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Population dynamics of termites in groundnut in relation to abiotic factor

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Abstract

Field experiments on population dynamics of termites incidence in groundnut were carried out under field conditions during summer and *kharif*, 2012 at Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand. The activity of termites commenced from 1st week of March [10th Standard meteorological week (SMW)] and continued till 2nd week of June (14th SMW) during summer, whereas 4th week of July (30th SMW) to 1st week of November (43rd SMW) during *kharif*. The pest activity was found higher in groundnut field during 2nd week of March (11th SMW) to 2nd week of June (23th SMW) in summer, whereas it was 3rd week of September (37th SMW) to the end of the crop period during *kharif*. The pest activity was at peak level on 2nd week of June (23rd SMW) and 2nd week of October (40th SMW) during summer and *kharif* season, respectively.

The evaporation, minimum, maximum and mean temperature, soil temperature at 5 cm, 10 cm, and 15 cm depth at afternoon hours and soil temperature at 15 cm depth at morning hours had highly significant positive relationship with termites activity in groundnut in both the seasons. Morning, evening and mean vapour pressure had highly significant negative relationship and wind speed had significant negative association with termites population in groundnut in both the seasons. Morning, evening and mean relative humidity had negative relationship with termites population but non-significant in summer and significant in *kharif* season.

Keywords: termite, groundnut, population dynamics and abiotic factors

Introduction

Groundnut (*Arachis hypogaea* Linnaeus) is an annual legume crop and belongs to family Leguminosae. It is also known as peanut, earthnut, monkeynut and goobers. It is world's largest source of edible oil and ranks 13th among the food crops as well as 4th most important oilseed crop of the world (Ramanathan, 2001) [7]. Groundnut seeds are nutritional source of vitamin E, calcium, phosphorus, magnesium, zinc, iron, riboflavin, thiamine and potassium. Groundnut oil is considered as stable and nutritive as it contains just the right proportion of Oleic (40-50%) and Linoleic (25-35%) acids (Mathur and Khan, 1997). Asia possesses first rank in area (63.4%) and production (71.1%) of groundnut. Major groundnut growing countries are India (26%), China (19%) and Nigeria (11%). Groundnut is grown in 43.20 Lakh hectare area with a production of 38.70 million tonne and productivity of 691 kg/ha in India. It is mainly grown in southern and north-western states. Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra and Madhya Pradesh together occupy about 90 per cent of the groundnut area in the country. Gujarat ranks first in production (30%) of groundnut in the country. It is production 3.57 million tonne and grown in area of 1.83 million hectare with a Productivity of 1861 kg/ha (Anon., 2012) [1].

The crop is mainly attacked by 500 species of arthropod. The major insect pests damaging to groundnut crop are aphid (*Aphis craccivora* Koch), leaf miner (*Stomopteryx nertara* Meyrick), stem borer (*Sphenoptera perotett* Cameron), white grub (*Holotrichia consanguinea* Blanchard), bihar hairy caterpillar (*Spilosoma oblique* Walker), red hairy caterpillar (*Amsacta albistriga* Butler), leaf eating caterpillar (*Spodoptera litura* Fabricius), pod borer (*Helicoverpa armigera* (Hubner) Hardwick), jassid (*Empoasca kerri* Pruthi), thrips (*Scirtothrips dorsalis* Lindman), jewel beetle (*Sphenoptera indica*), termites (*Odontotermes obesus* Rambur) and grasshopper (*Hieroglyphus banian* Fabricius) reported by Atwal and Dhaliwal (2008) [3].

Termites are most primitive social insects of the animal kingdom in order Isoptera. The termites present in a colony consist of several castes *viz.*, workers, soldiers, reproductive queen and king (Watson *et al.*, 1983). In groundnut roots damaged causes 25-100 per cent of plants being lost by termites, pod scarification of groundnut as high as 30 per cent has been reported and 30-40 per cent pod damage by termites (Anon., 2013) [2].

Material and Methodology

In order to study the population dynamics and impact of weather parameters on incidence of termites on groundnut, a field experiment was conducted at Agronomy farm, B. A. College of Agriculture, Anand Agricultural University, Anand during the summer and *khari*f season 2012 in a Randomized Block Design with three replications.

Groundnut variety GG-20 was sown during 23rd February, 2012 as first season and 18th July, 2012 as second season in an area of 25 m x 20 m (500 m²) at a spacing of 75 cm between two rows and 10 cm within the rows. To record the termites population in field, 25 wooden sticks (about 5 cm diameter, 1 m length) was installed after sowing at the depth of 15 cm. The termite counts were recorded by observing each wooden stick at weekly interval and again reinstalled the sticks. If, whole wooden sticks eaten by termites, the new sticks were installed. The termite population was correlated with meteorological parameters to know the role of abiotic factors on termite fluctuation.

Result and Discussion

The above results exposed that the termites incidence was low in March (5.56 to 45.56), medium in April to May (53.40 to 78.26) and higher in first fortnight of with peak level on 2nd week of June (101.45) in groundnut during summer season (Table 1). According to Chattopadhyay (2001), termite attack was noticed from the first week of May to the 3rd week of June and maximum infestation was observed in the 1st week of June (just before the monsoon). Bharpoda (2006) [4] noticed the activity of termite during later part of summer and early part of monsoon in Aonla orchard being maximum during second fortnight of June. In *Khari*f season groundnut crop, the pest activity was found low during last week of July (3.05) to 2nd week of September (10.52), mediocre in second fortnight

of September to 1st week of October (56.84) and higher during 2nd week of October (96.75) to end of crop season with peak level on 2nd week of October (96.75). The population of termite workers and pseudo workers were high during October-February (Sen-Sarma, 1986) [7].

The above correlation coefficient results exposed that evaporation, temperature minimum, maximum and mean, soil temperature [at 5 cm, 10 cm, and 15 cm depth at afternoon hours] and soil temperature [at 15 cm depth at morning hours] had significantly positive relationship with termite activity in groundnut in both the seasons. Wind speed, morning, evening and mean vapour pressure had highly significant negative relationship with termite populations in groundnut during both the seasons. Bright sunshine had positive association with termites activity but non-significant in summer and highly significant in *khari*f. In contrast to this, soil temperature at 5 cm and 10 cm depth at morning hours positively correlated with termite incidence in groundnut but significant in summer and non-significant in *khari*f season. Morning, evening and mean relative humidity had negative relationship with termite population in groundnut but non-significant in summer. Evening and mean relative humidity had highly significant negative and morning relative humidity significant negative relationship with termite populations in groundnut during *khari*f season (Table 3). Gadhiya (2012) [5] reported that the evaporation and soil temperature (afternoon) at 10 cm depth were highly significant and positively correlated with termite populations, whereas morning relative humidity had highly significant negative association with population. The wind speed, maximum, minimum and mean temperature, soil temperature at 5 cm, 10 cm and 15 cm depth at morning hours and soil temperature at 5 cm and 15 cm depth during afternoon hours had significantly positive relationship with termite incidence in wheat.

Table 1: Population fluctuation of termites in groundnut in relation to abiotic factors (summer, 2012)

Month/ Week	SMW	WAS	No. of termites/stick	Evaporation (mm/ day)	BSS (hrs)	WS (hrs)	Temperature (°C)			Relative humidity (%)			Vapour pressure (mm)			Soil temperature (°C) at cm depth						
							Min	Max	Mean	Mor	Eve	Mean	Mor	Eve	Mean	Morning			Evening			
																5	10	15	5	10	15	
March	I	10	1	5.56	5.8	8.9	3.2	12.9	32.0	22.5	76.9	21.9	49.4	10.1	7.2	8.65	19.7	24.3	26.8	38.4	30.8	28.7
	II	11	2	22.92	6.9	9.4	3.5	14.4	33.9	24.1	65.5	21.8	43.65	10.6	8.6	9.60	20.9	25.7	27.7	41.8	32.4	29.2
	III	12	3	38.08	7.4	8.0	3.2	15.6	36.9	26.2	70.5	20.6	45.55	10.6	8.0	9.30	23.2	27.7	29.1	44.6	34.2	31.4
	IV	13	4	45.56	8.1	9.3	3.3	18.8	39.8	29.3	67.3	21.0	44.15	12.9	10.8	11.85	25.9	29.5	31.3	46.2	36.3	32.6
April	I	14	5	53.40	8.4	9.5	3.8	21.0	40.1	30.5	78.3	23.1	50.7	17.4	12.3	14.85	28.4	32.1	33.0	48.0	38.3	34.7
	II	15	6	55.45	8.3	9.5	4.5	21.8	39.4	30.6	87.1	25.9	56.5	19.7	12.4	16.05	29.1	32.4	34.0	47.6	38.3	35.5
	III	16	7	62.04	8.8	8.1	5.6	25.6	35.7	30.6	62.4	33.4	47.9	16.2	14.3	15.25	30.3	33.3	34.6	46.3	38.8	35.4
	IV	17	8	71.56	9.9	10.8	5.8	24.6	38.2	31.4	62.9	29.7	46.3	20.8	14.1	17.45	31.0	33.9	34.9	49.6	43.0	36.8
May	I	18	9	67.50	9.2	10.6	6.1	23.3	39.6	31.5	81.4	30.1	55.8	22.6	15.0	18.80	31.6	34.7	35.9	49.2	40.4	35.6
	II	19	10	74.65	9.4	10.5	6.0	25.9	38.9	32.4	76.1	38.7	57.4	22.1	18.9	20.50	33.1	35.8	37.0	50.5	42.1	38.3
	III	20	11	78.26	9.4	10.5	6.1	25.3	39.0	32.2	74.4	37.7	56.1	21.0	18.4	19.70	33.0	36.1	37.4	50.6	42.1	38.8
	IV	21	12	76.21	9.7	10.8	6.6	25.7	39.9	32.8	77.1	37.3	57.2	22.4	19.1	20.75	33.9	36.9	37.9	51.1	42.4	39.1
June	I	22	13	81.30	9.8	10.3	7.8	26.3	39.6	32.9	76.0	36.6	56.3	22.3	17.8	20.05	33.8	36.6	37.9	49.9	42.2	39.3
	II	23	14	101.45	9.5	7.7	8.6	27.8	37.7	32.8	85.2	42.9	64.5	24.5	21.1	22.80	34.4	36.8	37.8	50.4	41.7	40.7

SMW: Standard meteorological week WAS: Week after sowing BSS: Bright Sunshine WS: Wind Speed Min: Minimum Temperature Max: Maximum Temperature

Table 2: Population fluctuation of termites in groundnut in relation to abiotic factors (*khari*f 2012)

Month/ Week	SMW	WAS	No. of termites/stick	Evaporation (mm/ day)	BSS (hrs)	WS (hrs)	RF (mm)	Temperature (°C)			Relative humidity (%)			Vapour pressure (mm)			Soil temperature (°C) at cm depth						
								Min	Max	Mean	Mor	Eve	Mean	Mor	Eve	Mean	Morning			Evening			
																	5	10	15	5	10	15	
July	IV	30	1	3.05	4.3	0.9	7.2	2.2	26.6	32.8	29.3	90.6	72.4	81.5	24.7	24.5	24.6	29.6	30.8	31.3	35.5	33.7	32.2
August	I	31	2	6.23	4.4	1.2	7.4	5.2	26.3	31.6	29.0	89.4	71.7	80.6	24.5	24.3	24.4	28.6	29.6	30.5	34.8	33.0	31.5
	II	32	3	8.28	3.2	1.5	7.1	84.9	25.6	31.3	28.8	93.3	78.6	86.0	24	24.5	24.3	28.7	30.2	31.1	35.2	33.6	31.7
	III	33	4	7.52	2.5	2.4	6.4	191.4	24.8	29.9	27.3	94.6	81.3	88.0	23.8	25	24.4	26.1	27.0	28.7	31.2	29.8	29.1
	IV	34	5	19.96	3.9	3.2	5.5	27.6	25	32.1	28.3	95.9	70.7	83.3	24.5	23.9	24.2	27.5	28.4	29.4	36.7	34.0	31.3
September	I	35	6	7.76	3.4	3.2	3.6	176.2	25.7	32.4	29.3	97.8	80.3	89.1	25.9	26.8	26.4	27.8	28.9	29.8	35.4	32.9	30.8

	II	36	7	10.52	3.4	2.7	5.2	165.6	25.3	31.8	28.6	99.3	85.4	92.4	25.2	26.7	26.0	27.6	28.5	29.2	33.5	31.4	30.2
	III	37	8	26.37	2.6	1.3	5.7	47.9	25	30	27.4	99.3	82.3	90.8	24.9	25.6	25.3	26.7	27.5	28.5	33.1	30.5	29.4
	IV	38	9	32.92	3.6	5.3	4	24.8	24.6	32.3	28.4	95.4	71.1	83.3	24.2	24.2	24.2	27.1	28.5	29.6	37.3	33.9	31.6
October	I	39	10	56.84	3.7	8	3.2	5	23.8	32.8	28.2	92.3	59	75.7	22.8	21.1	22.0	26.8	28.1	29.3	38.7	34.8	32.0
	II	40	11	96.75	4.4	8	2.9	0	25	36.2	30.5	89.7	58.1	73.9	23.6	23.3	23.5	29.2	30.6	31.7	42.7	38.3	34.8
	III	41	12	68.62	4.6	8.8	2.1	0	20.7	36.1	28.6	93.7	39.3	66.5	20.2	17.4	18.8	27.6	30.1	31.4	41.9	37.6	34.6
	IV	42	13	71.21	4.7	9.6	1.7	0	19.7	36	27.9	91.7	40.1	65.9	19.2	17.1	18.2	26.6	28.9	30.9	41.4	36.5	34.1
November	I	43	14	73.66	4.6	9.8	1.8	0	18.8	35.3	27.3	85.6	31	58.3	16.3	12.7	14.5	25.2	28.4	30.2	40.6	36.3	33.5

SMW: Standard meteorological week WAS: Week after sowing BSS: Bright Sunshine WS: Wind Speed Min: Minimum Temperature Max: Maximum Temperature RF: Rain fall

Table 3: Correlation coefficient between termites population and abiotic factors in groundnut (2012)

Sr. No.	Weather parameters	Termites population	
		Summer	Kharif
1	Evaporation (mm/day)	0.946**	0.706**
2	Bright Sunshine Hours, hrday ⁻¹ (BSS)	0.254	0.847**
3	Wind Speed, kmhr ⁻¹ (WS)	-0.902**	-0.660**
4	Maximum Temperature, °C (MaxT)	0.961**	0.879**
5	Minimum Temperature, °C (MinT)	0.678**	0.684**
6	Mean Temperature, °C (MT)	0.949**	0.784**
7	Morning Relative Humidity, % (RH ₁)	-0.285	-0.631*
8	Evening Relative Humidity, % (RH ₂)	-0.083	-0.863**
9	Mean Relative Humidity, % (MRH)	-0.225	-0.864**
10	Morning Vapour Pressure, mm of Hg (VP ₁)	-0.704**	-0.720**
11	Evening Vapour Pressure, mm of Hg (VP ₂)	-0.715**	-0.754**
12	Mean Vapour Pressure, mm of Hg (MVP)	-0.711**	-0.742**
13	Soil Temperature, °C (5 cm depth Morning)	0.968**	0.105
14	Soil Temperature, °C (10 cm depth Morning)	0.965**	0.330
15	Soil Temperature, °C (15 cm depth Morning)	0.959**	0.572*
16	Soil Temperature, °C (5 cm depth Afternoon)	0.942**	0.876**
17	Soil Temperature, °C (10 cm depth Afternoon)	0.943**	0.836**
18	Soil Temperature, °C (15 cm depth Afternoon)	0.976**	0.865**
19	Rain fall (mm)	-	-0.730**

**Correlation is significant at the 0.01 level (N=14, r=0.660)

* Correlation is significant at the 0.05 level (N=14, r=0.532)

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