Survey of Dysdercus Volkeri F. (Hemiptera: Pyrrhocoridae) in Cotton Agro-ecology of Some Local Governments in Katsina State, Nigeria

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ABSTRACT

Field surveys were conducted from July December in 2019 and 2020 cropping seasons in three Local Government Areas (LGAs) of Katsina State. The areas are Faskari, Kankara, and Malumfashi. These locations were chosen because farmers of these areas grow cotton on large scales. Three cotton cultivating villages were randomly selected from each LG for this study. In each village three cotton fields of one hectare was considered for the *D. volkeri* nymph, adults populations, alternative host and predators from three upper, middle and lower portions of three randomly selected cotton plants. The result showed that the LGAs surveyed were the hotspots for *D. volkeri* nymph and adult populations in October and November, respectively. *Dysdercus* nymph had higher occurrence in Burdigau (657) and Kukasheka (566) villages of Malumfasi Local Government. Similarly, Danmurabu, Gundawa and Kankara villages had (624, 588 and 382) nymph populations, respectively in Kankara LGA. While in Faskari Local Lovernment, Sheme, Kadisau and Daudawa recorded with 555, 350 and 297 nymph populations in the same month respectively. Higher numbers of adult populations were recorded in the month of November in all the three LGAs surveyed. Daudawa had (307), Kukasheka (266) and Gundawa (186) in Faskari, Malumfashi and Kankara Local Government, respectively. Predators such as *Odontopus sexpunctatus and Phonoctonus lutescens* were found feeding by inserting their proboscis on *D. volkeri* adults at Marmara and Daudawa in Malumfashi and Faskari LGAs, respectively. The present findings will provide a base line data on the status of *Dysdercus* pest in terms of distribution and abundance in cotton agro ecological zones of Katsina State of Nigeria.

Keywords: Survey, *Dysdercus volkeri,* Cotton, Katsina State

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INTRODUCTION

Cotton, (*Gossypium hirsutum* L.) belongs to the family *Malvaceae* (Paterson, 2009). It is an important fiber crop, which is cultivated in more than 80 countries of the world (Kutama *et al*., 2015). In Nigeria, cotton is the fifth most important export crop after cocoa, groundnut, oil palm, rubber and one of the major sources of foreign exchange for the country (Kutama *et al*., 2015).

In Nigeria, cotton is adaptive to most ecological zones and is being cultivated in the Northern, Eastern and Southern part of the country (Anonymous, 2017). However, North West ecological zone comprises of Kaduna, Kano, Katsina, Jigawa, Sokoto, Kebbi and Zamfara produced about 60 65 % of cotton in Nigeria (Central Bank of Nigeria CBN, 2017). Production is dominated by small scale farmers, with farm sizes ranging from 3-5 hectares all under rainfed cultivation. There are seven cotton varieties currently in commercial production in Nigeria and these are SAMCOT 8, 9, 10 (medium staples), 11, 12 and 13 (long staples) which are cultivated in the North- east, North West, North- Central, South-East and South- West respectively (Gbadegesin, 2007). Katsina State has become the largest producer cotton producing 90,000 100,000 metric tons of cotton over the last five years (FMARD, 2013).

However, among the major constraints hindering cotton cultivation are diseases and insect pests.

Several insect species that belongs to the order Pyrrhocoridae are serious pests of cotton worldwide (Gutierrez *et al*., 2005; Sontakke, *et al*., 2013; Jaleel, *et al*., 2013) with cotton stainer causing significant losses of between 30-100 % in Nigeria if not controlled (Amatobi, 2007, Horna, *et al*., 2009). Control of this pest has traditionally depended on the use of insecticides, cultural methods, growing of resistant varieties such as transgenic *Bt* cotton (Surpam, *et al*., 2015). Apparently, the most effective method of control is the use of broad spectrum insecticides; however, misuse of pesticides always associated with pest resistance to insecticides and may consequently lead to adverse economic and environmental problems (Yousuf *et al*., 2012). A better understanding of pest populations is needed in order to integrate these and other pest control options into an overall integrated pest management (IPM) plan to maximize cotton production.

MATERIALS AND METHODS

Survey for *D. volkeri* in Cotton Agro-Ecology of Katsina State

Field surveys were conducted from July December, 2019 and 2020 in three Local Government Areas (LGAs) of Katsina state (Fig. 1). The LGAs are Malumfashi (Kukasheka, Burdigau and Marmara villages), Kankara (Kankara, Gundawa and Danmurabu villages) and Faskari (Daudawa, Kadisau and Sheme villages). Two field visits in a month were made in each LGA. These locations were chosen because farmers in these areas grow cotton in large scales. In each village three cotton fields of one hectare was considered for the *D. volkeri* nymph and adult populations on randomly selected plants from three upper, middle and lower portions of leaves. *D. volkeri* predators at these LGAs were also considered. Hand picking methods was used to collect *D. volkeri.* All observations were made in the morning (7.00 am to 9.00 am) and evening (4.30 pm to 6.30 pm). Monthly records of weather factors such as maximum and minimum temperature (°C), relative humidity (RH) (%), and rain fall (mm) which prevailed in the periods of the field survey were collected from the Meteorological unit, Katsina State Agricultural

and Rural Development Authority, (KTARDA). The data obtained was calculated to obtain the mean and presented as bar chart. The differences of the means were separated using error bars. Monthly data of maximum and minimum temperature, relative humidity and wind velocity were also recorded.

RESULTS

Populations of *D. volkeri* Nymphs in Cotton Agro-Ecology

The result of the survey at different months showed that there were more nymphs recorded in Kukasheka, Burdigau and Marmara in Malumfashi LGA in the month of October when temperature, rainfall and relative humidity were 28 ^{0}C, 3.8 mm and 48 - 50 %, respectively compared to nymphs recorded in July and August (Fig.2). Among the LGAs surveyed Kankara Local Government had a total of 2,409 nymphs were recorded during the period of the survey with Danmurabu (624), Gundawa (588) and Kankara villages (382) in October**.** No nymphs were observed in the month of July (Fig. 3). In Faskari Local Government 2,259 numbers of nymphs were recorded. Sheme village had the highest (555) number of nymphs followed by Daudawa 350 and Kadisau (297) (Fig. 4)

Population of *D. volkeri*Adults in Cotton Agro-Ecology of Katsina State

The result of the survey showed that there were greater numbers of adults in Kukasheka 266 than Burdigau (168) and Marmara (98) in Malumfashi Local Government in November when maximum temperature and relative humidity were 28^{0}C, 3.8 mm 37 - 40 %, respectively. The lowest mean numbers of adults were recorded in July and December (Fig 5). However, in Kankara LGA Gundawa, Kankara and Danmurabu villages 186, 169 and 78 were adults found and recorded in November (Fig. 6). In Faskari LGA, Daudawa village had the highest (307) number of adults compared with Sheme (155) and Kadisau (113) villages during the month of November. No adult of *D. volkeri* was recorded during the month of July at both locations (Fig. 7).

Predators of *D. volkeri* in Cotton Agro-Ecology of the Three LGAs in Katsina State

The predator encountered while conducting the survey in 2019 and 2020 cropping seasons are presented in Table 2. However, among the predator Welwitschia bug *Odontopus sexpunctatus* and True bug *Phonoctonus lutescence* were found feeding by inserting their proboscis on the scutellum of the adult *D. volkeri* (Plate 1).

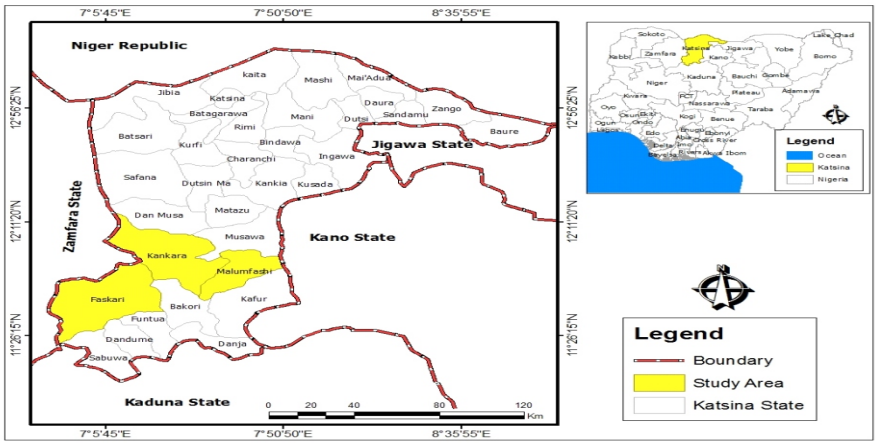

Figure 1: Map Showing *D. volkeri* collection sites in three LGAs of Katsina State.

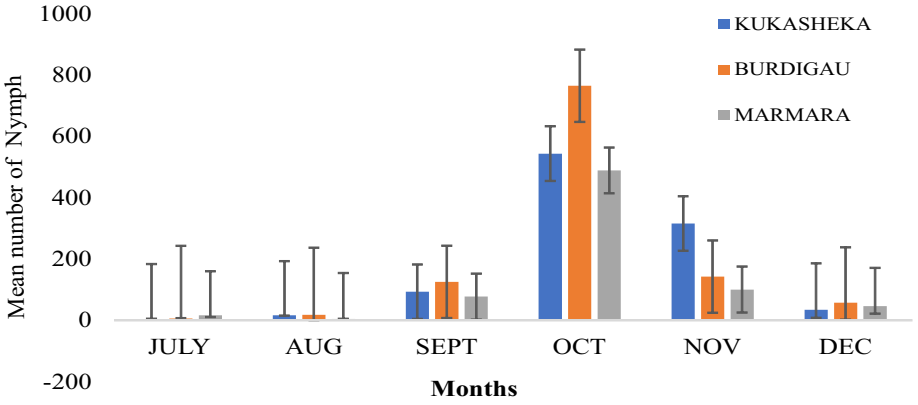

Fig 2: Distribution of *D. volkeri* Nymphs in Cotton Agrœcology at Malumfashi Local Government, Katsina State

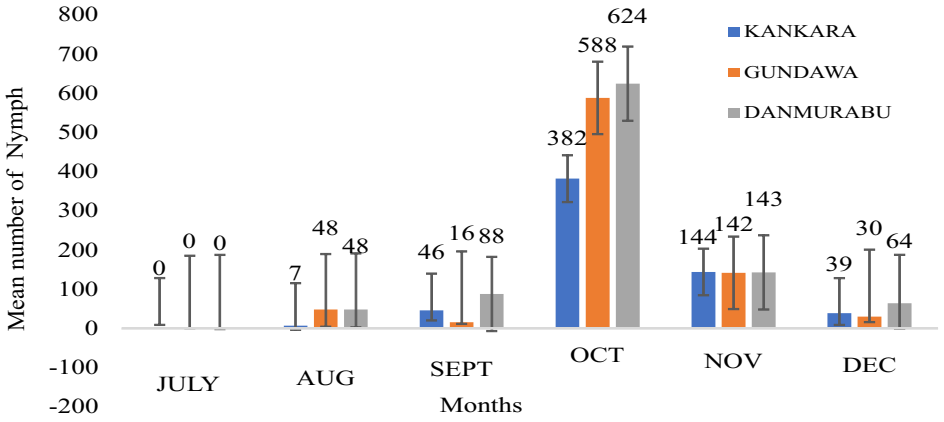

Fig 3: Distribution of *D. volkeri* Nymphs in Cotton Agrœcology at Kankara Local Government, Katsina State

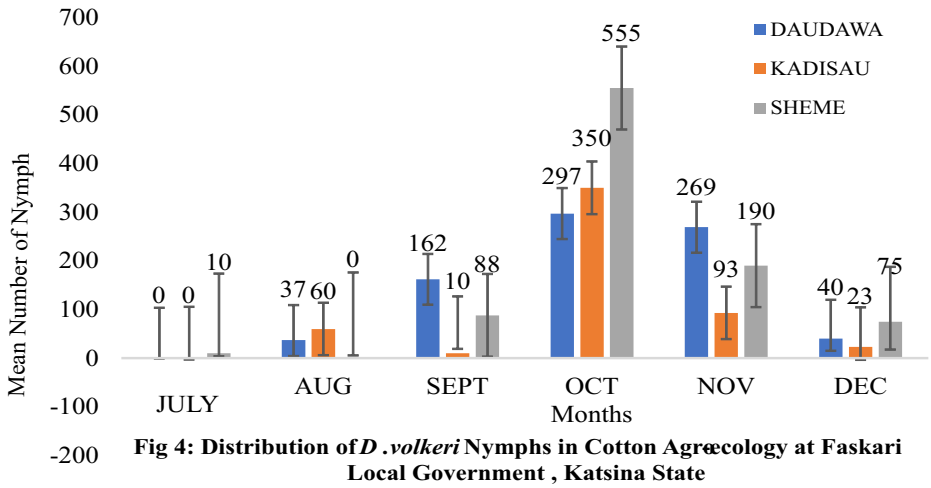

Fig 4: Distribution of *D .volkeri* Nymphs in Cotton Agrœcology at Faskari Local Government , Katsina State

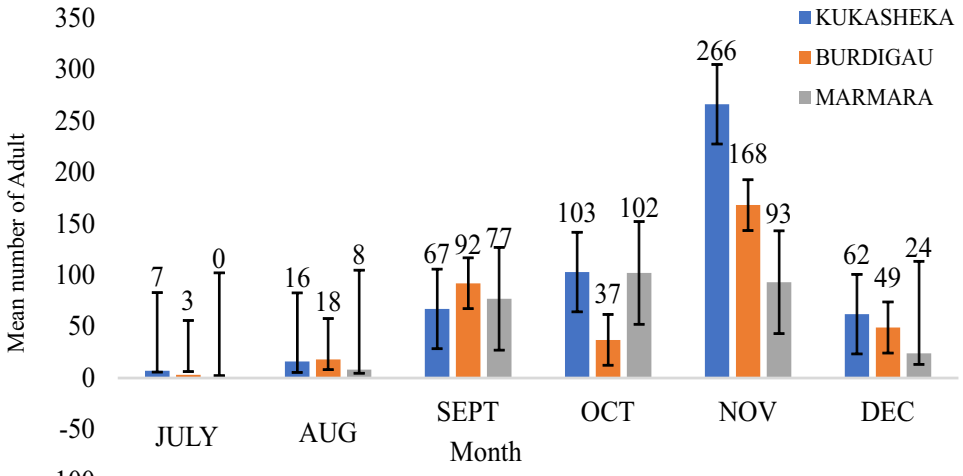

Fig 5: Distribution of *D. volkeri* Adults in Cotton Agroecology at Malumfashi Local Government, Katsina State

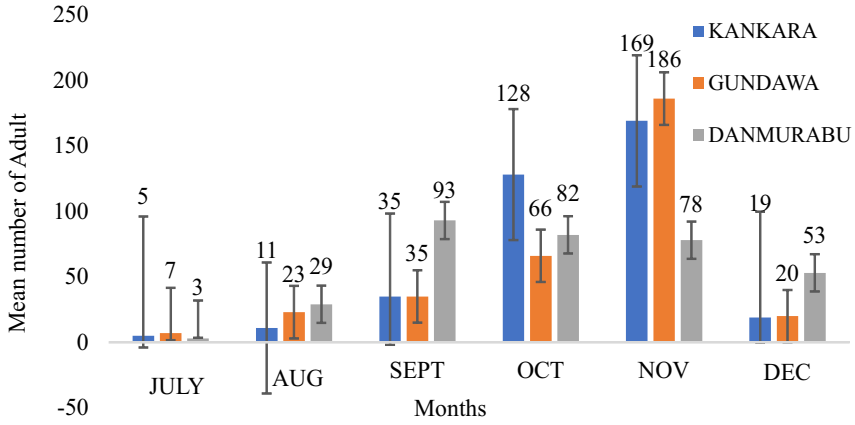

Fig 6: Distribution of *D. volkeri* Adults in Cotton Agroecology at Kankara Local Government, Katsina State

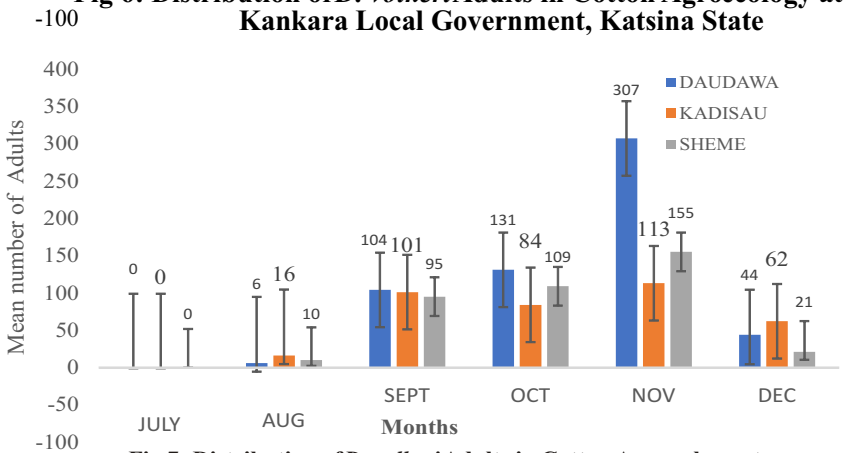

Fig 7: Distribution of *D. volkeri* Adults in Cotton Agroecology at Faskari Local Government, Katsina State

Table 1: Meteorological Data at Three Local Government Areas of Katsina State

Months	Average Temperature (°C) Max.	Min.	Average Rainfall (mm)	Average Relative humidity (%)	Average Wind Speed km/hr
July	28	27	114.6	76	1.13
August	27	26	222.8	80	0.78
September	28	27	44.2	76	0.69
October	28	26	3.8	48	0.37
November	25	22	0.00	37	0.27
December	23	20	0.00	35	0.48

Source: KTARDA

Table 2: Predators of *D. volkeri* and Local Government Collected in Cotton Agro-ecology of Katsina State

Common Name	Scientific Name	Relative Abundance/Area	Local Government Collected	Family	Order
Welwitschia bug	*Odontopus sexpunctatus*(Laporte)	4	Malumfashi, Kankara and Faskari	Pyrrhocoridae	Hemiptera
Assasin bug	*Rynocoris segmentarius* (Hahn)	3	Kankara and Faskari	Reduviidae	Hemiptera
Praying mantis	*Mantis religiosa* (Linnaeus)	2	Malumfashi, and Faskari	Mantidae	Mantodea
True bug	*Phonoctonus lutescence* (Guerin)	3	Kankara and Faskari	Pyrrhocoridae	Hemiptera
Spider	*Latrodectus hasselti* (Clerck)	3	Malumfashi, and Faskari	Theridiidae	Araneae
Lizard	*Agama agama* (Linneaus)	1	Malumfashi, Kankara and Faskari	Agamidae	Squamata
Toad	*Bufo bufo* (Linneaus)	1	Kankara and Faskari	Bufonidae	Anura

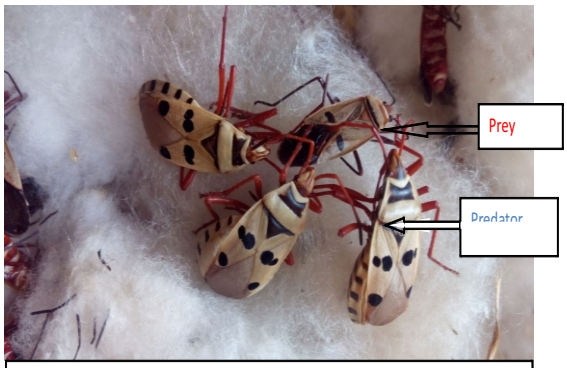

Plate I: *Odontopus sexpunctatus* Predator Feeding on *D. volkeri* adults in Cotton

DISCUSION

The present study showed that there were more number of *D. volkeri* in Kukasheka, Burdigau and Marmara in Malumfashi Local Government during the month of October when temperature, rainfall and relative humidity were 27°C, 3.8 mm and 48 - 50 %, respectively. The lowest mean number of nymphs were found and recorded in July and August. These results were in accordance to Shah *et al.* (2015) who reported in their spot-wise entomological survey that the population of whitefly was recorded maximum between June to October and the population trend was increasing with the passage of time. The present study was contrary to the reports of Shad *et al.* (2001) and Gayi *etal.* (2017) that the peak populations of sucking pests of cotton were found in the first fortnight of August and declined in early October. The present study confirmed findings by Patel and Patel *(*2015) who reported cotton stainers (*Dysdercus fasciatus* Sign.) being hygrosensitive to both dry and moist air, but not to intermediate relative humidity. In the present study, Sheme

village in Faskari Local Government has the highest mean number of *D. volkeri* followed by Daudawa and Kadisau in the month of July; this may be attributed to the favourable temperature and relative humidity 28 ^{0}C and 76 %, respectively. This spread and level of occurrence in the surveyed areas could be an indicator that the pest has a wider host range and favourable environmental conditions in these areas hence the high counts observed in all the three LGAs surveyed, since cotton was planted both in sole and intercropped systems, respectively. *D. volkeri* infestation in the study area was highest in October and gradually increased to the last week of November when weather conditions become warm and dry. Overall per leaf pest sucking insect populations peaked in the months of August and September, most probably due to warm and humid weather conditions in these months as reported by Mohapatra (2008) and Abdullah (2010) in India and Pakistan, respectively.

Predators of *D. volkeri* in cotton agro-ecology of the three LGAs in Katsina State

The presence of Phonoctonus lutescens predator in D. volkeri has been reported (Issa *et al*., 2020). In this present study, *Odontopus sexpunctatus and Phonoctonus lutescens* has been observed to feed by inserting their proboscis on *D. volkeri adults. This observation is in line with the findings of* Mani, (2004) who reported that *Phonoctonus*, *Rhynocoris segmentarius* were found on sunflower but the populations were not enough to suppress the large numbers of *D. volkeri*. Considering the feeding habit of *O. sexpunctatus*, it could be a good biological control agent of *D. volkeri* more especially on cotton plants.

This further corroborates the findings of Mani, 2004 and Mani, 2013 who reported that abundant predators in sunflower field were *Rhynocoris segmentarious* and *Lygaeus rivularis.* During the period of study, populations of *Phonoctonus* were low in most of study areas. However, Issa *et al*. (2020) concludes that changes in environmental conditions may account for a significant portion of the population dynamics of *P. lutescens* in the cotton field. It is evident that predator populations are influenced by a wide range of factors related to the cotton growing environment and to human intervention. These factors affect the ability to develop and propagate populations and consequently their density in fields. Should the population density continue to increase then natural enemy populations would ideally start to regulate the population size (Muthupandi *et al*., 2014).

CONCLUSION

The research work showed that the Local Government Areas surveyed were the hotspots for *Dysdercus* nymph and adult populations between October and November.*D. volkeri* nymphs had higher occurrence in Burdigau (657) and Kukasheka (566) villages of Malumfashi Local Government. Similarly, Danmurabu, Gundawa and Kankara villages had (624, 588 and 382) nymph populations, respectively in Kankara LGA. While in Faskari Local Government, Sheme, Kadisau and Daudawa recorded with 555, 350 and 297 nymph populations in the same month, respectively. The present findings will provide a base line data on the status of *Dysdercus* pest in terms of distribution and abundance in cotton agro ecological zones of Katsina State of Nigeria and a better understanding of how the population dynamics of this pest and weather variation mechanism can fine-tune pest management strategies and response to pests attacks for adopting IPM strategies.

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