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MORPHOMETRICS AND PARASITIC LOAD OF *VARROA* MITES (ACARI: VARROIDAE) ON COLONIES OF *APIS MELLIFERA ADANSONII* (HYMENOPTERA: APIDAE) IN SOUTH WESTERN NIGERIA

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ABSTRACT: The parasitic mite *Varroa destructor* has been the dominant subject of discussion among bee scientists and bee-keepers worldwide. Unfortunately, few literatures has reported the presence of this dreaded honey bee parasites in Sub-Saharan Africa until 2012 when Nigeria was listed among impacted countries. In Sub-Saharan Africa, beekeeping activities have long been plagued with many problems such as low honey yield, frequent bee swarming and colony absconding. A three year field study was carried out to investigate the degree and pattern of infestation, the species and haplotypes of the *Varroa* mite parasitizing the bees *A. m. adansonii* in South Western Nigeria. Survey pathologies were carried out using alcohol wash method to dislodge mites from 42 colonies evenly sampled from 14 apiaries selected in Ogun, Osun and Lagos States. Thirty one colonies (73.8%) sampled were infested with *Varroa* mites, no significant difference were found between the levels of infestation during the dry and wet seasons at confidence interval of 95% (t = 1.542, df = 13, p = 0.147 (p> 0.05)). Average mite load on adult bees range from 0.01 to 0.10 mites per bee and mite load in colonies ranged from 4 to 55 mites per 100 bees. All the colonies can be rated as *Varroa* tolerant because infestation is not more than 0.15 mites per adult bee. Morphometric analysis of samples of the female mites from colonies in different locations showed there was no significant difference at 95% confidence intervals between the mean body lengths (t = 0.545, df = 19, p = 0.592 (p > 0.05)), mean body widths (t = 0.374, df = 19, p = 0.713 (p > 0.05)) and similarly, between the second and fourth leg segments of the mites. Comparing these morphometric data with the data base of other workers confirmed the only one species found in the area as *Varroa destructor*. Haplotype confirmation of the species further revealed the mites were the Korean haplotype "K' type referred to as the virulent type.

KEY WORDS: *Varroa destructor*, colony, apiary, mite load, haplotype, morphometric, characters, infestation

INTRODUCTION

Diseases and parasites in honey bees have become a global problem that threatens beekeeping. There are more than 100 species of mites alone that are associated with *Apis mellifera.* In the recent times, there has been increase in reported cases of colony losses from Europe, USA, South America, Australia, Middle East and Japan (Monheim et al. 2010). Africa is not excluded; Oyerinde and Ande (2009) reported the impacts of bee pests on colony establishment in Kwara State in Nigeria which had resulted in 15% decline in honey bee colony establishment in some Local Governments. Ojeleye (1999) opined that the problems of diseases and pests of honey bees in the tropics have been compounded by poor hive management, ecological problems and low level of research work addressing the issue. *Varroa destructor* (1987), *Acarapis woodi* (1984) and *Aethina tumida* (1997) have been identified as the major arthropod pests of honey bees (Kraus and Page 1995; Finley et al. 1996; Wilson et al. 1997; Hunt 1998).

Varroa jacobsoni, a parasite of serious concern causes varroasis and was first discovered in Java in 1904 (Oudemanns 1904). The loss of colonies to *Varroa* mites has been widely reported in Europe and United States by De Jong (1997), Wilson et al. (1997) and Sammataro et al. (2000). In New York State, Otis and Scott-Dupree (1992) reported high colony mortality due to heavy infestation levels (82.9–86.6% infestation of ~100 bee samples), Kraus and Page (1995) reported more than 50% colony losses in Sacramento, California due to *Varroa* infestations and Finley et al. (1996) reported 25–80% colony losses for beekeepers in the northeastern U.S. in 1995–1996 seasons. There is research article addressing the issue of *Varroa* mite infestation on honey bees in Nigeria.

Varroa mites are dorsoventrally flattened to fit ideally under the abdominal segments of the bee for feeding on the haemolymph by piercing through the intersegmental membranes with their chelicerate mouthparts (De Jong 1997). The adult male is white to light tan in colour, spherical shaped and 0.8 mm length and 0.7 mm in width, living inside the sealed brood while the female is reddish brown, crab shaped and 1.1 mm length and 1.6 mm width (Shimanuki and Knox 1991; Martin 2001). *Varroa* mites are ectoparasites that parasitize both the adult honey bees and brood (Fries 1993), feeding on the hemolymph of the late larval and pupa stages of bee brood and transmitting a number of pathogens such as bacteria, virus, microsporidium and fungal spores. The female mites are more likely found feeding on hemolymph of adult bees which they use as short-term hosts for spread (Sammataro et al. 2000; Bailey and Ball 1981; Ball 1994). The chelicherates that she pierces into the host functions as "dirty

syringes" causing extensive damage and exposing the bees to many diseases pathogens (Ball 1994). Adult bee symptoms of *Varroa* infestation include a reduction in adult bee population, deformed wings, evacuation of the hive by crawling adult bees, and queen supercedure while brood symptoms include a spotty brood pattern, discolouration and abnormal positioning of the brood. De Jong et al. (1982) reported a 6–25% loss in body weight of workers in infested colonies and the life span reduced by 34–68% due to the infestation. The feeding activities of *Varroa* cause 15–50% loss of haemolymph protein content and total haemolymph volume in emerging bees (Smirnov 1978; Weinberg and Madel 1985). Symptoms resembling European foulbrood, American foulbrood and sac brood have been identified by Hung et al. (1995); Bailey and Ball (1981). In light of this, Shimanuki et al. (1994) coiled a name for the symptoms as 'parasitic mite syndrome' (PMS). Many viruses are found associated with PMS such include Kashmir bee virus and deformed wing virus (Sammataro 1997) and black queen cell virus (Ball 1989). The *Varroa* and host bee relationship is not as damaging as the secondary infection that ultimately leads to 'colony collapse disorder' (CCD) (Hung et al. 1995). Schneider (1986) found reduced flight frequencies in drones infested with *Varroa jacobsoni*.

Varroa life history is in two distinct phases: the phoretic phase and the reproductive phase. The phoretic phase is the life cycle of the adult female mite on the abdominal segment of the adult honey bees and the reproductive phase is the life cycle in the sealed brood. The reproductive phase consists of four developmental stages: egg, protonymph, deutonymph and adult stages (Martin 2001). During the reproductive phase, the bee carries the adult female mite to a suitable brood cell and the mite leaves the bee and enters the rim of the brood cell (Boot et al. 1997), buries itself underneath the bee larva and enters the larval food. The mite lays the first egg 60 hours after the cell capping or when the larval food as been consumed and it begins to suck the larval hemolymph (De Jong 1984). Eggs are laid at intervals of 30 hours after the first lay with a maximum of 7 eggs laid in a drone cell and 6 eggs in a worker cell (Ifantidis 1983). Within 3 days, the eggs develop and hatch into immature 6-legged larva called protonymph which feeds, grows and molts within 3 days into 8-legged larva called deutonymph. The deutonymph resembles the adult female mites. In both the protonymph and deutonymph stages there are motile and immobile stages. (Ifantidis 1983; De Jong 1984). The female mite takes 7.5–8 days and male takes 5.5–6 days to develop to mature adult. In *Apis mellifera*, the mite reproduces in both worker and drone brood while in *Apis cerana*, it reproduces in drone brood present in the colony during certain period of the year, this limits its reproductive capacities (Sasaki 1989; Ball 1994). The brood development period affects the reproduction, in *Apis mellifera,* worker's development takes 21 days and 24 days for drone development while in *Apis cerana*, it takes 18 days for worker and 22 days for drone to develop. The duration of 18 days for worker brood development in *Apis cerana* is inadequate for *Varroa* reproduction cycle (Boot et al. 1997).

Varroa consists of at least four, but possibly seven, distinct species. The four recognized species, *Varroa jacobsoni, V.destructor, V. underwoodi* and *V. rindereri* are morphologically distinct and show clear differences in their mitochondrial DNA sequences. They are also reproductively isolated and show differences in their host specificity and geographical distribution (Anderson and Trueman 2000). *Varroa jacobsoni* is an ectoparasitic mite of the Eastern honey bee *Apis cerana*, the mite causes little damage to the bees (Ball 1994). *Varroa jacobsoni* and *Apis cerana* have developed a compromised host-parasite relationship (Ball 1994). *Apis mellifera* is parasitized by *V. destructor* worldwide. In *Apis mellifera*, the mite found low resistance and subsequently spread rapidly worldwide (Peng et al. 1987). The low resistance of *Apis mellifera* to mite is because they have not co-existed for a long period of time and there is no adaptive host-parasite relationship, hence the mites often kill its host (Le Conte 2010). There are two common genotypes of *Varroa destructor* the 'Korean' and 'Japanese' genotype some have suggested the later may be more virulent than the former type (De Guzman et al. 1999; Anderson 2000; Anderson and Trueman 2000). The two of them are capable of reproducing on *A. mellifera*.

A colony is rated as varroa-tolerant if it had not more than 15 mites for every 100 adult bees (Erickson et al. 1998). Shimanuki and Knox (1991) suggested that beekeepers whether having one or thousands of hives, must develop a bee disease management program that is dependent on periodic colony inspections, recognition of symptoms of bee diseases and level of severity and ability to

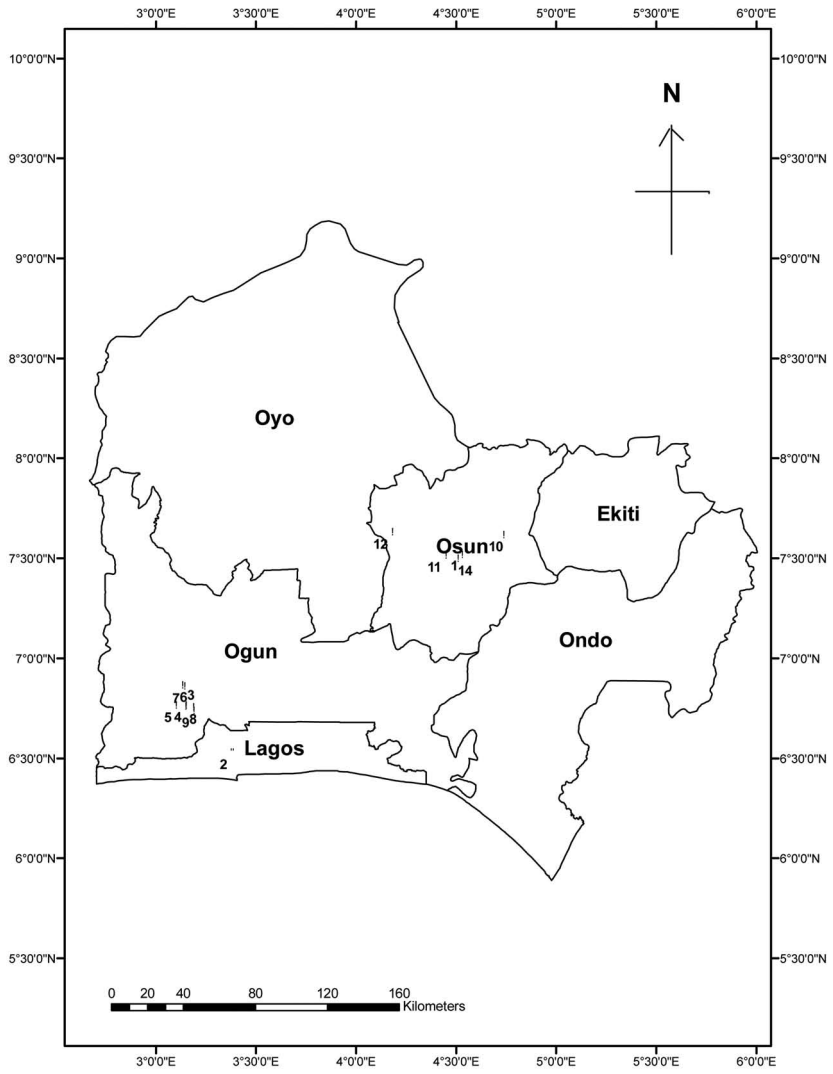

Fig. 1. Distribution of apiaries in Southwest Nigeria where colonies were sampled from December 2009 to December 2011 for *Varroa* mites. Apiaries sites: 1 — OAU farm, Ife Osun State; 2 — Unilag garden, Lagos St.; 3 — Shogade, Ifo Ogun St.; 4 — Coker farm, Ifo, Ogun St.; 5 — Olowo farm, Ota, Ogun St.; 6 — Abalabi 1, Ifo, Ogun St.; 7 — Abalabi 1I, Ifo, Ogun St.; 8 — Igbusi farm, Ogun State; 9 — Okeoko, Ogun State; 10 — Lev. Farm, Ilesa, Osun St.; 11 — Ipetumodu Osun State; 12 — Iwo, Osun State; 13 — Kosere, Ife, Osun State; 14 — Opa farm, Ife, Osun State.

take corrective actions for the disease. According to Clark and Roberts (1989), one of the principal disease control methods is the use of chemicals.

MATERIALS AND METHODS

Study site

Fourteen apiaries spread in Osun, Ogun and Lagos States were used for these studies conducted between December 2009 and September 2011. The apiaries were located within 20 to 170 km apart (Fig. 1). Sampling and treatments were split equally between each apiary and three colonies selected in each. The colonies were housed in Tanzania top bar hive.

Alcohol wash method (Macedo et al. 2002) was used to carry out the mite sampling. The methods are appropriate to get an accurate estimation of the mite population which allows beekeepers to employ control measures that save time and money (Macedo and Ellis 2000).

A wide mouth bottle with #8 mesh screen on the other side was used to collect some bee samples from a frame of brood in the brood nest The bottled was filled half level with the alcohol covering the bees. It was shaken gently and slowly inverted to empty the alcohol into a glass dish. The mites and the alcohol drained into the dish while the bees remained in the jar. About 90–95% of the mites from the adult bees were dislodged through this method. The dislodged mites was preserved in some of the alcohol. DNA analysis by the randomly amplified polymorphic DNA (RAPD) technique was carried out to determine the mite haplotype.

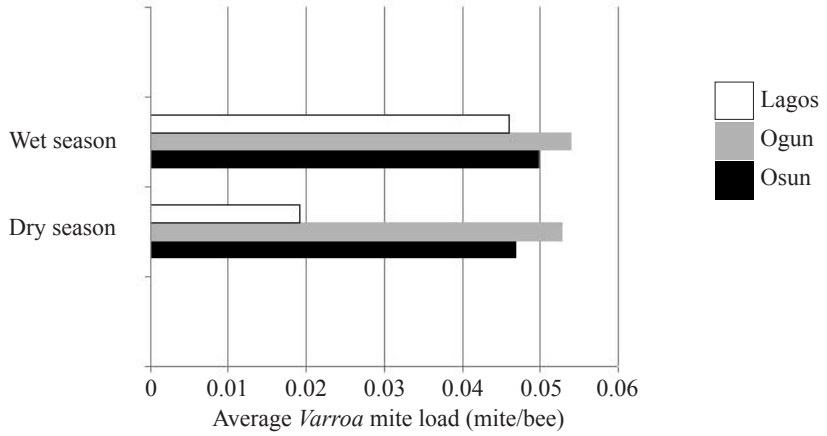

Fig. 2. Comparison between average *Varroa* mite load per adult bee during the dry and wet seasons in all the apiaries sampled in three states (Osun, Ogun and Lagos).

Table 1.
Student t-test for significant differences between the levels of infestation of *Varroa* mites samples in the dry and wet seasons.

		Mean	N	Std. deviation	Std. error mean	*t*	*df*	Sig. (2 tailed)
	wet season	.154857	14	.153411	.041000	–	–	–
	dry season	.143143	14	.144941	.038737	–	–	–
Pair 1	wet season & dry season	.011714	14	0.02842	0.00759	1.542	13	0.147

Estimation of colony level of mite infestation

The number of mites on the adult bees was estimated by taking the following steps (Macedo et al. 2002):
Number of sampled bees = N × 100 (e.g. 300 = N = 3)
Number of mites dislodged = n
Average number of mites per 100 bees = n/N
To account for the number of mites in sealed brood (Plate 5) multiply by 2 = n/N × 2
Colony level mite infestation = n/N + n/N × 2.
Levels of infestation were calculated in % per 100 bees.

Determination of Genotypes of *V. destructor*

The morphometric characteristics of the female mite samples from two apiaries in different geographic locations with distance higher than 150 km were examined. The mites in alcohol 70% v/v were processed for observation by placing in lactic acid 50% and were cleared in xylene. Stereoscopic microscope (Lancet, Series 2000), fitted with an ocular micrometer was used to measure morphometric characters of the mites: body width, body length and the leg segments of the second and fourth legs. The mean of the measurements were calculated and compared with existing morphometric data on *Varroa* by Anderson and Trueman (2000), Zhang (2000) and Boudagga et al. (2003). Data were analyzed using the SPSS 15.0 software package.

Polymorphic RAPD-type DNA markers were used to determine the haplotypes of the mites preserved in 70% alcohol and frozen at –20°C. Analysis was carried out in CSIRO laboratory Canberra, Australia by Dr Dennis Anderson.

RESULTS

Varroa mites infestation

Varroa mite infestations were found in 11 (78.57%) out of 14 apiaries sampled (Fig. 1). There was no significant difference between the levels of infestation on the colonies during the dry and wet seasons at confidence interval of 95% (t = 1.542, df = 13, p = 0.147 (p> 0.05)) (Table 1). Similarly, there was no significant difference at 95% confidence interval between the average mite load per adult bee during dry and wet season in all the apiaries in three states covered by the survey (t = –1.115, df = 2, p = 0.381 (p> 0.05)) (Fig. 2). The mite infestation cannot be established whether due to poor hive management or climatic factors or related to the geographical location of the apiaries.

During the dry season in February 2010, a total of 42 colonies sampled from 14 apiaries with 3

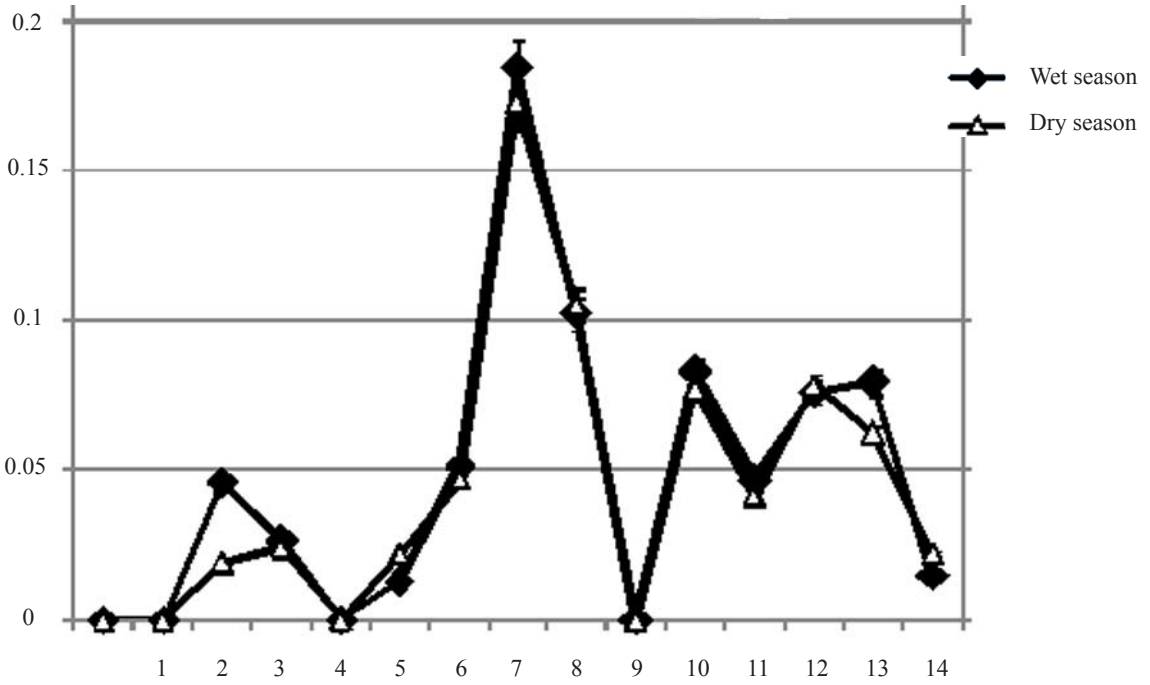

Fig. 3. *Varroa* mite infestation on adult bees in 42 colonies sampled during the wet and dry seasons between November 2009 and October 2010 (*Varroa* load = mites per adult bee).

Table 2.
Varroa mite population levels (mite per bees) in 42 colonies sampled from 14 apiaries monitored during the dry season from November 2009 to April 2010.

Apiary	Colony samples			Av. level of infestation
	Colony 1	Colony 2	Colony 3	Mite per bee
1. OAU farm, Ife Osun State	290/0 mites	300/0 mites	317/0 mites	0.000
2. Unilag garden, Lagos St.	298/3 mites	321/9 mites	301/6 mites	0.019
3. Shogade, Ifo Ogun St.	297/6 mites	294/6 mites	304/10 mites	0.024
4. Coker farm, Ifo, Ogun St.	207/0 mite	233/0 mite	340/0 mite	0.000
5. Olowo farm, Ota, Ogun St.	322/4 mites	280/6 mites	268/9 mites	0.022
6. Abalabi 1, Ifo, Ogun St.	299/14 mites	316/13 mites	325/17 mites	0.047
7. Abalabi 1I, Ifo, Ogun St.	310/59 mites	297/56 mites	252/35 mites	0.172
8. Igbusi farm, Ogun State	310/37 mites	297/28 mites	312/32 mites	0.105
9. Okeoko, Ogun State	300/0 mites	256/0 mite	217/0 mites	0.000
10. Lev. Farm, Ilesa, Osun St.	298/30 mites	299/19 mites	312/21 mites	0.077
11. Ipetumodu Osun State	230/0 mites	300/18 mites	307/19 mites	0.041
12. Iwo, Osun State	312/33 mites	279/19 mites	301/18 mites	0.078
13. Kosere, Ife, Osun State	256/17 mites	307/18 mites	231/14 mites	0.062
14. Opa farm, Ife, Osun State	199/2 mites	249/7 mites	309/7 mites	0.022

colonies randomly selected from each apiary revealed: 31 colonies (73.8%) were infested with *Varroa* mites while 11 colonies (26.2%) were not infested (Table 2), the highest mite load per adult bee recorded was 0.172 during the season (Fig. 3). Similarly, during the wet season, in the month of July 2010, a repeated sampling of the same 42 colonies from 14 apiaries under study revealed, 31 colonies (73.8%) were found infested with *Varroa* mites while 11 colonies (26.2%) were not infested (Table 3), the highest mite load per adult bee recorded was 0.184 during the season (Fig. 3). All the colonies except Abalabi II Ifo Ogun state, can be rated as *varroa* tolerant because infestations were less than 0.15 mites per adult bee (Erickson et al. 1998).

Table 3.
Varroa mite population levels (mite per bees) in 42 colonies sampled from 14 apiaries monitored during the wet season from May 2010 to October 2010.

Apiary	Colony samples			Av. level of infestation
	Colony 1	Colony 2	Colony 3	Mite per bee
1. OAU farm, Ife Osun State	250/0 mites	100/0 mites	300/0 mites	0.000
2. Unilag garden, Lagos St	317/10 mites	293/15 mites	312/17 mites	0.046
3. Shogade, Ifo Ogun St.	312/7 mites	304/6 mites	284/10 mites	0.026
4. Coker farm, Ifo, Ogun St.	217/0 mites	243/0 mites	240/0 mites	0.000
5. Olowo farm, Ota, Ogun St.	312/4 mites	210/3 mites	168/2 mites	0.013
6. Abalabi 1, Ifo, Ogun St.	294/16 mites	286/13 mites	250/13 mites	0.051
7. Abalabi 1I, Ifo, Ogun St.	300/60 mites	300/57 mites	152/25 mites	0.184
8. Igbusi farm, Ogun State	300/39 mites	300/27 mites	412/37 mites	0.102
9. Okeoko, Ogun State	100/0 mites	156/0 mites	107/0 mites	0.000
10. Lev. Farm, Ilesa, Osun St.	300/34 mites	279/20 mites	250/16 mites	0.083
11. Ipetumodu Osun State	290/11 mites	210/10 mites	300/20 mites	0.047
12. Iwo, Osun State	306/29 mites	279/20 mites	257/16 mites	0.076
13. Kosere, Ife, Osun State	298/19 mites	345/23 mites	179/19 mites	0.079
14. Opa farm, Ife, Osun State	324/6 mites	235/5 mites	315/2 mites	0.015

Table 4.
Student *t*-test for significant differences between body width and body length of *Varroa* mites samples from Kosere, Osun State and Abalabi I, Ogun State.

		Mean	N	Std. deviation	Std. error mean	*t*	*df*	Sig. (2 tailed)
Kosere	body width	1718.25	20	1.51083	0.33783			
Abalabi I	body width	1718.12	20	1.35786	0.30363			
Paired	Kosere & Abalabi		20	1.49662	0.33465	–0.374	19	0.713
Kosere	body length	1179.09	20	8.96431	2.00448			
Abalabi I	body length	1177.96	20	7.09108	1.58561			
Paired	Kosere & Abalabi			9.22661		0.545	19	0.592

Morphometric and RAPD analysis of *Varroa* species

The results of morphometric analysis of samples of 40 *Varroa* mites collected from two apiaries in different locations: Kosere farm in Ile Ife, Osun State at latitude: 7.55° N and longitude: 4.55° E geographic coordinates and Abalabi Farm I in Ifo, Ogun State at latitude: 6.49° N and longitude: 3.12° E geographic coordinates (Fig. 1) revealed that: with 95% confidence intervals body length were measured in the range of 1160.0–1190.7 µm and 1166.3–1188.3 µm respectively. Also with 95% confidence intervals body width were measured as 1716.0–1720.7 µm and 1750.9–1720.0 µm, respectively. Mean body lengths were 1179.09 and 1179.79 µm (Table 4) for the mites in the two locations respectively. Similarly, mean body width were 1718.25 and 1718.12 µm (Table 4) for the mites from the two locations respectively. No significant differences were observed between the mean body lengths (t = 0.545, df = 19, p = 0.592 ($p > 0.05$)) and mean body widths (t = 0.374, df = 19, p = 0.713 ($p > 0.05$)) (Table 4) for the mites from the two locations. Mean length of all segments of the second legs were 111.07 to 111.12 µm (Table 5) and the mean lengths of all segments of the fourth legs were 108.57 and 108.59 µm (Table 5). There were no significant differences observed between the sizes of second leg segments (t = 0.554, df = 6 and p = 0.599 (p > 0.05)) and the fourth leg segments (t = 0.146, df = 6 and p = 0.889 (p > 0.05)) (Table 5) of female mites from the two different apiaries in different locations. Measurements of body length and body width compared with the results of Anderson and Trueman (2000), Zhang (2000) and Boudagga et al. (2003) showed there was no significant difference (Table 6). Morphometric characters of the specimens studied

Table 5.
Student *t*-test for significant differences between length of leg segments for the second and fourth legs of *Varroa* mites samples from Kosere, Osun State and Abalabi I, Ogun State.

		Mean	N	Std. deviation	Std. error mean	*t*	*df*	Sig. (2-tailed)
Kosere	2nd leg	111.12	7	46.14975	17.44297			
Abalabi	2nd leg	111.07	7	46.18983	17.45811			
Pair 1	leg segments	–	–	0.23184	0.8763	0.554	6	0.599
Kosere	4th leg	108.59	7	37.76256	14.28425			
Abalabi	4th leg	108.57	7	37.90872	14.32815			
Pair 2	leg segments	–	–	0.38809	0.14668	0.146	6	0.889

Table 6.
Measurements (in µm) of the body length and width (Mean ± S.D) of *Varroa* females from Kosere, Ile-Ife, Osun State and Abalabi 1 Ifo, Ogun State compared to biometry of *Varroa jacobsoni* and *Varroa destructor* as reported by Anderson and Trueman (2000), Zhang (2000) and Boudaga et al. (2003).

	Body length Mean ± S.D	Body width Mean ± S.D	No. of specimen examined
Varroa mite from Kosere, Osun State, Nigeria	1179.09 ± 8.96	1718.25 ± 1.5	20
Varroa mite from Abalabi, Ogun State, Nigeria	1177.96 ± 7.09	1718.12 ± 1.4	20
V. destructor (Anderson and Trueman 2000)	1167.3 ± 26.8	1708.9 ± 41.2	42
V. jacobsoni (Anderson and Trueman 2000)	1063.0 ± 26.4	1506.8 ± 36.0	73
V. destructor (Zhang 2000)	1159.0 ± 21.6	1700.0 ± 46.5	5
V. destructor (Boudaga 2000)	1204.9 ± 40.1	1738.5 ±35.3	20
V. destructor (Boudaga 2000)	1164.9 ± 38.46	1711.2 ± 47.44	20
V. destructor (Boudaga 2000)	1197.1 ± 28.31	1775.6 ± 38.81	60

corresponded with that of *Varroa destructor* and not *Varroa jacobsoni*. The specimens display high phenotypic consistency and were larger in body length and body width than *Varroa jacbsoni* (Table 6) confirming all the mites specimens examined belong to the species called *Varroa destructor*. Also, independent confirmation and banking of the species carried out in CSIRO Laboratory Canberra, Australia corroborates the mites' identification as *Varroa destructor*.

The mites sent for haplotype confirmation by PCR-restriction enzyme analyses in CSIRO laboratory Canberra, Austrralia revealed they were the Korean haplotype "K' type commonly referred to as the virulent type.

DISCUSSION

The result of the study of *Varroa* mite infestation among bee colonies in southwest Nigeria supports the assertion of De Jong (1997) that *Varroa* mite epidemic is a worldwide problem and Anderson and Trueman (2000) observation that high prevalence have been reported in Africa (Egypt and South Africa), United States, Europe and Canada with the exception of Australia. *Varroa* mite remains as the most economically significant parasite associated with honey bees. A single mite preying on an adult bee will shorten its life by 50%, and mites feeding on pupae cause deformities (Root 1990), that render the adult bees unviable if indeed they do mature to adulthood. The net result of a *Varroa* infestation on a colony is reduced production of bees and honey, vulnerability to robbing and disease, and eventual failure of the hive.

The results from morphometric and DNA study of the *Varroa* confirmed the species infesting *Apis mellifera* colonies in Southwest Nigeria are *Varroa destructor.* This observation clearly supported the claims of Anderson and Trueman (2000) that *Varroa* is more than one species, the *Varroa* on *Apis cerana* differs from that on *Apis mellifera.* Delfinado-Baker (1988) claimed that the physical differences exhibited by *Varroa* on *Apis cerana* and on *Apis mellifera* suggest that *Varroa* may be more than one species. Similarly, Anderson and Trueman (2000) clearly demonstrated through comprehensive molecular study techniques that *Varroa* is actually two species but having about 20 mitotypes: *V. jacobsoni* and *V. de-*

structor. The former parasitizes *Apis cerana* and the later parasitizes *A. mellifera.* He showed that the two differ mainly in mtDNA CO-1 gene sequence and could also be separated according to the female body size. The *Varroa destructor* is larger in size and more spherical than *Varroa jacobsoni*.

From the result of the haplotype examination of the *Varroa* as the Korean type "K' type which is a virulent type and official report and confirmation during the banking of the mite specimen in CSIRO Laboratory Canberra Australia, it can be concluded that Southwest Nigeria in Africa has endemic population of *Varroa* mites. Although, earlier report by Anderson and Trueman (2000) excluded Nigeria but reported Egypt and South Africa as having the "K" mitotype. Even though the virulent haplotype have been identified, the observation contradicts the claims of De Jong (1984) and other workers that *Varroa* mite is less virulent on African races of *Apis mellifera* than it is on European races. They believed the mite virulence depends on a number of factors most importantly the strain of honey bees and that *Varroa* would not present the same level of problem in Africa as it had in Europe and USA..

The study has identified low level of mite infestation per adult bee in Nigeria, however, economic threshold have not been attained with regard to levels of infestation in other countries. Ali and Ellis (2000) observed colonies in the Midwest USA with more than 0.12 mite per bee when brood is not present (in the fall) will have increased mortality if the mites populations are not reduced. He further claimed that colonies with more than 0.25 mites per bee will perish in the winter. Similarly, Macedo and Ellis (2000) are of the opinion that in the mid August in USA even when brood is present and infestation is $\geq$ 0.03 mite per bee, treatment must be applied as soon as possible. Other workers like Strange and Sheppard (2001) put the economic threshold of *Varroa destructor* in Northwest USA at 0.12 mite per bee while Delaplane and Hood (1997) put it in the Southeast USA at 0.07–0.12 mite per bee.

The low level of infestation of mites per adult bee can be justified by the observations of Camazine (1986); Ritter and De Jong (1984) and Ritter et al. (1984) that the shorter developmental time exhibited by African honey bees appears to result in a larger degree of infertility of adult female mite after invasion of worker brood. Furthermore, keeping the number of mites below some recommended economic threshold has contributed to the relative tolerance of the African honey bees. The mite and the bee exhibit a balanced parasite-host relationship. The low level of mite infestation can be supported by the observations of Ritter et al. (1990) and Ducos de Lahittle et al. (1998) that African honey bees in Africa will be largely tolerant to *Varroa* and only a small percentage of the bees will succumb to the mite, resulting in colonies increasingly tolerant and mite level rapidly decreasing. They further supported this view with data from North Africa where *Varroa* has reportedly been of little significance. The view of all the workers is that *Varroa* would spread among the African honey bee colonies but would be a little significant pest.

The insignificant differences observed between the mite load per bee during the wet and dry seasons agrees with the opinions of De Jong (1984) that in Tropics, brood is available throughout the year in the colonies and therefore *Varroa* mites will always be available. On the other hand, the observation contradicts the opinion that season (Moretto et al. 1991) and environment (Marcangeli et al. 1992) influence *Varroa* infestation.

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