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# A Survey of *Passiflora foetida* L. and Associated Weed Species on Arable Crops in Ballah, Southern Guinea Savanna Zone Of Nigeria.

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## ABSTRACT

*A survey was conducted in the research field of the Institute of Agricultural Research and Training, Obafemi Awolowo University Ile-Ife, Ballah sub-station in southern Guinea savanna of Nigeria during 2010 to 2011 cropping season with an objective to determine the relative abundance of Passiflora foetida L. and predict the potential of the weed species dominating arable fields. Passiflora foetida L. was found to be with a high percentage frequency of occurrence (16.99 %) and relative abundance ranging from 27.05 to 62.29 % at crop vegetative stage and 17.49 to 74.75 % during harvesting of arable crops. The fields of cowpea and soyabean had higher frequencies of occurrence of the alien weed compare with sole cassava and maize plots and their intercrops with lower frequencies of occurrence. This study advocated periodic observation of weed flora by farmers to ascertain cases of invasion of farmlands by alien weed species to facilitate early management strategy that could limit spread of such weed species.*

*Keywords : Passiflora foetida,* arable crop fields, associated weed species, Ballah.

## INTRODUCTION

Arable crop production in West Africa sub-region is experiencing an enormous economic losses due to crop pests. Weed is the number one pest which farmers must contend with in most common crops in West African agriculture. Weeds unlike other pests are ubiquitous and account for at least one third of this loss (Gurbachan, 2005). They cause enormous losses and sufferings to farmers by way of reduction in crop yield and quality, wastage of human energy and resources and increases cost of cultivation (Murugan & Kathiresan, 2010).

In recent times, cases of invasion of farmlands by exotic plant species have been reported (Wilcove *et al.*, 1998; Mack *et al.*,2000) causing negative impact on human health, the economy, native species and ecosystem (Pimentel *et al.*, 2005). The rate of exotic species introduction appears to be increasing with globalization (Stohlgreen *et al*.,2008).

*Passiflora* comes from Latin word "Passio" that was first discovered by Spanish discoverers in 1529 and was described as a symbol for "Passion of Christ" (Kinghorn, 2001; Dhawan *et al*., 2004). The genus *Passiflora*, comprising about 400 species, is the largest in the family

Passifloraceae (Montanher *et al*., 2007). A large genus of herbaceous or woody tendril climber (The Wealth of India, 2001), mostly distributed in the warm temperate and tropical regions of the World, but they are much rarer in Asia, Australia, and tropical Africa (Beninca *et al*., 2007). Many of the species are of ornamental value and a few are cultivated for their edible fruits.

*Passiflora foetida* (stinking passion flower) is a perennial herbaceous evergreen broadleaf herb of the family Passifloraceae. The whole plant has an unpleasant odour, but the ripe fruit is edible (Randall, 2003). It is commonly found as an invader on disturbed site and it favours wet areas (PIER, 2002), but can tolerate arid conditions (Randall, 2003). The weed is regarded as a native of South America but is now a pantropic weed which has also been introduced to tropical regions around the world. The fruit is edible, but not a common food item because it contains little pulp. It has a sweet taste, similar to the large fruited passion floras that are popular in other areas of the pacific (Moore and McMakin, 2002).

*Passiflora foetida* is a weed of upland rice and other field crops. It occurs in wet areas or those where there is a pronounced wet season. It is common in plantations, rough pastures, roadsides and wasteland (Mack *et al.*,2000). This weed is one of the most serious weed found in the forest savannah transition zone of sub-Saharan Africa and also in the high rainfall areas of southeast Asia.

In West Africa, it devastates field crop like rice, cotton field or grain legumes and plantation. *Passiflora foetida* infestation causes severe crop yield losses, land abandonment, deforestation and land degradation. In Nigeria, the weed is found in most part of the southern Guinea and Sudan savanna zone of the country where it forms a dense ground cover which prevent growth and development and delay the establishment of other species, especially the field crop like rice/cotton field also in grain legumes field and fallows (PIER, 2002).

A woody, annual or perennial vine, 1.5 to 6 m long; stem, cylindrical, densely hairy; tendrils arise next to leaves on the shaded side of the stem; leaves heart-shaped to three lobed, alternate, arranged helically, with long-stalked glands and long fine hairs on margins, producing a disagreeable smell when crushed; flowers white to lilac, bisexual. It flowers all year round, opening in the morning and closing before noon. The green to orange or red fruits are enclosed in lacy bracts. A large number of varieties occur (The wealth of India, 2001).

Traditionally the fresh or dried whole plant of *P. foetida* and their preparations are accepted for medicinal use in European countries for the treatment of nervous anxiety. It shows antispasmodic sedative, anxiolytic and hypotentive activities (Dhawan *et al,* 2001). The decoction from the leaves and fruits of this plant is used to treat asthma and hysteria. The leaf paste of *P. foetida* is applied for headache and to treat skin diseases (Chopra *et al*, 1956).

This weed species invaded the research field of the Institute of Agricultural Research and Training, Obafemi Awolowo University Ile-Ife, Ballah sub-station in southern Guinea savanna of Nigeria.

Peasant farmers around the research field believed that, the new weed was first seen few seasons after the departure of Fulani herdsmen that once settled in some portion of the research field. Therefore, managing this new weed species becomes necessary to prevent spread so as to increase crops production. Hence, this study of weeds in arable crops was carried out to determine the relative abundance of *Passiflora foetida* L. to see the urgent need for its management.

## MATERIALS AND METHODS

### Arable field survey

The southern Guinea savanna zone of Nigeria is one of the sub-zones of moist savanna zone of West and Central Africa, characterized by bimodal rainfall that varies from 1200 - 1500 mm and an average temperature range of 19°-33°C and a length of growing period of about 181- 270 days.

The survey was conducted in research field of about 34 hectares at Ballah (9°29$^{l}$ N, 4°35$^{l}$ E) of Nigeria and is 307 m above sea level during 2010-2011 growing season. Eight cropping systems were identified at the time of survey: sole cropping of cassava, maize, soyabean and cowpea, intercropping of cassava and maize, cassava and yam, cassava, maize and yam, and a fallow field.

The field survey was carried out according to the quantitative survey method described by Thomas (1985) and Kamal-Uddin *et.al.*, (2009). Thirty-two transect lines were set to cover the research field and quadrats of size 1m x 1m were arranged 20 m apart in a grid pattern across each transect line. Each transect line (had 16 - 21 quadrats depending on the length ) was surveyed and observations were recorded from the quadrats. The weeds were identified using the hand book of West African Weeds (Akobundu and Agyakwa, 1998). Care was taken while selecting the fields to see that the crops were raised with normal care without any interference with weed control measure adopted until the completion of the survey. Data collected were density of *Passiflora foetida* L and associated weeds during vegetative stage and at harvest of arable crops. The composition of the weed flora was analysed by calculating the relative abundance (RA) of each specie within each experimental unit as follows: RA = (RD + RF) / 2, where RD (relative density) = number of a weed specie per unit area (within a quadrat) in the plot divided by the total number of weed species within the same unit area (quadrat); and RF (relative frequency) = proportion of quadrat in which the species were present per experimental unit divided by the total frequency of all species in the experimental unit (Takim & Fadayomi, 2009)

## RESULTS AND DISCUSSION

Forty-three weed species, comprising twenty-nine broadleaves, eight grasses and six sedge weed species, were reported from arable fields of IAR & T, Ballah sub-station during 2010 cropping season. Their frequency and percentage occurrence, were recorded (Table 1).

Table 1. Frequency Occurrence of Weed Species Encountered Across Arable Fields

| Weed species | Frequency | | Mean | Relative Frequency % |
|---|---|---|---|---|
| | Vegetative | Harvest | | |
| Broadleaves | | | | |
| *Gomphrena celosioides* Mart. | 28 | 33 | 44.5 | 1.26 |
| *Pupalia lappacea* (Linn.) Juss. | 16 | 11 | 13.5 | 0.57 |
| *Amaranthus spinosus* Linn. | 8 | 20 | 14 | 0.58 |
| *Celosia isertii* C.C.Townsend | 23 | 20 | 21.5 | 0.90 |
| *Vernonia cinera* (Linn.) Less. | 34 | 95 | 64.5 | 2.60 |
| *Synedrella nodiflora* Gaertn. | 8 | 6 | 7 | 0.29 |
| *Chromolaena odorata* (Linn.) R. M. King & Robinson | 27 | 39 | 33 | 1.35 |
| *Vernonia ambigua* Kotschy & Peyr | | | | |
| *Tridax procumbens* (Linn.) | 287 | 303 | 295 | 12.20 |
| *Azolla Africana* Desv. | 48 | 53 | 50.5 | 2.09 |
| *Daniellia oliveri* (Rolfe) Hutch & Dalz | — | 12 | 12 | 0.46 |
| *Combretum zenkeri* Engl. & Deils | 13 | 18 | 15.5 | 0.64 |
| *Aneilema beniniense* (P. Beauv.) | 120 | 176 | 148 | 6.06 |
| *Commelina benghalensis* Linn. | 59 | 63 | 61 | 2.53 |
| *Commelina diffusa* Burm. | 22 | 24 | 23 | 0.97 |
| *Ipomoea eriopcarpa* R. Br. | 59 | 61 | 60 | 2.49 |
| *Ipomoea triloba* Linn. | 32 | 38 | 35 | 1.44 |
| *Phyllanthus amarus* Schum. & Thonn. | 16 | 18 | 17 | 0.71 |
| *Euphorbia heterophylla* Linn. | 151 | 188 | 169.5 | 6.99 |
| *Alchornea cordifolia* (Schum & Thonn.) Mull.Arg | 5 | 11 | 8 | 0.33 |
| *Acalypha ciliata* Forsk. | 48 | 56 | 52 | 2.15 |
| *Crotalaria retusa* Linn. | 11 | 7 | 9 | 0.40 |
| *Tephrosia bracteolata* Guill. & Perr. | 18 | 25 | 21.5 | 0.89 |
| *Schrankia leptocarpa* DC. | 24 | 19 | 21.5 | 0.91 |
| *Mimosa pudica* Linn. | 2 | 6 | 4 | 0.16 |
| **Passiflora foetida* Linn. | 376 | 499 | 437.5 | 16.99 |
| *Mitracarpus villosus* (Sw.) DC. | 30 | 36 | 33 | 1.36 |
| *Fleurya ovalifolia* (Schum. & Thonn.) Dandy | 38 | 24 | 31 | 1.31 |
| *Fleurya aestuans* (Linn.) ex Miq. | 10 | 7 | 8.5 | 0.36 |
| Sedges | | | | |
| *Rhynchospora corymbosa* (Linn.) Britt. | 4 | 15 | 9.5 | 0.39 |
| *Cyperus haspan* Linn. | 42 | 51 | 46.5 | 1.94 |
| *Cyperus rotundus* Linn. | 8 | 6 | 7 | 0.29 |
| *Mariscus alternifolius* Vahl. | 3 | 8 | 5.5 | 0.22 |
| *Cyperus difformis* Linn. | 14 | 19 | 16.5 | 0.68 |
| *Cyperus iria* Linn. | 12 | 11 | 11.5 | 0.48 |
| Grasses | | | | |
| *Imperata cylindrica* (Linn.) Raeuschel | 296 | 257 | 276.5 | 11.51 |
| *Rhynchelytrum repens* (Willd.) C. E. Hubbard | 9 | 16 | 12.5 | 0.51 |
| *Panicum maximum* Jacq. | 7 | 24 | 15.5 | 0.62 |
| *Leptochloa caerulescens* Steud. | 160 | 167 | 163.5 | 6.86 |
| *Panicum repens* Linn. | 14 | 23 | 18.5 | 0.76 |
| *Loudetia arundinacea* (Hochst. ex. A. Rich.) | 182 | 167 | 174.5 | 7.25 |
| *Rottboellia cochinchinensis* (Lour.) Clayton | 3 | 9 | 6 | 0.24 |
| *Digitaria horizontalis* Willd | 9 | 27 | 18 | 0.72 |

* The new weed

*Passiflora foetida* was observed as the most dominant and frequent weed species, has the highest frequency of occurrence (16.99 %) followed by *Tridax procumbens* (12.20%), *Imperata cylindrica* (11.51%), *Loudetia arundinacea* (7.25%), *Euphorbia heterophylla* (6.99%), and *Leptochloa caerulescens* (6.86%). The weeds with lowest frequencies were *Mariscus alternifolius* (0.22%), *Rottboellia cochinchinensis* (0.24%) and *Synedrella nodiflora* (0.29%).

Table 2. The Occurrence of *Passiflora. foetida L. and* Associated Weed Species across Arable Fields During Vegetative Stage of Crops

| | | | Density (no/m$^2$) | | | Relative | | | Relative |
|---|---|---|---|---|---|---|---|---|---|
| Transect | X | No. of quadrats | *P. foetida* | Associated weed spp. | Total | Frequency | Density | Mean density | Abundance (%) |
| A1 | 6 | 16 | 35 | 150 | 185 | 0.38 | 0.189 | 2.188 | 28.20 |
| A2 | 6 | 16 | 51 | 225 | 306 | 0.38 | 0.166 | 3.188 | 27.05 |
| A3 | 8 | 16 | 40 | 285 | 325 | 0.50 | 0.123 | 2.500 | 31.15 |
| A4 | 8 | 17 | 45 | 208 | 253 | 0.47 | 0.177 | 2.647 | 32.15 |
| A5 | 10 | 16 | 50 | 249 | 299 | 0.63 | 0.167 | 3.125 | 39.60 |
| A6 | 9 | 19 | 76 | 305 | 381 | 0.42 | 0.199 | 4.000 | 31.00 |
| A7 | 11 | 21 | 55 | 215 | 270 | 0.52 | 0.203 | 2.619 | 36.34 |
| A8 | 15 | 21 | 79 | 270 | 349 | 0.71 | 0.226 | 3.762 | 47.02 |
| A9 | 12 | 20 | 95 | 250 | 345 | 0.60 | 0.275 | 4.750 | 43.07 |
| A10 | 12 | 20 | 160 | 186 | 346 | 0.60 | 0.462 | 8.000 | 53.12 |
| A11 | 11 | 20 | 76 | 181 | 257 | 0.55 | 0.295 | 3.950 | 42.28 |
| A12 | 12 | 20 | 129 | 243 | 372 | 0.60 | 0.346 | 6.450 | 47.33 |
| A13 | 13 | 20 | 115 | 244 | 359 | 0.65 | 0.320 | 5.750 | 48.51 |
| A14 | 11 | 20 | 65 | 256 | 321 | 0.55 | 0.202 | 3.250 | 37.60 |
| A15 | 11 | 20 | 81 | 242 | 323 | 0.55 | 0.250 | 4.050 | 40.03 |
| A16 | 13 | 20 | 114 | 224 | 338 | 0.65 | 0.337 | 5.700 | 49.36 |
| A17 | 13 | 20 | 106 | 208 | 314 | 0.65 | 0.337 | 5.300 | 49.37 |
| A18 | 14 | 20 | 161 | 207 | 368 | 0.70 | 0.444 | 8.050 | 57.27 |
| A19 | 13 | 20 | 127 | 231 | 358 | 0.65 | 0.354 | 6.350 | 50.27 |
| A20 | 14 | 21 | 117 | 258 | 375 | 0.66 | 0.312 | 5.571 | 48.60 |
| A21 | 13 | 20 | 81 | 300 | 381 | 0.65 | 0.212 | 4.050 | 43.12 |
| A22 | 16 | 20 | 130 | 207 | 337 | 0.80 | 0.385 | 6.500 | 59.28 |
| A23 | 14 | 20 | 90 | 235 | 325 | 0.70 | 0.276 | 4.500 | 48.84 |
| A24 | 11 | 20 | 122 | 242 | 364 | o.55 | 0.335 | 6.100 | 44.25 |
| A25 | 13 | 20 | 127 | 252 | 379 | 0.65 | 0.335 | 6.350 | 49.25 |
| A26 | 14 | 20 | 133 | 178 | 311 | 0.70 | 0.427 | 6.650 | 59.38 |
| A27 | 14 | 20 | 138 | 200 | 338 | 0.70 | 0.408 | 6.900 | 55.40 |
| A28 | 8 | 20 | 77 | 236 | 313 | 0.40 | 0.246 | 3.850 | 32.30 |
| A29 | 11 | 20 | 117 | 226 | 343 | 0.55 | 0.516 | 5.850 | 53.30 |
| A30 | 12 | 20 | 119 | 217 | 336 | 0.60 | 0.645 | 5.950 | 62.29 |
| A31 | 12 | 20 | 73 | 177 | 250 | 0.60 | 0.292 | 3.650 | 44.60 |
| A32 | 12 | 21 | 53 | 202 | 255 | 0.60 | o.207 | 2.650 | 40.39 |

X = number of quadrats that *P. foetida* occurred

*Passiflora foetida* L had a relative abundance ranging from 27.05 to 62.29 % at the vegetative crop growth stage (Table 2) while at the harvesting stage of the crops, a relative abundance of 17.49 % was the least recorded while the highest was 74.75 %.

Table 3. The Occurrence of *Passiflora foetida L. and* Associated Weed Species across Arable Fields During at Harvest.

| | | | Density (no/m²) | | | Relative | | | |
|---|---|---|---|---|---|---|---|---|---|
| Transect | X | No. of quadrats | *P. foetida* | Associated weed spp. | Total | Frequency | Density | Mean density | Relative Abundance (%) |
| A1 | 5 | 16 | 11 | 279 | 290 | 0.31 | 0.038 | 0.688 | 17.49 |
| A2 | 6 | 16 | 136 | 391 | 527 | 0.38 | 0.258 | 8.500 | 31.65 |
| A3 | 7 | 16 | 29 | 389 | 418 | 0.44 | 0.069 | 1.813 | 25.31 |
| A4 | 12 | 17 | 124 | 326 | 450 | 0.71 | 0.275 | 7.294 | 59.09 |
| A5 | 9 | 16 | 77 | 240 | 317 | 0.56 | 0.242 | 4.813 | 40.24 |
| A6 | 12 | 19 | 110 | 258 | 368 | 0.63 | 0.298 | 5.789 | 46.49 |
| A7 | 10 | 21 | 96 | 254 | 350 | 0.48 | 0.274 | 4.571 | 37.50 |
| A8 | 19 | 21 | 509 | 352 | 861 | 0.90 | 0.591 | 24.24 | 74.75 |
| A9 | 17 | 20 | 177 | 339 | 516 | 0.81 | 0.340 | 8.850 | 57.60 |
| A10 | 14 | 20 | 314 | 287 | 601 | 0.67 | 0.522 | 15.70 | 59.40 |
| A11 | 14 | 20 | 130 | 348 | 478 | 0.70 | 0.271 | 6.500 | 48.59 |
| A12 | 17 | 20 | 543 | 355 | 898 | 0.85 | 0.604 | 27.15 | 72.73 |
| A13 | 16 | 20 | 308 | 362 | 670 | 0.80 | 0.459 | 15.40 | 62.98 |
| A14 | 15 | 20 | 175 | 354 | 529 | 0.75 | 0.330 | 8.750 | 54.04 |
| A15 | 14 | 20 | 109 | 369 | 478 | 0.70 | 0.228 | 5.450 | 46.40 |
| A16 | 15 | 20 | 116 | 388 | 504 | 0.75 | 0.329 | 5.800 | 53.96 |
| A17 | 17 | 20 | 443 | 304 | 747 | 0.85 | 0.593 | 22.15 | 72.15 |
| A18 | 14 | 20 | 270 | 401 | 671 | 0.70 | 0.402 | 13.50 | 55.10 |
| A19 | 13 | 20 | 215 | 445 | 660 | 0.68 | 0.325 | 10.75 | 50.48 |
| A20 | 16 | 21 | 288 | 380 | 668 | 0.80 | 0.431 | 13.71 | 61.55 |
| A21 | 18 | 20 | 243 | 406 | 649 | 0.90 | 0.374 | 12.15 | 63.72 |
| A22 | 17 | 20 | 275 | 375 | 650 | 0.85 | 0.423 | 13.75 | 63.65 |
| A23 | 18 | 20 | 277 | 354 | 631 | 0.90 | 0.438 | 13.85 | 66.94 |
| A24 | 14 | 20 | 173 | 376 | 549 | 0.70 | 0.315 | 8.650 | 50.75 |
| A25 | 16 | 20 | 165 | 304 | 469 | 0.80 | 0.351 | 8.250 | 57.59 |
| A26 | 18 | 20 | 111 | 306 | 417 | 0.90 | 0.266 | 5.550 | 58.30 |
| A27 | 18 | 20 | 301 | 283 | 584 | 0.90 | 0.515 | 15.05 | 70.77 |
| A28 | 15 | 20 | 199 | 271 | 470 | 0.75 | 0.423 | 9.900 | 58.65 |
| A29 | 16 | 20 | 162 | 332 | 494 | 0.80 | 0.327 | 8.100 | 56.39 |
| A30 | 17 | 20 | 179 | 293 | 472 | 0.85 | 0.379 | 8.950 | 61.46 |
| A31 | 16 | 20 | 121 | 304 | 425 | 0.80 | 0.284 | 6.050 | 54.23 |
| A32 | 15 | 21 | 76 | 323 | 399 | 0.71 | 0.190 | 3.800 | 45.02 |

X = number of quadrats that *P. foetida* occurred .

(Table 3) indicating a highly infested agricultural arable fields. This is in agreement with the report of Takim (2012) who stated that *Euphorbia heterophylla, Passiflora foetida* and *Cleome viscosa* were more in abundance in the continuously cultivated maize fields at Ballah.

Table 4. Frequency of Occurrence (%) of *P. foetida* L. at Vegetative and Harvest Stage in Different Cropping Systems.

| Cropping system | Vegetative | Harvest |
|---|---|---|
| | % | |
| Fallow field | 3.05 | 3.53 |
| Sole Cassava | 6.96 | 3.16 |
| Sole Cowpea | 28.93 | 40.50 |
| Sole Maize | 4.27 | 3.81 |
| Sole Soyabean | 38.56 | 36.34 |
| Cassava/Maize intercrop | 15.98 | 12.1 |
| Cassava / Yam intercrop | 0.60 | 0.46 |
| Cassava/ Maize /Yam intercrop | 1.69 | 0 |

The frequency of occurrence of the new weed species differed across different cropping systems (Table 4). The fields of cowpea and soyabean had higher frequencies of occurrence compare with sole cassava and maize plots with lower frequencies of occurrence. This supports the report of Lemerle & Murphy, (2000) that broadleaf weeds tend to increase in continuous broadleaf crops such as legume crop while Blackshaw (1994) observed that cereal crops grown continuously for several years tend to select for grass weeds. Weeds adaptation to cropping system could be due to a consistently hospitable environment for weeds that have phenological and physiological similarities to the crop (Murphy & Lemerle, 2006).

The intercrop fields had a relatively lower incidence of the new weed except cassava/maize intercrop plot that had higher frequency of occurrence than sole maize and sole cassava plots. Cassava/yam or cassava/maize/yam intercrops had the least frequency of occurrence ranging from 0 to 1.69 % . The shading effect resulting from the crop canopy limit availability of resources required for weed germination. This effect is more pronounced in intercrops because of the combined foliage of the component crops which intercepted most of the green and red light leaving far red to reach the ground. Far red light is known to be inhibitory to weed germination (Clark & Francis, 1985) could be responsible for the better weed (*P. foetida*) suppression by the intercropped fields. The reduction in weed densities of intercropped fields could also be as a result

of limited availability of resources to weed species. The interrow spaces provide room for weeds to flourish in monocrops compared to the intercrops, therefore increasing weed density in monocrops.

## CONCLUSION

*Passiflora foetida* was found to have the highest frequency of occurrence (16.99 %) and relative abundance ranging from 27.05 to 62.29 % and 17.49 to 74.75 % at vegetative and harvesting stage of crop life, respectively. The new weed dominated the cowpea and soyabean monoculture fields compared to plots with sole cassava, sole maize, and their intercrops. This study recommends periodical observation of weed flora by farmers to ascertain cases of invasion of farmlands by alien weed species this would enable early adoption of an effective management strategy that could limit its spread.

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