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SURVEY OF NOSEMA DISEASE INFECTION HONEY BEES (*APIS MELLIFERA* L.) IN MINIA REGION

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ABSTRACT:

A survey of nosema disease was carried out in four apiaries located at Shoushah, Maqusah, Tallah and Faculty of Agriculture, of Minia region, Egypt, throughout the year 2014. Results showed that the highest mean infection percentage (100.00%) was recorded in winter season at 12th February in Shoushah and Tallah regions associated with average temperature 13.4 °C and 75% relative humidity. While the lowest mean percentage of nosema infection (0.00%) was recorded in all regions of the study in two periods in summer season. The first was from 14th July to 7th August with an average temperature ranged from 28.0 to 30.1 °C and relative humidity from 52 to 63% and the second was from 19th August to 27th August with an average temperature ranged from 28.7 to 29.4 °C and relative humidity ranged from 57 to 65%.

Key words: Nosema - apiaries

INTRODUCTION

Nosema disease is a parasitic disease of adult honey bees (*Apis mellifera* L.) caused by two species of microsporidia, *Nosema apis* Zander (Zander, 1909) and *Nosema ceranae* (Fries *et al.*, 1996). Transmission of nosema within honey bee colony is mainly via the fecal-oral route in which pathogens are spread by transferring feces of diseased hosts to uninfected ones via ingestion. Adult bees ingest nosema spores when they feed on contaminated food and also

when they are cleaning up fecal material from infected bees. The spores germinate within the midgut and release polar tubes that transfer their sporoplasm into midgut epithelial cells where they generate more spores. Millions of new spores can be found inside midgut of bees in a few weeks after initial infection (Bailey and Ball, 1991). Affected honey bees tend to die away from the hive, and there are no obvious signs of disease, which making it difficult to notice, hence it is often referred to as "the silent

killer" (Hornitzky, 2005). Since late 2006, a mysterious illness, termed "Colony Collapse Disorder" (CCD), has been devastating massive numbers of honey bee colonies and threatens the beekeeping industry in the United States. As part of our efforts is to identify the causes of sudden disappearances and extensive die-off of colonies in the hope of designing appropriate control strategies to safeguard bee health in the future, the status of nosema infections in honey bees collected from states affected by CCD was also examined. While our investigation did not show a direct correlation between nosema infection and CCD, the results revealed that *N. ceranae*, a species of nosema originally found in the Asian honey bee, *Apis ceranae* (Fries et al., 1996). The current study aimed to study the following points:-

- 1) Recording the timing appearance of nosema disease in Minia region.
- 2) Determination the relation between the mean infection percentage and temperature and relative humidity over the year.

MATERIALS AND METHODS

The present study was carried out at four locations of Minia Governorate, the apiary of Faculty of Agriculture Minia University and three other private apiaries at Shousha, Maqusa and Tallah villages. Trails of the study were conducted through the four seasons of 2014.

1. Investigation of bee samples:

Thirty six Carniolan honeybees (*Apis mellifera carnica*), 9 colonies in each apiary. Colonies housed in Langstroth hives and having an approximately equal strength with bees covered 7 combs and equal stored food of honey and pollen were allocated to this study. Colonies were inspected at 4 day intervals over the year (Forsgren, and Fries, 2005). They received normal feeding program over the period of study. Samples of adult honey bee workers were collected randomly from the entrance of different hives (Shimanuki and Knox, 2000). All bee samples were kept in 70% ethanol (Yanping, et al., 2007) and stored at -20 °C prior to examination (Gajger et al., 2010). Crush adult bees with distilled water (Topolska, and Hartwig, 2005) in a mortar (Lotfi, et al. 2009). Thereafter, the filtrate was examined microscopically at x 400 magnification, under-bright-field. (Topolska, and Hartwig, 2005) to determine the percentage of infected bees.

Data of the average temperature and relative humidity over the year was got from National Research Center of Malloy in Minia Governorate. Correlation and regression coefficients between the percentage of nosema disease infection and both temperature and relative humidity were calculated.

Results and Discussion

1. Mean infection of nosema disease and its relation to temperature and relative humidity over the year:-

Appearance symptoms of nosema disease was recorded in certain

apiaries located in Minia region over the year of study as follows:

Data in Table (1) and Fig. (1) showed that the highest mean percentage of nosema infection in winter season (100.00%) was recorded at 12th February in Shoushah and Tallah regions associated with average temperature 13.4 °C and 75% relative humidity. While the lowest mean percentage of nosema infection (65.10%) was recorded at 8th March in Shoushah region with average temperature 20.9 °C and 71% relative humidity.

Regression coefficient between mean percentage of infection and

temperature was negative, which means that increasing temperature by one degree, mean infection percentage decreased about 0.157%. While the regression coefficient between mean percentage of infection and relative humidity was positive, which means by increasing relative humidity by one percentage, infection percentage increased about 0.541%.

These results came in agreement with the obtained data by (Moeller, 1978) who found that mean infection percentage of nosema was up to 100% in winter season.

Table (1): Development the mean infection% of honeybee by nosema disease during winter season 2014 at Minia region.

Dates	Regions				Mean daily temperature °C	Mean daily relative humidity %
	Shoushah	Maqusah	Tallah	Faculty of Agri. apiary		
3January	87.29	82.34	83.00	84.86	11.5	89
7 January	89.93	89.98	90.09	87.23	12.4	84
11 January	85.40	86.03	87.20	86.29	9.8	91
15 January	95.04	95.04	96.30	94.32	10.6	87
19 January	80.68	82.23	81.53	80.00	13.1	82
23 January	91.91	95.11	98.70	95.69	13.6	87
27 January	94.08	95.28	96.36	94.32	12.7	66
31 January	82.67	80.93	81.86	81.00	13.6	73
4 February	86.36	89.60	88.76	87.56	12.8	79
8 February	89.40	90.32	88.69	89.21	12.8	76
12 February	100.00	98.60	100.00	99.20	13.4	75
16 February	94.75	97.56	96.98	95.23	13.1	84
20 February	83.54	86.71	86.88	85.00	16.2	71
24 February	94.87	96.00	97.58	96.56	15.0	84
28 February	94.99	97.02	96.89	95.30	13.6	79
4 March	71.94	75.36	72.69	73.33	18.5	67
8 March	65.10	70.56	68.88	68.39	20.9	71
12March	72.98	75.23	74.00	74.89	15.4	68
16 March	71.84	70.56	71.89	70.45	13.4	57
20 March	75.24	77.85	80.25	77.78	16.8	81
Regression coefficient (%Mean Infection/ Mean daily Temperature)						-0.157
Regression coefficient (%Mean Infection/ Mean daily relative humidity)						0.541

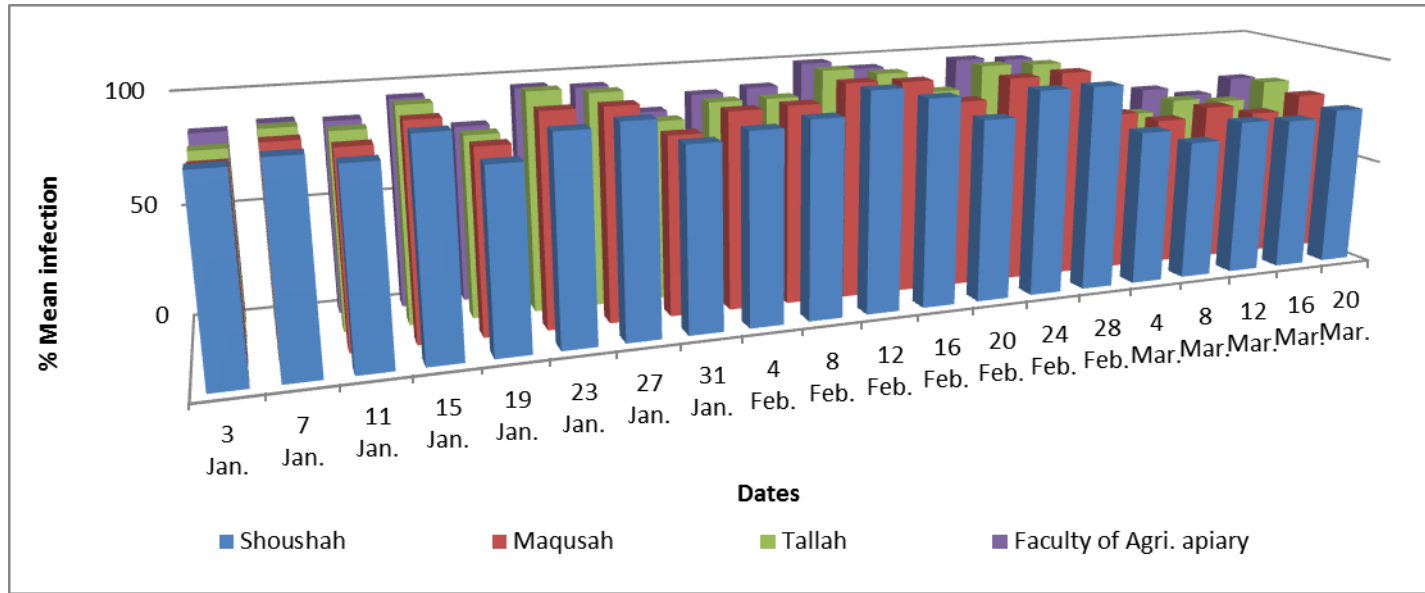


Fig (1): Development the mean infection% of honeybee by nosema disease during winter season 2014 at Minia region.

Data presented in Table (2) and Fig. (2) showed that the lowest mean percentage of nosema infection was 0.00% in spring season from 16th June to 24th June in all regions of study which recorded with average temperature ranged from 25.1 to 33.2 °C and relative humidity ranged from 32 to 56%.

While the highest mean percentage of nosema infection (83.56%) was recorded in 24th March in Tallah region which associated with average temperature 16.7°C and 76% relative humidity.

Determination of regression coefficient between mean percentage of infection and temperature was

negative (-4.579). While the regression coefficient between percentage of infection and relative humidity was positive (1.493) which came in agreement with (Lotfi, et al. 2009) who showed that increase mean infection level come from increase humidity level in early spring.

These results are agreement with (Moshaverinia, et al.2012) who found that the mean infection of nosema disease was up to 53% in Spring . While other data are in agreement which showed by (Razmaraii and Karimi 2010) who found that mean infection percentage of nosema was up to 59.8 % in May.

Table (2): Development the mean infection% of honeybee by nosema disease during spring season 2014 at Minia region.

Dates	Regions				Mean daily temperature °C	Mean daily relative humidity%
	Shoushah	Maqusah	Tallah	Faculty of Agri. apiary		
24 March	79.05	82.85	83.56	80.53	16.7	76
28 March	61.53	70.56	75.60	69.00	17.9	58
1 April	66.78	70.63	69.50	72.54	18.5	60
5 April	56.62	55.02	56.36	55.00	19.2	58
9 April	60.07	62.00	60.54	64.76	20.1	68
13 April	54.44	55.78	54.78	53.86	19.6	53
17 April	64.24	64.80	65.96	69.63	22.0	60
21 April	48.74	53.00	54.80	46.97	21.8	59
25 April	28.72	32.60	31.80	31.00	27.0	52
29 April	33.98	39.53	37.61	37.00	25.3	48
3 May	38.42	37.90	40.35	42.42	27.1	40
7 May	30.22	40.96	37.90	35.86	23.3	72
11 May	39.70	33.68	35.70	36.69	22.4	49
15 May	21.34	22.89	20.00	19.63	25.5	41
19 May	31.15	25.96	31.78	29.00	26.6	39
23 May	24.35	18.96	18.76	22.63	25.8	45
27 May	10.11	14.30	16.96	13.00	30.2	39
31 May	14.21	15.96	16.00	16.98	27.3	46
4 June	6.01	7.65	8.57	7.79	34.2	26
8 June	9.19	10.86	11.00	10.59	26.4	48
12 June	7.99	9.90	10.67	11.98	28.3	42
16 June	0.00	0.00	0.00	0.00	33.2	32
20 June	0.00	0.00	0.00	0.00	32.2	35
24 June	0.00	0.00	0.00	0.00	25.1	56
Regression coefficient (%Mean Infection/ Mean daily Temperature)						-4.579
Regression coefficient (%Mean Infection/ Mean daily relative humidity)						1.493

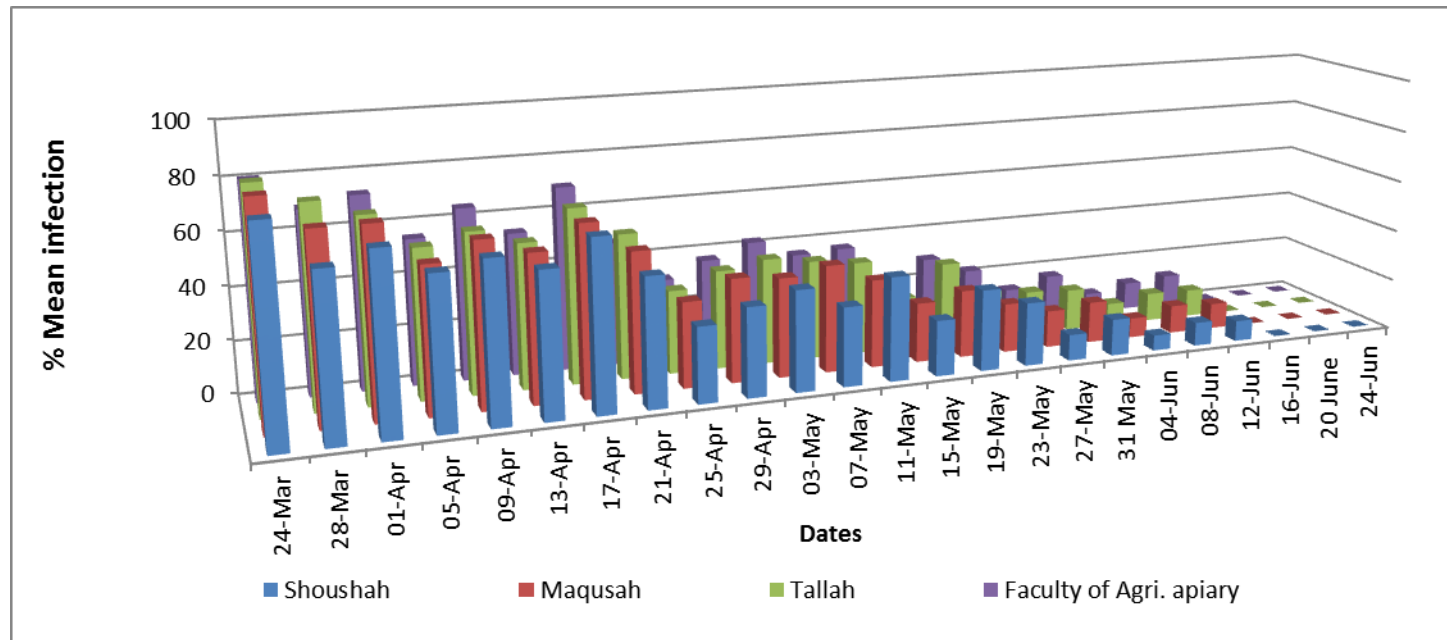


Fig (2): Development the mean infection% of honeybee by nosema disease during spring season 2014 at Minia region.

Results in Table (3) and Fig. (3) showed considerable decreased level in nosema infection. The highest mean percentage of nosema infection was 11.50% in Tallah region at 12th September during summer season (12 September) with average temperature 27.3 °C and 56% relative humidity. While the lowest mean percentage of nosema infection (0.00%) was recorded in all regions of the study in two periods, the first was from 14th July to 7th August with average temperature ranged from 28.0 to 30.1 °C and relative humidity ranged from 52 to 63% and the second was from

19th August to 27th August with average temperature ranged from 28.7 to 29.4 °C and relative humidity ranged from 57 to 65%. Regression coefficient between percentage of infection and temperature was negative (-0.962). Also the regression coefficient between percentage of infection and relative humidity was negative (-0.023). These data are agreement with the results showed by (Razmaraii, and Karimi, 2010) who found that mean infection percentage of nosema was up to 1.1 % in August because the humidity level in summer month is lack.

Table (3): Development the mean infection% of honeybee by nosema disease during summer season 2014 at Minia region.

Dates	Regions				Mean daily temperature °C	Mean daily relative humidity%
	Shoushah	Maqusah	Tallah	Faculty of Agri. apiary		
28 June	4.44	7.56	8.01	5.23	31.9	41
2 July	3.80	4.35	5.50	4.89	30.6	52
6 July	5.99	7.70	6.32	7.52	28.1	57
10 July	4.07	4.96	4.02	5.62	28.9	56
14 July	0.00	0.00	0.00	0.00	28.9	54
18 July	0.00	0.00	0.00	0.00	28.0	61
22 July	0.00	0.00	0.00	0.00	29.1	56
26 July	0.00	0.00	0.00	0.00	29.3	59
30 July	0.00	0.00	0.00	0.00	30.1	52
3 August	0.00	0.00	0.00	0.00	28.6	63
7 August	0.00	0.00	0.00	0.00	30.1	52
11 August	7.25	8.09	9.65	7.56	28.2	69
15 August	2.68	4.56	3.50	2.96	29.2	52
19 August	0.00	0.00	0.00	0.00	29.2	65
23 August	0.00	0.00	0.00	0.00	29.4	65
27 August	0.00	0.00	0.00	0.00	28.7	57
31 August	8.00	9.00	10.30	8.50	28.3	60
4 September	5.08	6.08	7.59	5.76	29.1	52
8 September	2.74	5.69	4.08	3.69	28.0	54
12 September	9.65	10.98	11.50	9.68	27.3	56
16 September	5.14	5.09	4.77	5.50	28.9	50
20 September	6.96	6.50	7.96	5.96	26.0	69
Regression coefficient (%Mean Infection/ Mean daily Temperature)						-0.962
Regression coefficient (%Mean Infection/ Mean daily relative humidity)						-0.023

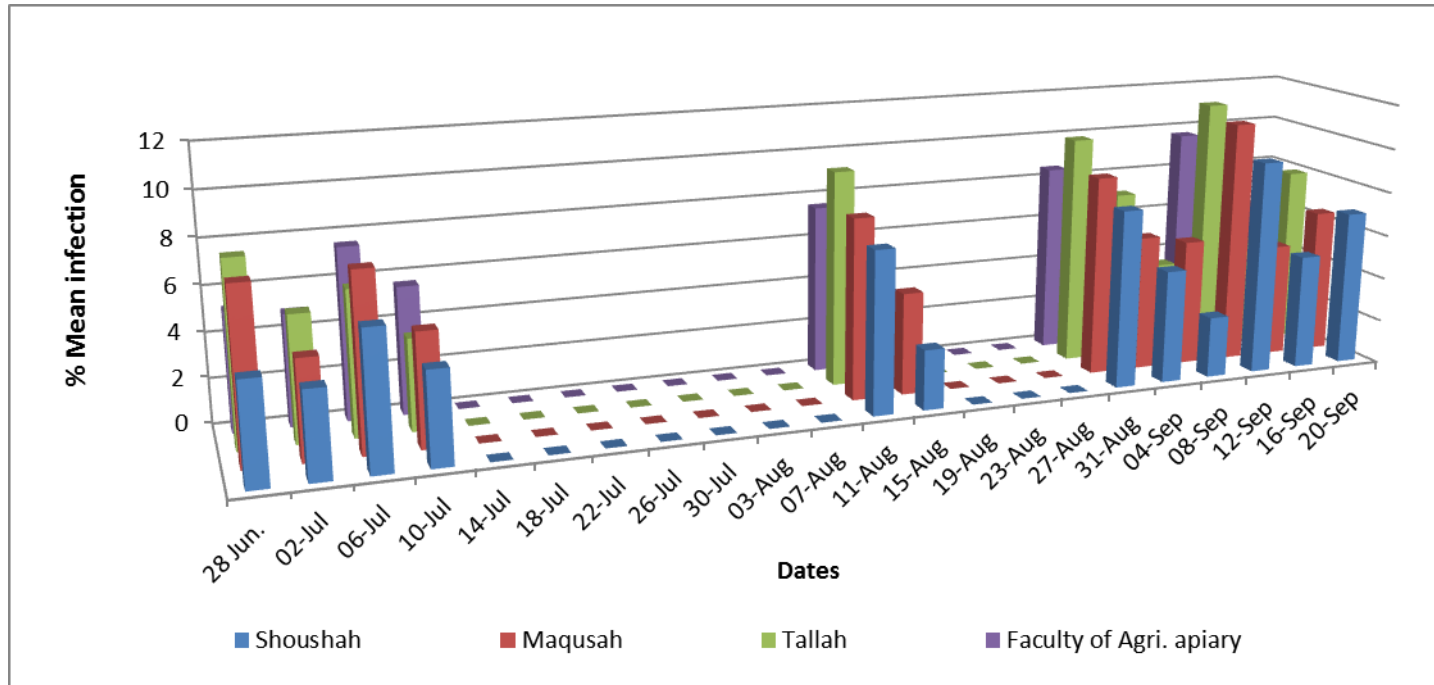


Fig (3): Development the mean infection% of honeybee by nosema disease during summer season 2014 at Minia region.

Data presented in Table (4) and Figure (4) showed that no recording of nosema infection (0.00%) was recorded during autumn season in all regions at 24th of September which accompanied with average temperature 29.8 °C and 42% relative humidity.

The highest mean percentage of nosema infection was 71.16% in Shoshah region in 22nd December with

average temperature and relative humidity 12.9 °C and 90%, respectively. These results are agreement with the obtained data by Lotfi *et al.* (2009) who found that the highest level of infection could be related not only to the highest humidity but also the decrease in the population of the colony.

Table (4): Development the mean infection% of honeybee by nosema disease during autumn season 2014 at Minia region.

Dates	Regions				Mean daily temperature °C	Mean daily relative humidity%
	Shoushah	Maqusah	Tallah	Faculty of Agri. apiary		
24 September	0.00	0.00	0.00	0.00	29.8	42
28 September	2.72	4.69	4.59	1.75	27.2	64
2 October	3.91	4.21	5.50	3.56	22.8	66
6 October	2.68	4.11	4.32	2.53	23.9	67
10 October	6.94	7.90	8.23	7.50	23.8	67
14 October	14.29	11.96	11.25	12.78	22.2	72
18 October	8.99	12.89	10.25	8.96	23.7	63
22 October	30.62	32.22	33.58	30.85	19.3	76
26 October	6.57	6.80	7.30	6.50	22.0	63
30 October	22.20	23.21	21.25	22.56	20.1	71
3 November	13.24	12.40	14.35	13.89	18.8	70
7 November	28.45	28.90	28.36	29.00	18.7	71
11 November	32.54	33.89	33.56	33.23	19.4	83
15 November	10.92	12.90	13.68	11.89	17.7	75
19 November	24.80	24.60	25.60	23.98	18.1	85
24 November	30.42	30.56	29.02	30.89	15.6	79
28 November	54.75	51.98	53.26	53.89	14.9	82
2 December	49.91	45.90	44.20	47.00	17.0	79
6 December	50.44	47.96	51.60	52.69	17.0	88
10 December	34.95	32.14	32.90	33.74	13.0	80
14 December	52.18	54.58	56.89	54.00	13.5	89
18 December	46.58	42.97	46.80	45.86	14.5	80
22 December	71.16	66.97	70.58	68.96	12.9	90
Regression coefficient (%Mean Infection/ Mean daily Temperature)						-3.751
Regression coefficient (%Mean Infection/ Mean daily relative humidity)						1.522

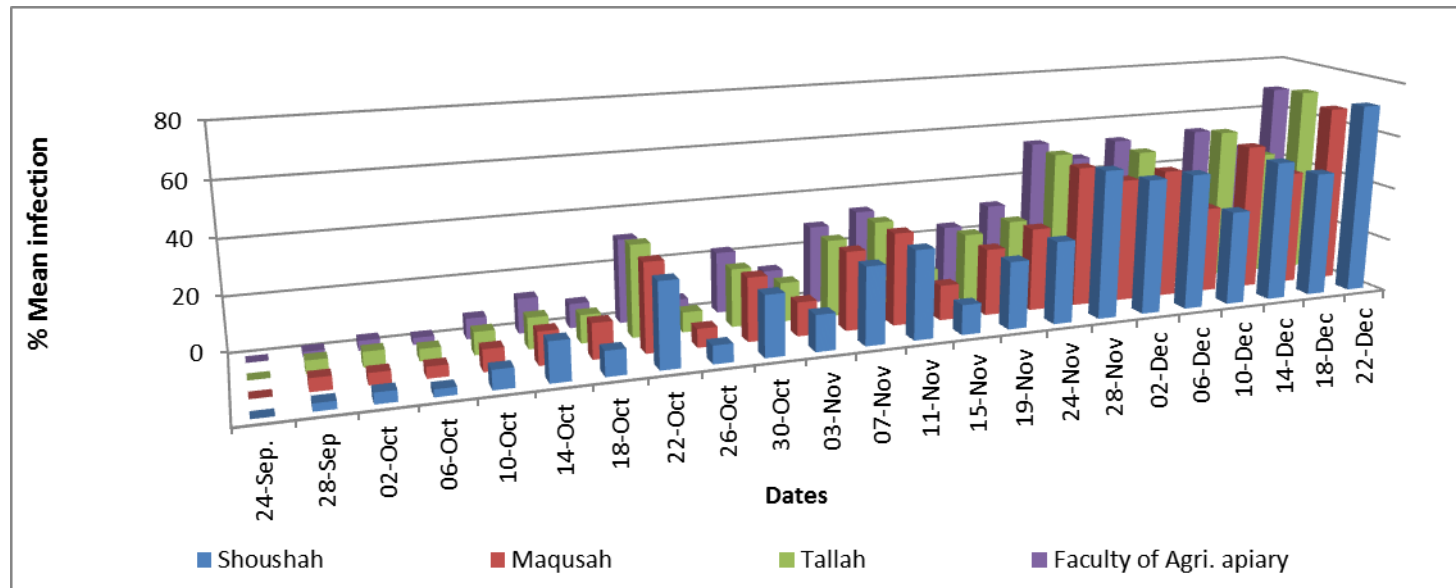


Fig (4): Development the mean infection% of honeybee by nosema disease during autumn season 2014 at Minia region.

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