

## THE NATURAL MORTALITY AND THE ASSOCIATED PARASITIDS OF THE HOUSE FLY, *MUSCA DOMESTICA* L. AT MINUFIYA GOVERNORATE, EGYPT

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**ABSTRACT:** *The parasitoids of the house fly, Musca domestica L. were examined at three centers of Minufiya Governorate, Egypt. The centers were Shebin Elkom, Quessna and Elbagoor. The studies were extended to a whole year from January, 2009 to December, 2009. Three parasitoid species referred to order Hymenoptera were found to be associated with the pupae of M. domestica, two parasitoids referred to family Pteromalidae (Cyrtoptyx sp. and Spalangia nigroaenea Curtis) and the third one referred to family Chalcididae (Dirhinus wohlfahrtiae Ferriere). The parasitoids: Cyrtoptyx sp. and Spalangia nigroaenea Curtis were recorded on the house fly pupae for the first time in Egypt. The parasitism ratios were 30%, 52% and 30% at Shebin Elkom, Quessna and Elbagour centers, respectively. However, the natural mortalities ranged between( 4% to 100%), (0% to 100%), and (0% to 66%) at the same centers in respectively.*

**Key words:** *House fly, parasitoids, natural mortality, poultry farm, Egypt.*

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### INTRODUCTION

House fly, *Musca domestica* L., (Diptera: Muscidae) is cosmopolitan pests associated with dairy farms and cattle feedlots. Development of pesticide resistance by this fly has led to research on its natural enemies. Most attention has focused on wasps (Hymenoptera) that parasitize house fly, *M. domestica* L. pupae (Noronha *et al.*, 2007). The use of pteromalid parasitoids for muscoid fly control is becoming increasingly common. Two species that are often recommended for releases are *Spalangia cameroni* Perkins and *Muscidifurax raptor* Girault and Sanders (Kaufman and Geden, 2009). In India, two species of house fly parasitoids were recovered from its pupae, *Spalangia cameroni* (84.26%) and *Spalangia endius* (15.74%) between April and December 2004, the peaks of parasitism was in rainy months and the lowest parasitism was in summer months (Sangeetha and Jebanesan 2005). In north-western Florida the predominant parasite observed attacking muscoid flies (76% for stable flies and 58% for house flies) was *S. cameroni* and *Muscidifurax* sp. (Greene *et al.*, 1989). in southern California, USA, seven parasitoid species were recovered from 90% stable fly and house fly pupae *S. endius*, *S. cameroni*, *S. nigroaenea*, *M. raptor*, *M. zaraptor*. *Aleochara* sp.

and *Urolepis rufipes* which had not been previously recorded to parasitize these hosts in California (Mayer *et al.*, 1991). Parasitism of house fly and stable fly in cattle confinements were increased through field seasons peaking in August and September in Nebraska, USA (Seymour and Campbell, 1993). In Egypt, Nasser and Eraky, 1994 found that the percentage parasitism by *Nasonia vitripennis* in dipteran pupae collected from a slaughter house near El-Kharga New vally, Egypt from December 1991 to February 1992, was the highest in *Sarcophaga carnaria* (25%), followed by *Chrysomya albiceps* (16.76%) and *Musca domestica* (10%). Also, El-Sabah *et al.*, 2004 recovered in Egypt, *P. vindemmiae*, *S. gemina* and *S. cameroni* (Pteromalidae), *D. wohlfahrtiae*, *D. graffici* and *D. luzonsis* (Chalcididae), from immature stages of fruit fly *Ceratitidis capitata*. In South Korea, five species of hymenopterous parasitoids were found parasitizing pupae of house flies in poultry and livestock facilities, refuse dump sites and garbage dumpsters at 8 sites in northwest and southeast South Korea in April-October 1995: *Spalangia nigroaenea*, *S. nigra*, *Muscidifurax raptor*, *Pachycrepoides vindemmiae* and *Nasonia vitripennis* (Rueda *et al.*, 1997). During the summer from a dairy farm in northern Illinois, *S. nigroaenea* was the most parasitoid recovered from house flies, followed by *Muscidifurax* sp. (Olbrich and King, 2003). The population patterns of the parasitoid, *S. endius* at a dumping ground near Kuala Lumpur city, the percentage of *S. endius* adult emergence varied seasonally. During the relatively heavy rainfall months of August and November 1988, and January, March and April 1989, adult emergence was low (0-14.2%) compared to the less rainy months of July, September and December 1988, and May 1989 (29.3-39.6%) (Sulaiman *et al.*, 1991). Surveys on the parasitoids of house fly stages are very important to know the most effective species which will be used in the biological control.

The aim of this research is to study the emergence percentages, parasitism percentages, unknown mortality of house fly pupae and the presence of parasitoids along one year at three localities of Minufiya governorate, this will be helpful in designing integrated pest management programs to control house fly, especially at poultry farms.

## MATERIALS AND METHODS

To study the parasitoids of house fly pupae, three poultry farms at three centers of Minufiya Governorate were chosen (Shebin Elkom, Quessna, and Elbagour). House fly pupae were collected biweekly intervals by hand for one year from the period of 7 January 2009 till 25 December 2009 from each farm. The obtained numbers of pupae from each farm (50 individual) were put individually in glass test tube covered with muslin cloth supported with rubber band and kept in the laboratory under  $25 \pm 5$  °C and  $60 \pm 5$  % RH. Glass tubes of pupae were observed daily to check the parasitoid emergency. Emerged parasitoids were counted, also pupae which transferred to adult fly

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were counted, and dead pupae were counted. Dead pupae were dissected to know the presence or absence of emerged fly or dead parasitoids. Percentages of parasitism, emerged flies and percentages of mortality were calculated. The emerged parasitoids were separated, mounted and identified by Prof. Dr. A. H. El-Heneidy and Prof. Dr. A. S. Hendawy, Biological Control Research Department, Plant Protection Research Institute, Giza, Egypt with the cooperation of the Prof. Dr. M. O. Kolaib, Professor of Entomology (Biological Control), Department of Economic Entomology & Agricultural Zoology, Faculty of Agriculture Shebin Elkom, Egypt. The experiments were conducted in the biological control laboratory of the previous department.

### **RESULTS AND DISCUSSION**

Data presented in Table (1) reported that the highest means of emergency percentages at Shebin Elkom locality were recorded at June, December, and February samples resulting 95, 91, and 90%, respectively, followed by November samples giving 82 % and January samples 79%. The least means of emergency percentages were recorded with the samples of August which was only 2%, followed by March and July samples recording 6 & 7%, while it was 10.7 and 13% for samples of April and September, respectively. The mean of emergency percentages of pupae to adult flies along the year samples was 45.54%.

As for the mean parasitized pupae percentages, results in Table (1) indicated that the highest percentages of parasitism was recorded at October month giving about 17%, followed by May month giving 9%, meanwhile there were no parasitism at the other months of the year. The mean of the percentages of pupae parasitism along the year of observation was 2.62%.

Regarding to the means of the unknown mortality which include all dead pupae by other reasons except parasitism process, results in Table (1) indicated that the highest means of unknown mortality were recorded at August, March, and July months resulting 98, 94, and 93%, respectively followed by April month 89.3%, while the least means of the unknown mortality were recorded at the pupae of June month giving only 5%, followed by December 9 % and February 10%. The mean of the unknown mortality of pupae along the year samples was 51.84%.

Table (1): The natural mortality of House fly *Musca domestica* pupae at Shebin Elkom locality of Minufiya governorate, during 2009 year months.

Date of samples	Average number of house fly pupae (50 individual)						% Total Mortality
	Emerged to fly		Parasitized pupae		Unknown mortality		
	No.	%	No.	%	No.	%	
Jan. 7	41	82	0	0	9	18	18
21	38	76	0	0	12	24	24
Feb. 4	45	90	0	0	5	10	10
18	45	90	0	0	5	10	10
Mar. 4	2	4	0	0	48	96	96
18	4	8	0	0	46	92	92
Apr. 1	9	18	0	0	41	82	82
15	0	0	0	0	50	100	100
29	7	14	0	0	43	86	86
May 13	38	76	9	18	3	6	24
29	0	0	0	0	50	100	100
Jun. 12	47	94	0	0	3	6	6
26	48	96	0	0	2	4	4
Jul. 10	3	6	0	0	47	94	94
24	4	8	0	0	46	92	92
Aug. 7	2	4	0	0	48	96	96
21	0	0	0	0	50	100	100
Sep. 4	6	12	0	0	44	88	88
18	7	14	0	0	43	86	86
Oct. 2	11	22	15	30	24	48	78
16	23	46	10	20	17	34	54
30	39	78	0	0	11	22	22
Nov. 13	42	84	0	0	8	16	16
27	40	80	0	0	10	20	20
Dec. 11	46	92	0	0	4	8	8
25	45	90	0	0	5	10	10
<b>Total</b>	<b>592</b>	<b>-</b>	<b>34</b>	<b>-</b>	<b>674</b>	<b>-</b>	<b>-</b>
<b>Mean</b>	<b>22.77</b>	<b>45.54</b>	<b>1.31</b>	<b>2.62</b>	<b>25.92</b>	<b>51.84</b>	<b>54.46</b>

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Data in Table (2) recorded that there was only two species of parasitoids along the year samples of Shebin Elkom locality, *Cyrtoptyx* sp. and *Dirhinus wohlfahrtiae*, where the first parasitoid was found at spring months with presence percentages as 26.47%, and 29.41% at fall season, while the second parasitoid was present at fall season only with 44.12%, there were no presence for the parasitoid *Spalangia nigroaenea*. The presence percentages of the three parasitoid were 55.88, 44.12, and 0% for *Cyrtoptyx* sp., *D. wohlfahrtiae* and *S. nigroaenea*, respectively.

Table (2): Population density and occurrence percentages of the parasitoids of *Musca domestica* pupae at Shebin Elkom center, Minufiya governorate, during 2009 seasons.

Season	Parasitoids						Total %
	<i>Cyrtoptyx</i> sp.		<i>Dirhinus wohlfahrtiae</i>		<i>Spalangia nigroaenea</i>		
	No.	%	No.	%	No.	%	
Winter	00.00	00.00 %	0.00	0.00 %	0.00	0.00 %	00.00 %
Spring	09.00	26.47 %	0.00	0.00 %	0.00	0.00 %	26.47 %
Summer	00.00	00.00 %	0.00	0.00 %	0.00	0.00 %	00.00 %
Fall	10.00	29.41 %	15.00	44.12 %	0.00	0.00 %	73.53 %
Total	19.00	55.88 %	15.00	44.12 %	0.00	0.00 %	100.00 %

Data presented in Table (3) reported that the highest means of emergency percentages were recorded at February, March and September samples resulting 95, 94, and 93%, respectively, followed by December samples giving 92% and October samples 88.7%. The least means of emergency percentages were recorded with the samples of June which was 0% followed by July sample recording only 1% , while it was 4 and 10% for samples of May and August , respectively. The mean of emergency percentages of pupae to adult flies along the year samples was 61.15%.

As for the mean parasitized pupae percentages, results in Table (3) indicated that the highest percentages of parasitism was recorded at may month giving about 26% , followed by April month giving 3.3% , and October month giving 2.7%. The mean of the percentages of pupae parasitism along the year of observation was 3.46%.

Regarding to the means of the unknown mortality which include all dead pupae by other reasons except parasitism process, results in Table (3) indicated that the highest means of unknown mortality were recorded at July, June and August months resulting 99, 98, and 90%, respectively, followed by May month 70%, while the least means of the unknown mortality were

recorded at the pupae of February and September months giving only 5%, followed by March 6%. The mean of the unknown mortality of pupae along the year samples was 35.38 %.

**Table (3): The natural mortality of the House fly *Musca domestica* pupae at Quessna locality of Minufiya governorate, during 2009 year months.**

Date of sample	Average number of house fly pupae(50 individual)						% Total Mortality
	Emerged to fly		Parasitized		Unknown mortality		
	No.	%	No.	%	No.	%	
Jan. 7	35	70	1	2	14	28	30
21	40	80	0	0	10	20	20
Feb. 4	47	94	0	0	3	6	6
18	48	96	0	0	2	4	4
Mar. 4	49	98	0	0	1	2	2
18	45	90	0	0	5	10	10
Apr. 1	50	100	0	0	0	0	0
15	36	72	5	10	9	18	28
29	26	52	0	0	24	48	48
May 13	4	8	26	52	20	40	92
29	0	0	0	0	50	100	100
Jun. 12	0	0	2	4	48	96	100
26	0	0	0	0	50	100	100
Jul. 10	0	0	0	0	50	100	100
24	1	2	0	0	49	98	98
Aug. 7	1	2	0	0	49	98	98
21	9	18	0	0	41	82	82
Sep. 4	47	94	1	2	2	4	6
18	46	92	1	2	3	6	8
Oct. 2	43	86	0	0	7	14	14
16	50	100	0	0	0	0	0
30	40	80	4	8	6	12	20
Nov. 13	39	78	4	8	7	14	22
27	47	94	0	0	3	6	6
Dec. 11	47	94	0	0	3	6	6
25	45	90	1	2	4	8	10
<b>Total</b>	<b>795</b>	<b>-</b>	<b>45</b>	<b>-</b>	<b>460</b>	<b>-</b>	<b>-</b>
<b>Mean</b>	<b>30.58</b>	<b>61.15</b>	<b>1.73</b>	<b>3.46</b>	<b>17.69</b>	<b>35.38</b>	<b>38.85</b>

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Data in Table (4) recorded that there were three species of parasitoids along the year samples of Quessna locality, *Cyrtoptyx* sp. and *D. wohlfahrtiae* and *S. nigroaenea* where the first parasitoid was found at 4 seasons with presence percentages as 2.22%, 68.89%, 2.22% and 2.22% at winter, spring, summer and fall, respectively, while the second parasitoid was present at summer season only with 6.67% and the third parasitoid was present at fall season only with 17.78%. The presence percentages of the three parasitoid were 75.56, 6.67 and 17.78% for *Cyrtoptyx* sp., *D. wohlfahrtiae* and *S. nigroaenea*, respectively.

**Table (4): Population density and occurrence percentages of the parasitoids of *Musca domestica* pupae at Quessna center, Minufiya governorate during 2009 seasons.**

Season	Parasitoids						Total %
	<i>Cyrtoptyx</i> sp.		<i>Dirhinus wohlfahrtiae</i>		<i>Spalangia nigroaenea</i>		
	No.	%	No.	%	No.	%	
Winter	01.00	02.22 %	0.00	0.00 %	0.00	00.00 %	02.22 %
Spring	31.00	68.89 %	0.00	0.00 %	0.00	00.00 %	68.89 %
Summer	01.00	02.22 %	3.00	6.67 %	0.00	00.00 %	08.89 %
Fall	01.00	02.22 %	0.00	0.00 %	8.00	17.78 %	20.00 %
Total	34.00	75.56 %	3.00	6.67 %	8.00	17.78 %	100.00 %

Data presented in Table (5) reported that the highest means of emergency percentages were recorded at July, August and October samples resulting 100, 92 and 92%, respectively, followed by February samples giving 91% and April samples 88.7%. The least means of emergency percentages were recorded with the samples of June which was only 43%, followed by May and January samples recording 53 & 67%, while it was 78 and 80% for samples of September and December, respectively. The mean of emergency percentages of pupae to adult flies along the year samples was 80.70%.

As for the mean parasitized pupae percentages, results in Table (5) indicated that the highest percentages of parasitism was recorded at May month giving 29%, followed by December, January and August months giving 3, 2 and 1%, respectively, meanwhile there were no parasitism at the other months of the year. The grand mean of the percentages of pupae parasitism along the year of observation was 2.70%.

Regarding to the means of the unknown mortality which include all dead pupae by other reasons except parasitism process, results in Table (5) indicated that the highest means of unknown mortality were recorded at June, January and September months resulting 57, 22 and 22%, respectively, followed by may month 18%, while the least means of the unknown mortality were recorded at the pupae of July month giving 0%, followed by August 7% and October 8%. The mean of the unknown mortality of pupae along the year samples was 16.60%.

**Table (5): The natural mortality of the House fly *Musca domestica* pupae at Elbagoor locality of Minufiya governorate, during 2009 year months.**

Date of sample	Average number of house fly pupae(50 individual)						% Total Mortality
	Emerged to fly		Parasitized		Unknown mortality		
	No.	%	No.	%	No.	%	
Jan. 7	37	74	2	4	11	22	26
21	39	78	0	0	11	22	22
Feb. 4	46	92	0	0	4	8	8
18	45	90	0	0	5	10	10
Mar. 4	40	80	0	0	10	20	20
18	42	84	0	0	8	16	16
Apr. 1	43	86	0	0	7	14	14
15	46	92	0	0	4	8	8
29	44	88	0	0	6	12	12
May 13	32	64	14	28	4	8	36
29	21	42	15	30	14	28	58
Jun. 12	26	52	0	0	24	48	48
26	17	34	0	0	33	66	66
Jul. 10	50	100	0	0	0	0	0
24	50	100	0	0	0	0	0
Aug. 7	47	94	0	0	3	6	6
21	45	90	1	2	4	8	10
Sep. 4	39	78	0	0	11	22	22
18	39	78	0	0	11	22	22
Oct. 2	45	90	0	0	5	10	10
16	49	98	0	0	1	2	2
30	44	88	0	0	6	12	12
Nov. 13	43	86	0	0	7	14	14
27	40	80	0	0	10	20	20
Dec. 11	38	76	0	0	12	24	24
25	42	84	3	6	5	10	16
<b>Total</b>	<b>1049</b>	<b>-</b>	<b>35</b>	<b>-</b>	<b>216</b>	<b>-</b>	<b>-</b>
<b>Mean</b>	<b>40.35</b>	<b>80.70</b>	<b>1.35</b>	<b>2.70</b>	<b>8.30</b>	<b>16.60</b>	<b>19.30</b>



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Data in Table (6) recorded that there were three species of parasitoids along the year samples of Elbagour locality, *Cyrtoptyx* sp. and *D. wohlfahrtiae* and *S. nigroaenea* where the first parasitoid was found at spring seasons only with presence percentages as 62.86%, also the second parasitoid was present at spring season only with 20% and the third parasitoid was present at winter, summer and fall seasons with 5.71, 2.86 and 8.57%, respectively. The presence percentages of the three parasitoid were 62.86, 20 and 17.14% for *Cyrtoptyx* sp., *D. wohlfahrtiae* and *S. nigroaenea* respectively.

Table (6): Population density and occurrence percentages of the parasitoids of *Musca domestica* pupae at Elbagour center, Minufiya governorate during 2009 seasons.

Season	Parasitoids						Total %
	<i>Cyrtoptyx</i> sp.		<i>Dirhinus wohlfahrtiae</i>		<i>Spalangia nigroaenea</i>		
	No.	%	No.	%	No.	%	
Winter	00.00	00.00 %	0.00	00.00 %	2.00	5.71 %	05.71 %
Spring	22.00	62.86 %	7.00	20.00 %	0.00	0.00 %	82.86 %
Summer	00.00	00.00 %	0.00	00.00 %	1.00	2.86 %	02.86 %
Fall	00.00	00.00 %	0.00	00.00 %	3.00	8.57 %	08.57 %
Total	22.00	62.86 %	7.00	20.00 %	6.00	17.14 %	100.00 %

The obtained results is in line with those conducted in different countries such as Dabbour *et al.*, 1981 in Saudi Arabia, reported that *D. wohlfahrtiae* and *S. nigroaenea* are both internal parasites in the pupae of the house fly, the two parasitoids were recorded for the first time. Rueda and Axtell, 1985 in North Carolina, mentioned that 10 species of house fly parasites were found in dairy, beef, swine and sheep housing, the most prevalent parasites from beef and dairy cattle parasites were *Muscidifurax raptor* Girault, *Pachycrepoides vindemmiae* (Rondani) and *Spalangia cameroni*. Srinivasan and Balakrishnan, 1989 in Pondicherry, India, reported that *Spalangia nigroaenea* and *S. cameroni* were found with cattle-dung samples, but *Dirhinus himalayanus* occurred only with poultry-dropping puparia, prevalence of all parasitoids was highest in May- September. Omar *et al.*, 1991 in Peninsular, Malaysia, reported that *Spalangia bouceki* and *S. nigroaenea* were found parasitizing puparia of house fly. Alahmed, 1999 in Saudi Arabia, recorded 4 parasitoids were associated with the house fly puparia from September 1997 to December 1998, *Spalangia nigroaenea* Curtis (the most abundant parasitoids 93% and very active during the fall and spring seasons), *Dirhinus wohlfahrtiae* Ferriere and *Muscidifurax Zaraptor*

Kogan & Lenger, in addition, *M. zaraptor* was first recorded. Romero *et al.*, 2010 in North-Center of Florida, found that the most common parasitoids attacking house fly and stable fly pupae dairy from September 2001 to September 2002 were *Spalangia nigroaenea* (predominant in July, August and September), *S. cameroni* (found through entire year) and *S. endius* (most active from October to May with a peak in January).

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## الموت الطبيعي والطفيليات المصاحبة للذباب المنزلى فى محافظة المنوفية بجمهورية مصر العربية

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### الملخص العربى

تناولت الدراسة حصر للطفيليات المصاحبة لعدارى الذباب المنزلى فى مزارع الدواجن بثلاثة مراكز من محافظة المنوفية وهى مركز شبين الكوم، مركز قويسنا ومركز الباجور وأمتدت دراسة الحصر لمدة عام بداية من شهر يناير ٢٠٠٩ حتى نهاية شهر ديسمبر ٢٠٠٩. وقد أظهرت الدراسة أنه تم تسجيل ثلاثة طفيليات من غشائية الأجنحة إثنان منها تتبع عائلة *Pteromalidae* وهما *Cyrtoptyx sp.* و *Spalangia nigroaenea* Curtis والثالث هو *Dirhinus wohlfahrtiae* Ferriere ويتبع عائلة Chalcididae . هذا وقد لوحظ أن الطفيليان *Spalangia nigroaenea* Curtis و *Cyrtoptyx sp.* تم تسجيلهما لأول مرة على عدارى الذباب المنزلى فى جمهورية مصر العربية. وقد وجد ان نسب التطفل فى عدارى الذباب المنزلى ٣٠% ، ٥٢% و ٣٠% فى مركز شبين الكوم ، مركز قويسنا ومركز الباجور على التوالى ، بينما تراوحت نسب الموت الطبيعى فى عدارى الذباب المنزلى التى تم جمعها من مزارع الدواجن من (٤% إلى ١٠٠%) ، (صفر% إلى ١٠٠%) و (صفر% إلى ٦٦%) فى نفس المراكز على الترتيب.

**الموت الطبيعي والطفيليات المصاحبة للذباب المنزلى فى محافظة المنوفية  
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**الملخص العربى**

تناولت الدراسة حصر للطفيليات المصاحبة لعدارى الذباب المنزلى فى مزارع الدواجن بثلاثة مراكز من محافظة المنوفية وهى مركز شبين الكوم، مركز قويسنا ومركز الباجور وأمتدت دراسة الحصر لمدة عام بداية من شهر يناير ٢٠٠٩ حتى نهاية شهر ديسمبر ٢٠٠٩. وقد أظهرت الدراسة أنه تم تسجيل ثلاثة طفيليات من غشائية الأجنحة إثنان منها تتبع عائلة **Pteromalidae** وهما **Cyrtoptyx sp.** و **Spalangia nigroaenea** Curtis والثالث هو **Dirhinus wohlfahrtiae** Ferriere ويتبع عائلة **Chalcididae** . هذا وقد لوحظ أن الطفيليان **Spalangia nigroaenea** Curtis و **Cyrtoptyx sp.** تم تسجيلهما لأول مرة على عدارى الذباب المنزلى فى جمهورية مصر العربية. وقد وجد ان نسب التطفل فى عدارى الذباب المنزلى ٣٠% ، ٥٢% و ٣٠% فى مركز شبين الكوم ، مركز قويسنا ومركز الباجور على التوالى ، بينما تراوحت نسب الموت الطبيعى فى عدارى الذباب المنزلى التى تم جمعها من مزارع الدواجن من (٤% إلى ١٠٠%) ، (صفر% إلى ١٠٠%) و (صفر% إلى ٦٦%) فى نفس المراكز على الترتيب.