Bar chart showing information about whiteflies on cassava farms in Kwara State.
Fig. 7. Bar chart showing information about the abundance of whiteflies on cassava farms in 3 Lagos State.

Fig. 8. Bar chart showing information about the abundance of whiteflies on 10 cassava farms in Nassarawa State.
Fig. 9. Bar chart showing information about the abundance of whiteflies on 13 cassava farms in Niger State.

Fig. 10. Bar chart showing information about the abundance of whiteflies on 28 cassava farms in Ogun State.
Fig. 11. Bar chart showing information about the abundance whiteflies on 15 cassava farms in Ondo State.

Fig. 12. Bar chart showing information about the abundance whiteflies on 12 cassava farms in Osun State.
Fig. 13. Bar chart showing information about the abundance whiteflies on 24 cassava farms in Oyo State.

Fig. 14. Bar chart showing information about the abundance whiteflies on 9 cassava farms in Plateau State.
Table 4
Descriptive statistics of mean of symptom severity.

| State     | Mean  | Median | Mode | Standard deviation | Variance | Kurtosis | Skewness | Range | Min | Max | Sum  |
|-----------|-------|--------|------|--------------------|----------|----------|----------|-------|-----|-----|------|
| Benue     | 2.69  | 2.60   | 2.5  | 0.35               | 0.12     | 2.73     | 0.47     | 1.52  | 2   | 3.52| 80.60|
| Ekiti     | 3.13  | 3.25   | 3.5  | 0.37               | 0.14     | 1.71     | -0.42    | 1.01  | 2.55| 3.56| 34.38|
| Kwara     | 2.01  | 2.24   | 0    | 1.07               | 1.14     | 2.92     | -1.11    | 3.17  | 0   | 3.17| 32.20|
| Lagos     | 2.60  | 2.80   | 2    | 0.53               | 0.28     | 1.50     | -0.60    | 1.00  | 2   | 3.00| 7.80 |
| Nassarawa | 2.39  | 2.80   | 2.8  | 1.06               | 1.12     | 3.76     | -1.43    | 3.50  | 0   | 3.50| 23.92|
| Niger     | 2.30  | 2.75   | 0    | 1.38               | 1.89     | 2.37     | -0.96    | 3.76  | 0   | 3.76| 29.93|
| Ogun      | 2.56  | 2.67   | 2    | 0.61               | 0.37     | 12.37    | -2.72    | 3.17  | 0   | 3.17| 71.73|
| Ondo      | 2.37  | 2.73   | 0    | 1.00               | 1.00     | 4.86     | -1.84    | 3.18  | 0   | 3.18| 35.55|
| Osun      | 2.81  | 2.75   | 2.5  | 0.31               | 0.10     | 1.65     | 0.32     | 0.90  | 2.43| 3.33| 33.67|
| Oyo       | 2.44  | 2.53   | 0    | 0.90               | 0.80     | 5.96     | -1.31    | 4.31  | 0   | 4.31| 58.65|
| Plateau   | 1.94  | 1.00   | 1    | 1.21               | 1.47     | 1.58     | 0.59     | 2.86  | 1   | 3.86| 17.44|

Fig. 15. Boxplot representation of no. of whiteflies counted in 184 cassava farms across the 12 Nigerian States.

Fig. 16. Boxplot representation of no. of uninfected cassava plants in 184 cassava farms sampled across 12 Nigerian States.
Fig. 17. Boxplot representation of no. of infected cassava plants in 184 cassava farms sampled across 12 Nigerian States.

Fig. 18. Boxplot representation of mean of Cassava mosaic virus symptom severity across 12 Nigerian States.

Table 5

|                  | Whiteflies Counted | No. of uninfected farms | No. of infected farms | Mean of symptom severity |
|------------------|--------------------|-------------------------|-----------------------|--------------------------|
| Whiteflies counted| 1.0000             | −0.0245                 | 0.0225                | 0.1401                   |
| No. of uninfected plants | −0.0245         | 1.0000                  | −0.9985               | −0.5853                  |
| No. of infected plants  | 0.0225           | −0.9985                | 1.0000                | 0.5852                   |
| Mean of symptom severity | 0.1401       | −0.5853                 | 0.5852                | 1.0000                   |
Table 8
Multiple comparison post-hoc test results for whiteflies counted in 184 farms in 12 Nigerian States.

| Groups compared | Lower limits for 95% confidence intervals | Mean difference | Upper limits for 95% confidence intervals | p-value |
|-----------------|------------------------------------------|----------------|------------------------------------------|---------|
| Benue           | –15.0550                                  | –4.7879        | 5.4792                                   | 0.9343  |
| Benue           | –8.3505                                   | 0.6667         | 9.6838                                   | 0.1000  |
| Benue           | –17.0325                                  | –7.0833        | 2.8658                                   | 0.4573  |
| Benue           | –31.6379                                  | –14.0000       | 3.6379                                   | 0.2829  |
| Benue           | –10.1694                                  | 0.4667         | 11.1027                                  | 1.0000  |
| Benue           | –10.9771                                  | –3.0000        | 7.8658                                   | 0.9999  |
| Benue           | –10.4037                                  | 0.0000         | 11.7370                                  | 0.9867  |
| Ekiti           | –5.9542                                   | 0.6667         | 11.7370                                  | 0.9000  |
| Ekiti           | –14.4542                                  | –2.2955        | 9.8633                                   | 0.1000  |
| Ekiti           | –28.1844                                  | –9.2121        | 9.7601                                   | 0.9143  |
| Ekiti           | –7.4724                                   | 5.2545         | 17.9815                                  | 0.9725  |
| Ekiti           | –6.7092                                   | 5.2238         | 17.1568                                  | 0.9577  |
| Ekiti           | –15.1962                                  | –4.8312        | 5.5338                                   | 0.9345  |
| Ekiti           | –15.7748                                  | –4.2121        | 7.3505                                   | 0.9898  |
| Ekiti           | –9.4542                                   | 2.7045         | 14.8633                                  | 0.9999  |
| Ekiti           | –8.8179                                   | 1.7879         | 12.3937                                  | 1.0000  |
| Ekiti           | –7.6376                                   | 5.4545         | 18.5466                                  | 0.9706  |
| Kogi            | –18.8735                                  | –7.7500        | 3.3735                                   | 0.4932  |
| Kogi            | –32.9927                                  | –14.6667       | 3.6594                                   | 0.2707  |
| Kogi            | –11.9419                                  | –0.2000        | 11.5419                                  | 1.0000  |
| Kogi            | –11.1070                                  | –0.2308        | 10.6455                                  | 1.0000  |
| Kogi            | –19.4142                                  | –10.2857       | –1.1572                                  | 0.0124  |
| Kogi            | –20.1352                                  | –9.6667        | 0.819                                    | 0.1033  |
| Kogi            | –13.8735                                  | –2.7500        | 8.3735                                   | 0.9997  |
| Kogi            | –13.0677                                  | –3.6667        | 5.7344                                   | 0.9823  |
| Kogi            | –12.1367                                  | 0.0000         | 12.1367                                  | 1.0000  |
| Kogi            | –25.7188                                  | –6.9167        | 11.8854                                  | 0.9889  |
| Kogi            | –4.9219                                   | 7.5500         | 20.0219                                  | 0.7084  |
| Kogi            | –4.1413                                   | 7.3192         | 19.1798                                  | 0.6175  |
Correlation analysis, ANOVA, and multiple comparison post-hoc tests were performed to understand the relationship between the numbers of whiteflies counted, uninfected cassava plants, infected cassava plants, and the mean of symptom severity in and across the States under investigation. Correlation coefficient matrix and the p-value computed using the field data are presented in Table 5 and Table 6 respectively. Tables 7–14 give the results of the ANOVA and multiple comparison post-hoc tests for whiteflies counted, uninfected cassava farms, infected cassava farms, and mean of symptom severity across the 12 States of Nigeria. Figs. 19–22 show the mean comparisons of the four parameters for easy data interpretations.

Table 8 (continued)

| Groups compared | Lower limits for 95% confidence intervals | Mean difference | Upper limits for 95% confidence intervals | p-value |
|-----------------|------------------------------------------|----------------|----------------------------------------|---------|
| Kwara Ogun      | −12.5859                                 | −2.5357        | 7.5144                                  | 0.9996  |
| Kwara Ondo      | −13.1979                                 | −1.9167        | 9.3646                                  | 1.0000  |
| Kwara Osun      | −6.8915                                  | 5.0000         | 16.8915                                 | 0.9685  |
| Kwara Plateau   | −6.2150                                  | 4.0833         | 14.3817                                 | 0.9798  |
| Kwara Plateau   | −5.9043                                  | 7.7500         | 20.5943                                 | 0.7128  |
| Lagos Nassarawa | −4.7078                                  | 14.4667        | 33.6411                                 | 0.3618  |
| Lagos Niger     | −4.2210                                  | 14.4359        | 33.0928                                 | 0.3218  |
| Lagos Ogun      | −13.3142                                 | 4.3810         | 22.0761                                 | 0.9997  |
| Lagos Ondo      | −13.4222                                 | 5.0000         | 23.4222                                 | 0.9992  |
| Lagos Osun      | −6.8854                                  | 11.9167        | 30.7188                                 | 0.6435  |
| Lagos Oyo       | −6.8372                                  | 11.0000        | 28.8372                                 | 0.6830  |
| Lagos Plateau   | −4.7521                                  | 14.6667        | 34.0854                                 | 0.3601  |
| Nassarawa Niger | −12.2827                                 | −0.0308        | 12.2212                                 | 1.0000  |
| Nassarawa Ogun  | −20.8163                                 | −10.0857       | 0.6449                                  | 0.0891  |
| Nassarawa Ondo  | −21.3582                                 | −9.4667        | 2.4248                                  | 0.2785  |
| Nassarawa Osun  | −15.0219                                 | −2.5500        | 9.9219                                  | 1.0000  |
| Nassarawa Oyo   | −14.4301                                 | −3.4667        | 7.4967                                  | 0.9970  |
| Nassarawa Plateau | −13.1834                        | 0.2000       | 13.5834                                 | 1.0000  |
| Niger Ogun      | −19.8308                                 | −10.0549       | 0.2791                                  | 0.0373  |
| Niger Ondo      | −20.4735                                 | −9.4359        | 1.6017                                  | 0.1824  |
| Niger Osun      | −14.1798                                 | −2.5192        | 9.1413                                  | 0.9999  |
| Niger Oyo       | −13.4667                                 | −3.4359        | 6.5949                                  | 0.9939  |
| Niger Plateau   | −12.4000                                 | 0.2308         | 12.8616                                 | 1.0000  |
| Ogun Ondo       | −8.7011                                  | 0.6190         | 9.9392                                  | 1.0000  |
| Ogun Osun       | −2.5144                                  | 7.5357         | 17.5859                                 | 0.3719  |
| Ogun Oyo        | −1.4836                                  | 6.6190         | 14.7217                                 | 0.2415  |
| Ogun Plateau    | −0.8755                                  | 10.2857        | 21.4470                                 | 0.1050  |
| Ondo Osun       | −4.3646                                  | 6.9167         | 18.1979                                 | 0.6911  |
| Ondo Oyo        | −3.5872                                  | 6.0000         | 15.5872                                 | 0.6621  |
| Ondo Plateau    | −2.6148                                  | 9.6667         | 21.9481                                 | 0.2955  |
| Osun Oyo        | −11.2150                                 | −0.9167        | 9.3817                                  | 1.0000  |
| Osun Plateau    | −10.0943                                 | 2.7500         | 15.5943                                 | 0.9999  |
| Oyo Plateau     | −7.7186                                  | 3.6667         | 15.0519                                 | 0.9964  |

Table 9
ANOVA test results for number of uninfected cassava plants in 184 farms in 12 Nigerian States.

| Source of variation | Sum of squares | Degree of freedom | Mean squares | F statistic | Prob > F |
|---------------------|----------------|------------------|--------------|------------|----------|
| Columns             | 2178.73        | 11               | 198.067      | 3.46       | 0.0002   |
| Error               | 9784.22        | 171              | 57.218       |            |          |
| Total               | 11962.95       | 182              |              |            |          |
Table 10
Multiple comparison post-hoc test results for number of uninfected cassava plants in 184 farms in 12 Nigerian States.

| Groups compared | Lower limits for 95% confidence intervals | Mean difference | Upper limits for 95% confidence intervals | p-value |
|-----------------|--------------------------------------------|-----------------|------------------------------------------|---------|
| Benue           | -12.9254                                  | -4.2121         | 4.5012                                   | 0.9167  |
| Benue           | -16.5067                                  | -8.8542         | -1.2016                                  | 0.0086  |
| Benue           | -11.6935                                  | -3.2500         | 5.1935                                   | 0.9840  |
| Benue           | -23.3020                                  | -10.3333        | 4.6353                                   | 0.5085  |
| Benue           | -17.9531                                  | -8.5667         | 0.4598                                   | 0.0819  |
| Benue           | -14.5672                                  | -6.3590         | 1.8493                                   | 0.3199  |
| Benue           | -9.2694                                   | -2.7738         | 3.7218                                   | 0.9647  |
| Benue           | -12.6171                                  | -4.8000         | 3.0171                                   | 0.6891  |
| Benue           | -15.4435                                  | -7.0000         | 1.4435                                   | 0.2214  |
| Benue           | -9.6865                                   | -2.9167         | 3.8532                                   | 0.9623  |
| Benue           | -22.8395                                  | -13.4444        | -4.0494                                  | 0.0002  |
| Ekiti           | -14.3242                                  | -4.6420         | 5.0401                                   | 0.9210  |
| Ekiti           | -9.3566                                   | 0.9621          | 11.2808                                  | 1.0000  |
| Ekiti           | -22.2223                                  | -6.1212         | 9.9799                                   | 0.9855  |
| Ekiti           | -15.1555                                  | -4.3545         | 6.4646                                   | 0.9771  |
| Ekiti           | -12.2740                                  | -2.1469         | 7.9802                                   | 0.9999  |
| Ekiti           | -7.3581                                   | 1.4383          | 10.2347                                  | 0.0000  |
| Ekiti           | -10.4007                                  | -0.5879         | 9.2249                                   | 1.0000  |
| Ekiti           | -13.1066                                  | -2.7879         | 7.5308                                   | 0.9993  |
| Ekiti           | -7.7053                                   | 1.2955          | 10.2962                                  | 1.0000  |
| Ekiti           | -20.3431                                  | -9.2323         | 1.8785                                   | 0.2183  |
| Kogi            | -3.8359                                   | 5.6042          | 15.0443                                  | 0.7339  |
| Kogi            | -17.0318                                  | -1.4792         | 14.0735                                  | 1.0000  |
| Kogi            | -9.6774                                   | 0.2875          | 10.2524                                  | 1.0000  |
| Kogi            | -6.7351                                   | 2.4952          | 11.7255                                  | 0.9993  |
| Kogi            | -1.6667                                   | 6.0804          | 13.8274                                  | 0.2998  |
| Kogi            | -4.8301                                   | 4.0542          | 12.9385                                  | 0.9433  |
| Kogi            | -7.5859                                   | 1.8542          | 11.2943                                  | 1.0000  |
| Kogi            | -2.0408                                   | 5.9375          | 13.9158                                  | 0.3841  |
| Kogi            | -14.3903                                  | -4.5903         | 5.7097                                   | 0.9520  |
| Kwara           | -23.0400                                  | -7.0833         | 8.8733                                   | 0.9533  |
| Kwara           | -15.9011                                  | -5.3167         | 5.2678                                   | 0.8938  |
| Kwara           | -13.0049                                  | -3.1090         | 6.7869                                   | 0.9971  |
| Kwara           | -8.0530                                   | 0.4762          | 9.0054                                   | 1.0000  |
| Kwara           | -11.1240                                  | -1.5500         | 8.0240                                   | 1.0000  |
| Kwara           | -13.8419                                  | -3.7500         | 6.3419                                   | 0.9880  |
| Kwara           | -8.4065                                   | 0.3333          | 9.0732                                   | 1.0000  |
| Kwara           | -21.0949                                  | -10.1944        | 0.7060                                   | 0.0929  |
| Lagos           | -14.5060                                  | 1.7667          | 18.0393                                  | 1.0000  |
| Lagos           | -11.8591                                  | 3.9744          | 19.0878                                  | 0.9996  |
| Lagos           | -7.4577                                   | 7.5595          | 22.5767                                  | 0.8923  |
| Lagos           | -10.1009                                  | 5.5333          | 21.1676                                  | 0.9920  |
| Lagos           | -12.6233                                  | 3.3333          | 19.2900                                  | 0.9999  |
| Lagos           | -7.7211                                   | 7.4167          | 22.5545                                  | 0.9092  |
| Lagos           | -19.5911                                  | -3.1111         | 13.3689                                  | 1.0000  |
| Nassarawa       | -8.1901                                   | 2.0777          | 12.6055                                  | 0.9999  |
| Nassarawa       | -3.3138                                   | 5.7929          | 14.8995                                  | 0.6381  |
| Nassarawa       | -6.3252                                   | 3.7667          | 13.8585                                  | 0.9875  |
| Nassarawa       | -9.0178                                   | 1.5667          | 12.1511                                  | 1.0000  |
| Nassarawa       | -3.6543                                   | 5.6500          | 14.9543                                  | 0.7043  |
| Nassarawa       | -16.2358                                  | -4.8778         | 6.4803                                   | 0.9632  |
| Niger           | -4.7112                                   | 3.5852          | 11.8815                                  | 0.9615  |
| Niger           | -7.8082                                   | 1.5590          | 10.9262                                  | 1.0000  |
| Niger           | -10.5369                                  | -0.6410         | 9.2549                                   | 1.0000  |
| Niger           | -5.0705                                   | 3.4423          | 11.9551                                  | 0.9765  |
| Niger           | -17.8048                                  | -7.0855         | 3.6338                                   | 0.5789  |
| Ogun            | -9.9358                                   | -2.0262         | 5.8835                                   | 0.9996  |
| Ogun            | -12.7554                                  | -4.2262         | 4.3030                                   | 0.9024  |
### Table 10 (continued)

| Groups compared | Lower limits for 95% confidence intervals | Mean difference | Upper limits for 95% confidence intervals | \( p \)-value |
|-----------------|-------------------------------------------|-----------------|-------------------------------------------|----------------|
| Ogun Oyo        | \(-7.0193\) \(-0.1429\) \(6.7336\)       | \(1.0000\)      |
| Ogun Plateau    | \(-20.1428\) \(-10.6706\) \(-1.1985\)    | \(0.0124\)      |
| Ondo Osun       | \(-11.7740\) \(-2.2000\) \(7.3740\)       | \(0.9998\)      |
| Ondo Oyo        | \(-6.2330\) \(1.8833\) \(10.0197\)        | \(0.9998\)      |
| Ondo Plateau    | \(-19.1067\) \(-8.6444\) \(1.7784\)       | \(0.2208\)      |
| Osun Oyo        | \(-6.5656\) \(4.0833\) \(12.8232\)        | \(0.9335\)      |
| Osun Plateau    | \(-17.3449\) \(-6.4444\) \(4.5600\)       | \(0.7391\)      |
| Oyo Plateau     | \(-20.1900\) \(-10.5278\) \(-0.8655\)     | \(0.0191\)      |

### Table 11

ANOVA test results for number of infected cassava plants in 184 farms in 12 Nigerian States.

| Source of variation | Sum of squares | Degree of freedom | Mean squares | F statistic | Prob > F |
|---------------------|---------------|------------------|--------------|------------|----------|
| Columns             | 2080.4        | 11               | 189.131      | 3.29       | 0.0004   |
| Error               | 9817          | 171              | 57.409       |            |          |
| Total               | 11897.5       | 182              |              |            |          |

### Table 12

Multiple comparison post-hoc test results for number of infected cassava plants in 184 farms in 12 Nigerian States.

| Groups compared | Lower limits for 95% confidence intervals | Mean difference | Upper limits for 95% confidence intervals | \( p \)-value |
|-----------------|-------------------------------------------|-----------------|-------------------------------------------|----------------|
| Benue Ekiti     | \(-4.5158\) \(4.2121\) \(12.9400\)       | \(0.9176\)      |
| Benue Kogi      | \(1.1888\) \(8.8542\) \(16.5195\)        | \(0.0088\)      |
| Benue Kwarar    | \(-5.2076\) \(3.2500\) \(11.0706\)       | \(0.9843\)      |
| Benue Lagos     | \(-4.6604\) \(10.3333\) \(25.3271\)      | \(0.5112\)      |
| Benue Nassarawa | \(-0.4749\) \(8.5667\) \(17.6082\)       | \(0.0831\)      |
| Benue Niger     | \(-1.8630\) \(6.3590\) \(14.5809\)       | \(0.3225\)      |
| Benue Ogun      | \(-3.7327\) \(2.7738\) \(9.2803\)        | \(0.9651\)      |
| Benue Ondo      | \(-3.0302\) \(4.8000\) \(12.6302\)       | \(0.6914\)      |
| Benue Osun      | \(-1.4576\) \(7.0000\) \(15.4576\)       | \(0.2236\)      |
| Benue Oyo       | \(-3.9062\) \(2.8750\) \(9.6562\)        | \(0.9665\)      |
| Benue Plateau   | \(3.3670\) \(12.7778\) \(22.1885\)       | \(0.0006\)      |
| Ekiti Kogi      | \(-5.0563\) \(4.6420\) \(14.3404\)       | \(0.9219\)      |
| Ekiti Kwarar    | \(-11.2981\) \(-0.9621\) \(9.3738\)      | \(1.0000\)      |
| Ekiti Lagos     | \(-10.0068\) \(6.1212\) \(22.2492\)      | \(0.9857\)      |
| Ekiti Nassarawa | \(-6.4645\) \(4.3545\) \(15.1736\)       | \(0.9774\)      |
| Ekiti Niger     | \(-7.9972\) \(2.1469\) \(12.2909\)       | \(0.9999\)      |
| Ekiti Ogun      | \(-10.2494\) \(-1.4383\) \(7.3728\)      | \(1.0000\)      |
| Ekiti Ondo      | \(-9.2413\) \(0.5879\) \(10.4171\)       | \(1.0000\)      |
| Ekiti Osun      | \(-7.5481\) \(2.7879\) \(13.1238\)       | \(0.9993\)      |
| Ekiti Oyo       | \(-10.3530\) \(-1.3371\) \(7.6787\)      | \(1.0000\)      |
| Ekiti Plateau   | \(-2.5637\) \(8.5657\) \(19.6951\)       | \(0.3301\)      |
| Kogi Kwarar     | \(-15.0601\) \(-5.6042\) \(3.8517\)      | \(0.7360\)      |
| Kogi Lagos      | \(-14.0995\) \(1.4792\) \(17.0578\)       | \(1.0000\)      |
| Kogi Nassarawa  | \(-10.2691\) \(-0.2875\) \(9.6941\)      | \(1.0000\)      |
| Kogi Niger      | \(-11.7409\) \(-2.4952\) \(6.7505\)       | \(0.9993\)      |
| Kogi Ogun       | \(-13.8404\) \(-6.0804\) \(1.6796\)      | \(0.3024\)      |
| Kogi Ondo       | \(-12.9533\) \(-4.0542\) \(4.8450\)      | \(0.9440\)      |
| Kogi Osun       | \(-11.3101\) \(-1.8542\) \(7.6017\)      | \(1.0000\)      |
**Table 12** (continued)

| Groups compared     | Lower limits for 95% confidence intervals | Mean difference | Upper limits for 95% confidence intervals | p-value |
|---------------------|-------------------------------------------|-----------------|-------------------------------------------|---------|
| Kogi Oyo            | −13.9709                                  | −5.9792         | 2.0125                                    | 0.3754  |
| Kogi Plateau        | −6.3936                                   | 3.9236          | 14.2408                                   | 0.9855  |
| Kwara Lagos         | −8.9000                                   | 7.0833          | 23.0667                                   | 0.9538  |
| Kwara Nassarawa     | −5.2855                                   | 5.3167          | 15.9188                                   | 0.8949  |
| Kwara Niger         | −6.8035                                   | 3.1090          | 13.0214                                   | 0.9972  |
| Kwara Ogun          | −9.0197                                   | −0.4762         | 8.0673                                    | 1.0000  |
| Kwara Ondo          | −8.0400                                   | 1.5500          | 11.1400                                   | 1.0000  |
| Kwara Osun          | −6.3588                                   | 3.7500          | 13.8588                                   | 0.9881  |
| Kwara Oyo           | −9.1295                                   | −0.3750         | 8.3795                                    | 1.0000  |
| Kwara Plateau       | −1.3909                                   | 9.5278          | 20.4465                                   | 0.1587  |
| Lagos Nassarawa     | −18.0666                                  | −1.7667         | 14.5332                                   | 1.0000  |
| Lagos Niger         | −19.8343                                  | −3.9744         | 11.8856                                   | 0.9996  |
| Lagos Ogun          | −22.6019                                  | −7.5595         | 7.4828                                    | 0.8935  |
| Lagos Ondo          | −21.1938                                  | −5.5333         | 10.1271                                   | 0.9921  |
| Lagos Osun          | −19.3167                                  | −3.3333         | 12.6500                                   | 0.9999  |
| Lagos Oyo           | −22.6215                                  | −7.4583         | 7.7048                                    | 0.9069  |
| Lagos Plateau       | −14.0631                                  | 2.4444          | 18.9520                                   | 1.0000  |
| Nassarawa Niger     | −12.6229                                  | −2.2077         | 8.2075                                    | 0.9999  |
| Nassarawa Ogun      | −14.9148                                  | −5.7929         | 3.3291                                    | 0.6406  |
| Nassarawa Ondo      | −13.8754                                  | −3.7667         | 6.3421                                    | 0.9877  |
| Nassarawa Osun      | −12.1688                                  | −1.5667         | 9.0355                                    | 1.0000  |
| Nassarawa Oyo       | −15.0115                                  | −5.6917         | 3.6282                                    | 0.6965  |
| Nassarawa Plateau   | −7.1659                                   | 4.2111          | 15.5882                                   | 0.9884  |
| Niger Ogun          | −11.8954                                  | −3.5852         | 4.7251                                    | 0.9619  |
| Niger Ondo          | −10.9418                                  | −1.5590         | 7.8239                                    | 1.0000  |
| Niger Osun          | −9.2714                                   | 0.6410          | 10.5535                                   | 1.0000  |
| Niger Oyo           | −12.0110                                  | −3.4840         | 5.0431                                    | 0.9746  |
| Niger Plateau       | −4.3184                                   | 6.4188          | 17.1560                                   | 0.7250  |
| Ogun Ondo           | −5.8967                                   | 2.0262          | 9.9491                                    | 0.9996  |
| Ogun Osun           | −4.3173                                   | 4.2262          | 12.7697                                   | 0.9035  |
| Ogun Oyo            | −6.7668                                   | 0.1012          | 6.9892                                    | 1.0000  |
| Ogun Plateau        | 0.5160                                    | 10.0040         | 19.4920                                   | 0.0283  |
| Ondo Osun           | −7.3900                                   | 2.2000          | 11.7900                                   | 0.9999  |
| Ondo Oyo            | −10.0750                                  | −1.9250         | 6.2230                                    | 0.9998  |
| Ondo Plateau        | −2.4625                                   | 7.9778          | 18.4181                                   | 0.3415  |
| Osun Oyo            | −12.8795                                  | −4.1250         | 4.6295                                    | 0.9296  |
| Osun Plateau        | −5.1409                                   | 5.7778          | 16.6965                                   | 0.8550  |
| Oyo Plateau         | 0.2244                                    | 9.9028          | 19.5812                                   | 0.0394  |

**Table 13**
ANOVA test results for mean of Cassava mosaic diseases symptom severity.

| Source of variation | Sum of squares | Degree of freedom | Mean squares | F statistic | Prob > F |
|---------------------|----------------|-------------------|--------------|-------------|----------|
| Columns             | 14.223         | 11                | 1.293        | 1.91        | 0.0413   |
| Error               | 115.911        | 171               | 0.67784      |             |          |
| Total               | 130.133        | 182               |              |             |          |
Table 14
Multiple comparison post-hoc test results for mean of Cassava mosaic disease symptom severity.

| Groups compared | Lower limits for 95% confidence intervals | Mean difference | Upper limits for 95% confidence intervals | p-value |
|-----------------|------------------------------------------|-----------------|------------------------------------------|---------|
| Benue Ekiti     | −1.3872                                  | −0.4388         | 0.5096                                   | 0.9377  |
| Benue Kogi      | −0.1585                                  | 0.6744          | 1.5073                                   | 0.2540  |
| Benue Kwara     | −0.7682                                  | 0.1508          | 1.0698                                   | 1.0000  |
| Benue Lagos     | −1.5426                                  | 0.0866          | 1.7159                                   | 1.0000  |
| Benue Nassarawa | −0.6881                                  | 0.2943          | 1.2768                                   | 0.9981  |
| Benue Niger     | −0.5091                                  | 0.3843          | 1.2777                                   | 0.9627  |
| Benue Ogun      | −0.5822                                  | 0.1248          | 0.8318                                   | 1.0000  |
| Benue Ondo      | −0.5342                                  | 0.3166          | 1.1675                                   | 0.9878  |
| Benue Osun      | −1.0382                                  | −0.1192         | 0.7998                                   | 1.0000  |
| Benue Oyo       | −0.4940                                  | 0.2429          | 0.9797                                   | 0.9956  |
| Benue Plateau   | −0.2734                                  | 0.7492          | 1.7718                                   | 0.4098  |
| Ekiti Kogi      | 0.0594                                   | 1.1132          | 2.1670                                   | 0.0277  |
| Ekiti Kwara     | −0.5335                                  | 0.5896          | 1.7127                                   | 0.8615  |
| Ekiti Lagos     | −1.2270                                  | 0.5255          | 2.2779                                   | 0.9981  |
| Ekiti Nassarawa | −0.4424                                  | 0.7332          | 1.9088                                   | 0.6671  |
| Ekiti Niger     | −0.2791                                  | 0.8231          | 1.9254                                   | 0.3784  |
| Ekiti Ogun      | −0.3938                                  | 0.5637          | 1.5211                                   | 0.7443  |
| Ekiti Ondo      | −0.3126                                  | 0.7555          | 1.8235                                   | 0.4682  |
| Ekiti Osun      | −0.8035                                  | 0.3196          | 1.4427                                   | 0.9988  |
| Ekiti Oyo       | −0.2980                                  | 0.6817          | 1.6614                                   | 0.4953  |
| Ekiti Plateau   | −0.0213                                  | 1.1880          | 2.3973                                   | 0.0596  |
| Kogi Kwara      | −1.5511                                  | −0.5236         | 0.5039                                   | 0.8840  |
| Kogi Lagos      | −2.2805                                  | −0.5878         | 1.1050                                   | 0.9932  |
| Kogi Nassarawa  | −1.4647                                  | −0.3801         | 0.7046                                   | 0.9926  |
| Kogi Niger      | −1.2947                                  | −0.2901         | 0.7146                                   | 0.9987  |
| Kogi Ogun       | −1.3927                                  | −0.5495         | 0.2937                                   | 0.6011  |
| Kogi Ondo       | −1.3247                                  | −0.3578         | 0.6092                                   | 0.9884  |
| Kogi Osun       | −1.8211                                  | −0.7936         | 0.2339                                   | 0.3246  |
| Kogi Oyo        | −1.2999                                  | −0.4315         | 0.4369                                   | 0.9007  |
| Kogi Plateau    | −1.0463                                  | 0.0748          | 1.1959                                   | 1.0000  |
| Kwara Lagos     | −1.8009                                  | −0.0642         | 1.6726                                   | 1.0000  |
| Kwara Nassarawa | −1.0085                                  | 0.1435          | 1.2956                                   | 1.0000  |
| Kwara Niger     | −0.8436                                  | 0.2335          | 1.3106                                   | 0.9999  |
| Kwara Ogun      | −0.9543                                  | −0.0260         | 0.9024                                   | 1.0000  |
| Kwara Ondo      | −0.8762                                  | 0.1658          | 1.2079                                   | 1.0000  |
| Kwara Osun      | −1.3684                                  | −0.2700         | 0.8284                                   | 0.9997  |
| Kwara Oyo       | −0.8592                                  | 0.0921          | 1.0433                                   | 1.0000  |
| Kwara Plateau   | −0.5880                                  | 0.5984          | 1.7848                                   | 0.8911  |
| Lagos Nassarawa | −1.5635                                  | 0.2077          | 1.9789                                   | 1.0000  |
| Lagos Niger     | −1.4257                                  | 0.2977          | 2.0210                                   | 1.0000  |
| Lagos Ogun      | −1.5963                                  | 0.0382          | 1.6727                                   | 1.0000  |
| Lagos Ondo      | −1.4717                                  | 0.2300          | 1.9317                                   | 1.0000  |
| Lagos Osun      | −1.9426                                  | −0.2058         | 1.5309                                   | 1.0000  |
| Lagos Oyo       | −1.4914                                  | 0.1563          | 1.8039                                   | 1.0000  |
| Lagos Plateau   | −1.1312                                  | 0.6626          | 2.4563                                   | 0.9886  |
| Nassarawa Niger | −1.0417                                  | 0.0900          | 1.2217                                   | 1.0000  |
| Nassarawa Ogun  | −1.1607                                  | −0.1695         | 0.8217                                   | 1.0000  |
| Nassarawa Ondo  | −1.0761                                  | 0.0223          | 1.1207                                   | 1.0000  |
| Nassarawa Osun  | −1.5656                                  | −0.4135         | 0.7385                                   | 0.9910  |
| Nassarawa Oyo   | −1.0641                                  | −0.0515         | 0.9612                                   | 1.0000  |
| Nassarawa Plateau | −0.7814                               | 0.4549          | 1.6911                                   | 0.9889  |
| Niger Ogun      | −1.1625                                  | −0.2595         | 0.6435                                   | 0.9987  |
| Niger Ondo      | −1.0872                                  | −0.0677         | 0.9519                                   | 1.0000  |
Table 14 (continued)

| Groups compared       | Lower limits for 95% confidence intervals | Mean difference | Upper limits for 95% confidence intervals | p-value |
|-----------------------|------------------------------------------|-----------------|-------------------------------------------|---------|
| Niger Osun            | −1.5806                                  | −0.5035         | 0.5736                                    | 0.9332  |
| Niger Oyo             | −1.0680                                  | −0.1414         | 0.7851                                    | 1.0000  |
| Niger Plateau         | −0.8019                                  | 0.3649          | 1.5316                                    | 0.9972  |
| Ogun Ondo             | −0.6691                                  | 0.1918          | 1.0527                                    | 0.9999  |
| Ogun Osun             | −1.1724                                  | −0.2440         | 0.6843                                    | 0.9994  |
| Ogun Oyo              | −0.6304                                  | 0.1180          | 0.8665                                    | 1.0000  |
| Ogun Plateau          | −0.4066                                  | 0.6243          | 1.6553                                    | 0.7079  |
| Ondo Osun             | −1.4779                                  | −0.4358         | 0.6062                                    | 0.9697  |
| Ondo Oyo              | −0.9593                                  | −0.0738         | 0.8118                                    | 1.0000  |
| Ondo Plateau          | −0.7019                                  | 0.4326          | 1.5670                                    | 0.9852  |
| Osun Oyo              | −0.5892                                  | 0.3621          | 1.3133                                    | 0.9854  |
| Osun Plateau          | −0.3180                                  | 0.8684          | 2.0548                                    | 0.4114  |
| Oyo Plateau           | −0.5454                                  | 0.5063          | 1.5580                                    | 0.9189  |

Fig. 19. Multiple comparison post-hoc for mean whiteflies counted in 184 farms in 12 Nigerian States.
Fig. 20. Multiple comparison post-hoc for mean uninfected cassava plants in 184 farms in 12 Nigerian States.

Fig. 21. Multiple comparison post-hoc for mean infected cassava plants in 184 farms in 12 Nigerian States.
Acknowledgements

This work was fully funded by the Bill and Melinda Gates Foundation and Department for International Development (DFID) Grant no. OPP1082413 “West African Virus Epidemiology (WAVE) for root and tuber crops”, through a subgrant from Université Félix Houphouët-Boigny (UFHB). Data analysis was carried out by the IoT-Enabled Smart and Connected Communities (SmartCU) Research Cluster of Covenant University Ota, Nigeria.

Transparency document. Supporting information

Transparency data associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2018.05.016.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2018.05.016.

References

[1] N.J. Tonukari, et al., White gold: cassava as an industrial base, Am. J. Plant Sci. 06 (07) (2015) 972–979.
[2] C. Jansson, A. Westerbergh, J. Zhang, X. Hu, C. Sun, Cassava, a potential biofuel crop in (the) People’s Republic of China, Appl. Energy 86 (2009) S95–S99.
[3] K. Von Grebmer, J. Bernstein, D. Nabarro, N. Prasai, S. Amin, Y. Yohannes, et al., Global hunger index: getting to zero hunger, Int. Food Policy Res Inst. (2016) 2016.
[4] S. Kumar, N. Kumar, S. Vivekadish, Millennium development goals (MDGS) to sustainable development goals (SDGS): addressing unfinished agenda and strengthening sustainable development and partnership, Indian J. Community Med.: Off. Publ. Indian Assoc. Prev. Soc. Med. 41 (2016) 1.
[5] R.J. Hillocks, Cassava in Africa, Cassava: Biol. Prod. Util. (2002) 41–54.
[6] FAO, “WFP, The State of Food Insecurity in the World, 2014, p. 80.
[7] E.S. Bah, B.A. Bamkefa, S. Winter, A.G.O. Dixon, Distribution and current status of cassava mosaic disease and begomoviruses in Guinea, Afr. J. Root Tuber. Crop. 09 (01) (2011) 17–23.
[8] P. Sseruwagi, W.S. Sserubombwe, J.P. Legg, J. Ndunguru, J.M. Thresh, Methods of surveying the incidence and severity of cassava mosaic disease and whitefly vector populations on cassava in Africa: a review, Virus Res. 100 (1) (2004) 129–142.
[9] P.C. Chikoti, M. Tembo, M. Chisola, P. Ntawuruhunga, J. Ndunguru, Status of cassava mosaic disease and whitefly population in Zambia, Afr. J. Biotechnol. 14 (33) (2015) 2539–2546.
[10] V. Manyong, Impact: the Contribution of IITA-improved Cassava to Food Security in Sub-Saharan, IITA, Africa, 2000.
[11] A. Parmar, B. Sturm, O. Hensel, Crops that feed the world: production and improvement of cassava for food, feed, and industrial uses, Food Secur 9 (5) (2017) 907–927.
[12] J. Zinga, et al., East African cassava mosaic virus-Uganda (EACMV-UG) and African cassava mosaic virus (ACMV) reported for the first time in Central African Republic and Chad, New Dis. Rep. 26 (2012) (17–17).
[13] S. Macfadyen, C. Paull, L. Boykin, P. De Barro, M. Maruthi, M. Otim, et al., Cassava whitefly, Bemisia tabaci (Gennadius) (Hemiptera: aleyrodidae) in East African farming landscapes: a review of the factors determining abundance, Bull. Entomol. Res. (2018) 1–18.
[14] V.N. Fondong, J.S. Pita, M.E.C. Rey, A. De Kochko, R.N. Beachy, C.M. Fauquet, Evidence of synergism between African cassava mosaic virus and a new double-recombinant geminivirus infecting cassava in Cameroon, J. Gen. Virol. 81 (1) (2000) 287–297.