Tropentag 2021, hybrid conference
September 15-17, 2021
Conference on International Research on Food Security, Natural Resource Management and Rural Development
organised by the University of Hohenheim, Germany

"Towards shifting paradigms in agriculture for a healthy and sustainable future"

Effect of Plant Pathology and its Impact on Agriculture, Beekeeping and Food Security in Kwara State, Nigeria

Ajao Mufutau[1], Yusuf Oladimeji[2]

[1]*Kwara State University, Malete, AjaoAdeyemiMufutau,*
[2]*Ahmadu Bello University, P.M.B. 1044, Zaria, Kaduna State, Nigeria, Department of Agricultural Economics*

Abstract
Honey bee (*Apis mellifera*), the most domesticated western honeybee is faced with multiple factors and stressors affecting its health, productivity and survival leading to bee population decline and subsequently low agricultural production and food security. This work was therefore designed to identify, assess pest, predators and their effects on bees, agricultural production and suggest management strategies for pollinator conservation for sustainable food security. The method adopted involved a simple random sampling of fifty- seven (57) beekeepers was chosen for questionnaire administration. This consisted of six (6) institution based,twenty-one (21) non-governmental and thirty (30) private/individuals bee farms from 10 Local Government Areas (LGAs) of Kwara State, North-Central, Nigeria. Furthermore, a field survey and sample collection of honey bee pests and predators was also conducted at the six apiaries at the study area. The responses from the beekeepers, as well as field collection and laboratory analysis revealed ants as dominant pest and predators in apiaries at Asa (63.5 %); small hive beetle in Irepodun (95.2 %); termite, 68.1 % in Moro; and wax moth 78.9 % in Ilorin South respectively. These affects beekeeping practices, pollinators, hampering agricultural production and food security. The identified pests and predators manifest in low honey production, irritation and disease condition leading to hive abandonment, forcedswarming, reduced pollination efficiency, colony population decline and death, hence food insecurity. Suggested coping strategies among others include providing the beekeeper with adequate training on bee health maintenance, pollination service and skilled management expertise needed to identify and combat these problems. This is imperative if its impact on agriculture, beekeeping and food security would be achieved.
Keywords: Coping strategy, food security, bee survival, pests
Correspondence Author's E-mail: adeyemi.ajao@kwasu.edu.ng

Introduction

Agriculture, is the art, science, and industry of managing the growth of plants and animals for human useis strategic to the Nigerian economy and plays the key roles of supplying food for the population, rawmaterials for industries, earning foreign exchange, providing market forthe industrial sector and a key contributor to wealth creation and poverty alleviation. The sector is contributing averagely about 41% of the GrossDomestic Product (GDP) and accounts for 5% of total export earnings (Moustafa, 2001,FAO, 2009,Gallai*et al.*, 2009; Calderone, 2012).Worldwide, the contribution of bees and other insect pollinators to global crop production through effective pollination and increased crop yield for food security through agricultural practices is well acclaimed.

Practically, bees require three main basic types of resources to persist in its environment: (i) floral resources (both pollen and nectar) for provisioning nest cells and for sustenance, (ii) appropriate nesting substrate or other nest-building materials and, (iii) the provision of suitable abiotic conditions (microclimate and local topography).The need to design strategies for conserving pollinators in farmlands is driven by their ecological and economic importance (Donaldson, 2002; Brown and Paxton, 2009; Freitas *et al*., 2009) to society.

Bees benefit humans in numerous ways such as providing agricultural services like pollination of agricultural crops thereby increasing crop yield, diversity and crop availability at all times thus sustaining food security (Ahmad and Aslam, 2002, Harshwardhan Bhardwaj *et al.*, 2012

Methodology

A survey of various types of honey bee health stress factors was conducted for bee colonies in institutional, organizational and private apiaries in Kwara State to assess their effect on bee productivity and colony survival strategies and the management methods adopted by beekeepers to cope with the challenges. Primary data was collected through structured questionnaire and interview schedule to elicit necessary information.

A two stage random sampling technique was adopted to select the representative beekeepers and apiaries managers in the State.The method adopted involved a simple random sampling of fifty-seven (57) beekeepers was chosen for questionnaire administration. This consisted of six (6) institution based, twenty-one (21) non-governmental and thirty (30) private/individuals bee farms from 10 Local Government Areas (LGAs) of Kwara State, North-Central, Nigeria.

The questionnaire sought the demographic status of the beekeepers, type of bee health stress factors experienced, type of hive used and management strategies for coping with the challenges.

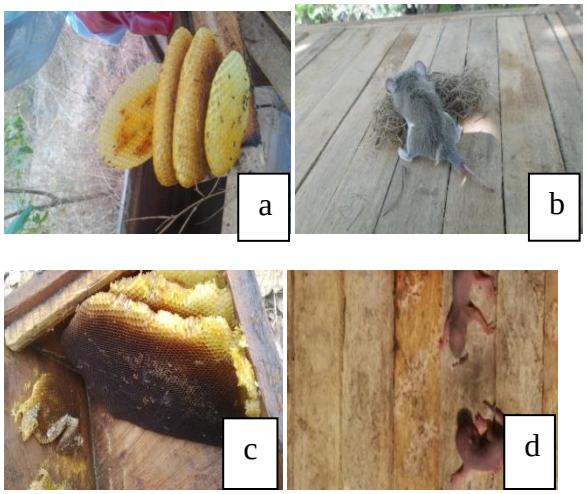
Results and Discussions

The content of table one revealed the age range of the respondents to be between 20 and 60 years with 27 (47.38%) of the bee farmers falling between 41-60years and 2(3.50%) from institutional, 12(21.05%) organizational and 16(28.07%) private/individual apiaries.46 (80.7%) of the respondents were male while 11(19.3%) were female. Most of the respondents had between 1-10 years of bee farming experience (83.3%, 85.7% and 33.3% for institutional, organizational and individual apiaries respectively. Majority of respondents from institutional and organizational apiarists had secondary and tertiary levels of education whilemost private apiarists had non-formal or primary level of education.

Table 2: Type of hives in use and nature of hive management practices by the beekeepers

Apiary type/ Location	Institutional Apiaries			Organizational Apiaries			Private /individual Apiaries			
		Hive type			Hive type			Hive type		Total
LGA	KTB	TTB	LANG	KTB	TTB	LANG	KTB	TTB	LANG	Colonies
Asa	110	105	0	120	15	0	13	33	0	396
Baruteen	112	0	0	203	30	0	112	110	0	567
Edu	203	0	0	145	48	0	230	120	0	746
Ekiti	145	34	0	150	0	0	124	23	0	476
Ifelodun	150	0	4	203	105	0	203	76	0	741
Ilorin South	120	35	0	145	0	4	400	75	3	782
Irepodun	520	130	3	203	0	0	340	90	3	1289
Moro	120	12	50	145	34	12	257	120	0	750
Oyun	68	0	3	150	0	0	223	13	3	460
Patigi	120	40	0	203	0	0	154	54	0	571
Total	**1668**	**356**	**60**	**1667**	**232**	**16**	**2056**	**714**	**9**	**6778**
MEAN	**166.8**	**35.6**	**6**	**166.7**	**23.2**	**1.6**	**205.6**	**71.4**	**1**	
STD	**128.8**	**46.3**	**15.5**	**32.3**	**33.7**	**3.8**	**112.8**	**39.6**	**1.5**	
MAX	**520**	**130**	**50**	**203**	**105**	**12**	**400**	**120**	**3**	
MIN	**68**	**0**	**0**	**120**	**0**	**0**	**13**	**13**	**0**	

Source: Field survey 2020



Figures a, b, c and d are pests and vertebrate predators of bees: (a)black ants preying on bee combs, (b) a mouse invading bee hive as home,(c) red ant attacking the combs and feeding on bees and (d) litters of squirrel living in bee hive.

The result of the present study revealed the existence of arthropods and vertebrate pests and predators in *Apis mellifera* colonies partly due to factors such as bad management practices occasioned by inexperience handling of the various hive types: Kenya Top Bar (KTB) Tanzania Top Bar (TTB) and Langstroth (LANG) hives. The study also identified hardship due to effect of climate change, incessant use of hazardous pesticides in farms around apiaries and effect of some human activities as a major stress factors causing pollinators decline, low yield of agricultural output and food insecurity which was similarly observed by Kristine *et al*. (2014).

The bee farmers responses and sample collections showed that termites *(Macrotermes bellicosus)* spiders (*Argiope aurantia*), hive beetles (*Aethina tumida*); wax moth *(Galleria mellonella)*; squirrels (*Marmota marmota*), geckos (*Hemidactylus frenatus*), bear (*Ursid ursus*), lizards (*Agama agama*) and birds (*Merop sorientalis)* were the most destructive pests and predators at the various apiaries at the study area. This result were similar to those of (Desalegn,

2001, Solomon, 2009, Lawal and Banjo, 2010 and Haylegebriel Tesfay, 2014) who reported that pest infestation was found to decrease enormously the performance and causes economic loss of bee colonies in South Western, Nigeria and Haylegebriel (2014) also corroborated the present study's finding by observing that Honey bees diseases, pests and predators are causing a significance economic loss in honey bees and their products.

Conclusion

Through effective colony sanitation, improved human bee management to increase colony strength, provision of adequate bee plants, improved human /bee activity, adopting specific control measures for respective pests and predators will reduce prevalence and intensity of stressors on honey bees, thereby have an impact on agriculture, beekeeping and food security in Kwara State, Nigeria, and world over.

References

Ahmad and Aslam, 2002,

B. Amssalu, and B. Desalegn, "Occurrence of small hive beetle (*Aethina tumida Murray*; Coleoptera: *Nitidulidae*) in honeybee (*Apis mellifera* L," Ethiopian Veterinary Journal. Vol. 10, no. 2, Pp. 101-110, 2006

R. Morse, and R. Nowogrodzki, "Honey bee pests, predators and diseases". 2nd ed . Ithaca N.Y., Cornell University

Press, 1990

FAO (2009), ProdSTAT Database. Food and Agriculture Organization of the United Nations. Available at http://faostat.fao.org/default.aspx

Gallai et al (2009)., "Economic valuation of the vulnerability of world agriculture confronted with pollinator decline,"*Ecological Economics*, 2009, 68: 810-821..

Calderone N. W. (2012), "Insect Pollinated Crops, Insect Pollinators and US Agriculture: Trend Analysis of Aggregate Data for the Period 1992–2009," *PLoS ONE* 7(5): e37235, May 2012. Updated values are for 2010

Brown, M.J.F. and Paxton, R.J. (2010) The conservation of bees: a global perspective. Apidologie 40:410-416.

Freitas et al., 2009; Brown and Paxton, 2009; Donaldson, 2002) Sabbahi, De and Marceau, 2005, Kristine M. Smith, Elizabeth H. Loh, Melinda K. Rostal, Carlos M. Zambrana-Torrelio, Luciana Mendiola and Peter Daszak(2014).Pathogens, Pests, and Economics: Drivers of Honey Bee Colony Declines and Losses. EcoHealth, pp 1-12

Solomon B.(2009). Indigenous knowledge and its relevance for sustainable beekeeping development: a case study in the Highlands of Southeast Ethiopia." Livestock Research for Rural Development. vol. 22, no.11, pp. 11, 2009

Lawal O.A and Banjo A.D. (2010).Appraising the knowledge and perception of pests problems in beekeeping business at different ecological zones in South Western Nigeria. World Journal of Zoology 5(2): 137-142.

Gerald R (2014). Honey Bee Population Decline in Michigan, Michigan Journal of Public Affairs, Volume 11, Spring 2014 | mjpa.umich.edu

Haylegebriel Tesfay, (2014) Honey Bee Diseases, Pest and Their Economic Importance in Ethiopia. International Journal of Innovation and Scientific Research, Vol. 10 No. 2 Oct. 2014, pp. 527-535