RESULTS

RESULTS

The present study had been carried out to compare the results of rearing silkworm *Bombyx mori* L. (Chull Thi No.1) fed on mulberry leaves with some nutritional additives, three plant oils extracted by steam distillation from either the leaves of lime (*Citrus ourantifdia*), clove (*Eugenia caryophyllus*) and jojoba (*Simmondsi chinensi*) oil. The treatments were used two times only in the first and the middle of the 4th and 5th instars. These treatments were used on 3 concentrations both in spring seasons of 2007 and 2008. The present work constituted three types of investigation on each treatment; biological, technological and physiological studies.

A- Biological results:

1- Larval mortality

a. Season 2007:

The 4th instar:

Data in table (1) and fig. (1) indicated that the mortality percentage of the fourth instar of mulberry silkworm *Bombyx mori* L fed on mulberry leaves supplemented with lime, clove and jojoba oils with 3 concentrations (0.5, 1.0 and 2.0 %) for each treatment cleared significant differences ($P<0.05$) within means as response to extracted oils. Lime oil gave the least percent mortality mean (8.00%) in 4th larval instar, followed by clove oil (09.77%) then jojoba oil (10.44%), while control group recorded the highest percent mortality (10.60%). The 3rd concentration of the lime oil recorded (6.3%) and the 2nd

Table (1): Effect of some plant extracted oils on grown larval mortality of mulberry silkworm *B.mori* for season 2007.

Concentrations / Compounds	4th				5th			
	0.5%	1%	2%	Mean	0.5%	1%	2%	Mean
Lime oil	9.0	8.6	6.3	08.00	5.0	5.3	5.6	05.55
Clove oil	9.3	6.6	7.9	09.77	6.6	5.6	7.6	06.66
Jojoba oil	10.3	9.9	9.6	10.44	7.0	7.0	6.3	06.88
Control	10.60				8.00			
F compounds	19.956***				18.035***			
L.S.D compounds	0.865				0.858			

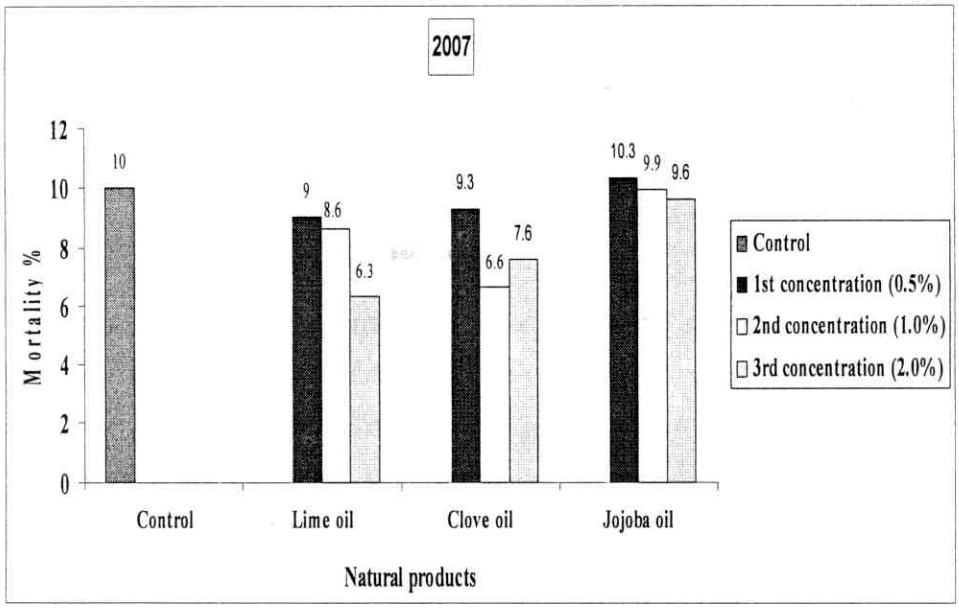

Fig. 1: Effect of some plant extracted oils on larval mortality for 4th instar of *B. mori.*

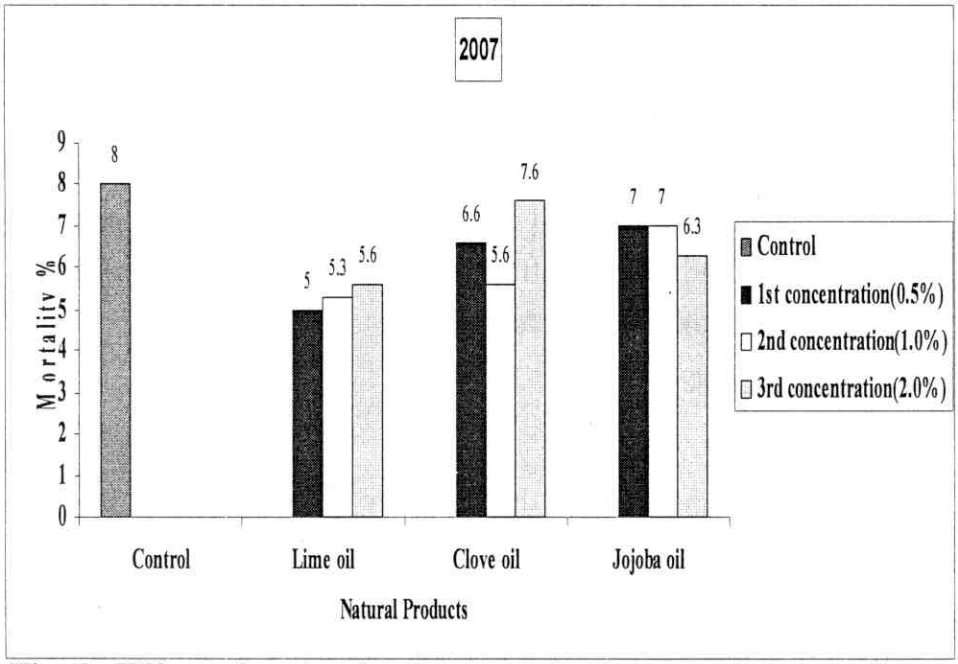

Fig. 2: Effect of some plant extracted oils on larval mortality for 5th instar of B. mori.

concentration of clove oil recorded (6.6%) showed the least percentage of mortality. Statistical analysis revealed non-significant differences (P>0.05) within the concentrations of the extracted oils.

The 5th instar:

Data in table (1) and fig.(2) indicated that the mortality percentage of the fifth instar fed on mulberry leaves supplemented with lime, clove and Jojoba oils with 3 concentrations (0.5, 1.0 and 2.0%) for each treatment revealed significant differences (p<0.05) within means of mortality percentage as response to extracted oils. Lime oil exhibited the least percent mortality mean (5.55%) in the 5th larval instar, followed by clove oil recorded (6.66%) then jojoba oil which recorded (06.88%), while control group recorded the highest percent mortality (08.00%). The 1st concentration of lime oil recorded (5.0%) and the 2nd concentration of clove oil recorded (5.6%) showed the least percentage, and followed by the 3rd concentration of jojoba oil which recorded (6.3%). Statistical analysis revealed non significant differences (p>0.05) within the concentrations of the extracted oils.

b - Season 2008:

The 4th instar:

Statistical analysis of data in table (2) and fig. (3) revealed significant differences (P<0.05) within means of mortality percentage of the fourth instar as response to extracted oils. Lime oil exhibited the least percent mortality mean (5.06%) in the 4th larval instar, followed by clove oil recorded (5.77%) then jojoba oil which recorded (6.11%), while control group recorded

Table (2): Effect of some plant extracted oils on grown larval mortality of mulberry silkworm *B.mori* for season 2008.

Concentrations / Compounds	4th				5th			
	0.5%	1%	2%	Mean	0.5%	1%	2%	Mean
Lime oil	4.6	5.3	5.3	5.06	4.6	4.6	5.0	5.33
Clove oil	5.0	6.0	6.3	5.77	5.6	5.6	6.3	6.22
Jojoba oil	6.0	6.3	6.0	6.11	6.0	6.3	6.3	7.11
Control	6.66				7.33			
F compounds	9.29***				14.71***			
L.S.D compounds	15.410				0.873			

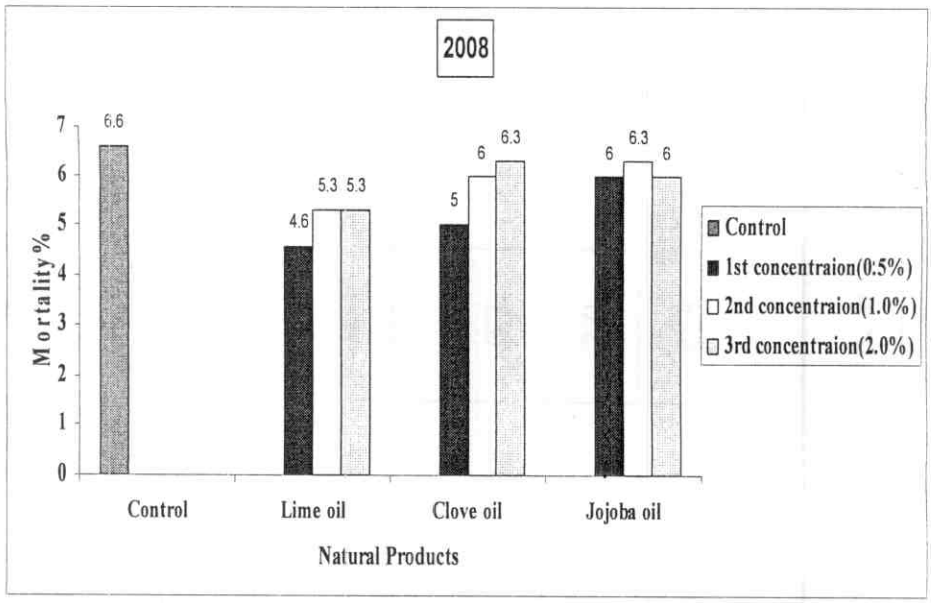

Fig. 3: Effect of some plant extracted oils on larval mortality for 4th instar of *B. mori*.

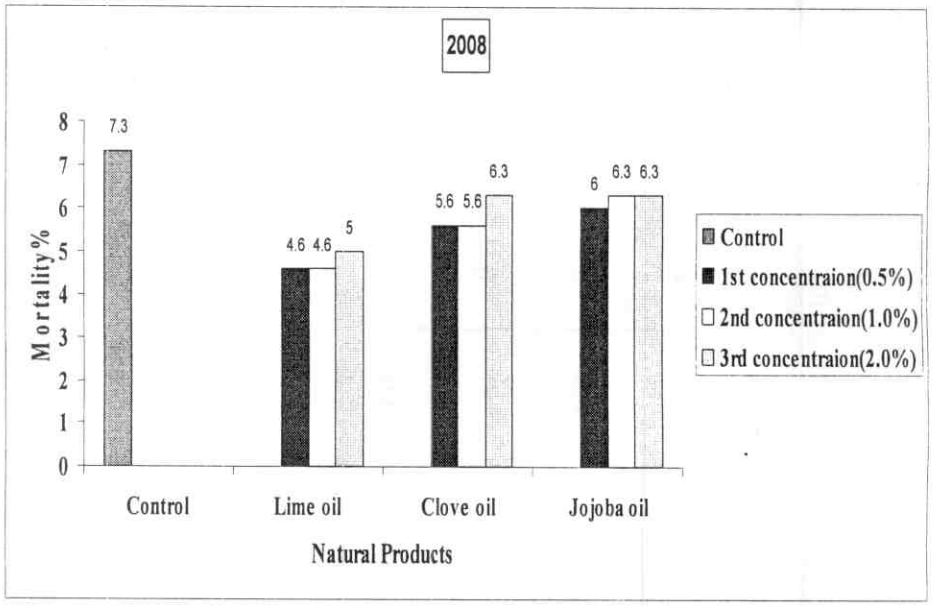

Fig. 4: Effect of some plant extracted oils on larval mortality for 5th instar of *B. mori*.

the highest mortality percent (6.66%). The 1st concentration of lime oil and clove oil exhibited (4.6% and 5.0%) respectively showed the least percentage, also the 1st and 3rd concentration of jojoba oil recorded (6.0% and 6.0%) showed low mortality rate. Statistical analysis revealed non significant differences (P>0.05) within the concentrations of the extracted oils.

The 5th instar:

Data in table (2) and fig. (4) indicated that statistical analysis revealed significant differences (P<0.05) within means of mortality percentage of the fifth instar as response to extracted oils. Lime oil exhibited the least percent mortality mean (5.33%) in the 5th larval instar, followed by clove oil recorded (6.22%) then jojoba oil recorded (7.11%), while control group recorded the highest percent mortality (7.33%). The three concentrations of lime oil exhibited (4.6% and 5.0%) respectively showed the least percentage, followed by the 1st and 2nd concentration of clove oil each recorded (5.6%) showed low percentage. Then the 2nd and 3rd concentrations of jojoba oil each recorded (6.3%). Statistical analysis revealed non significant differences (*P*>0.05) within the concentrations of the extracted oils.

2- Larval duration

a. Season 2007:

The 4th instar:

Statistical analysis of data represented in table (3) and fig. (5) revealed significant differences (P<0.05) within means of duration period of the fourth larval instar as response to extracted oils. Lime oil exhibited the shortest duration period (5.83 days), followed by clove oil recorded (6.38 days) while jojoba oil and

Table (3): Effect of some plant extracted oils on larval duration (days) of mulberry silkworm *B.mori* for season 2007.

Concentrations / Compounds	4th				5th			
	0.5%	1%	2%	Mean	0.5%	1%	2%	Mean
Lime oil	6.0	5.8	5.6	5.83	9.0	9.0	8.5	8.83
Clove oil	6.5	6.1	7.0	6.38	9.0	9.0	9.0	9.00
Jojoba oil	7.0	7.0	7.0	7.00	9.5	9.3	9.3	9.38
Control	7.0				9.5			
F Compounds	102.00***				25.8***			
L.S.D Compounds	0.162				0.181			

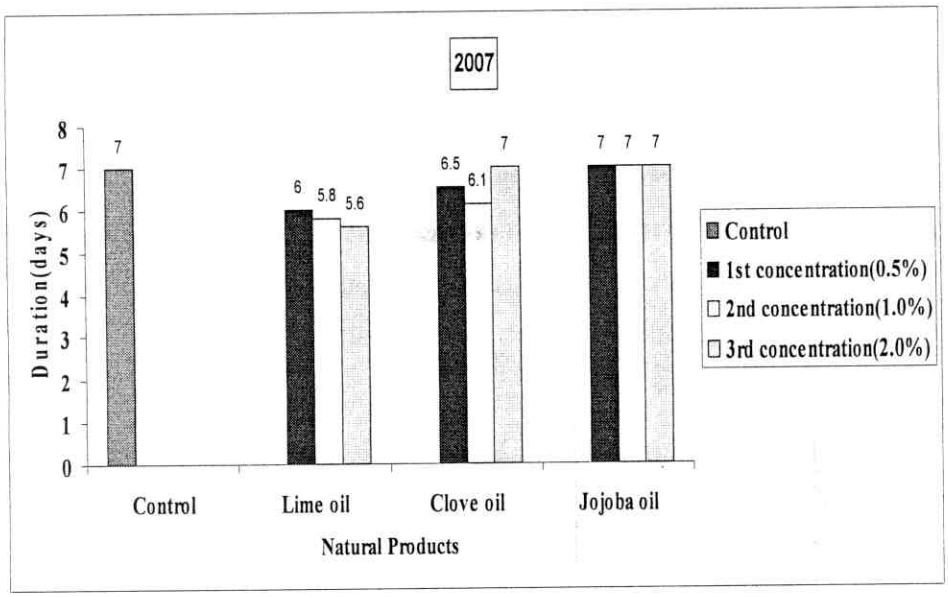

Fig. 5: Effect of some plant extracted oils on larval duration for 4th instar of *B. mori*.

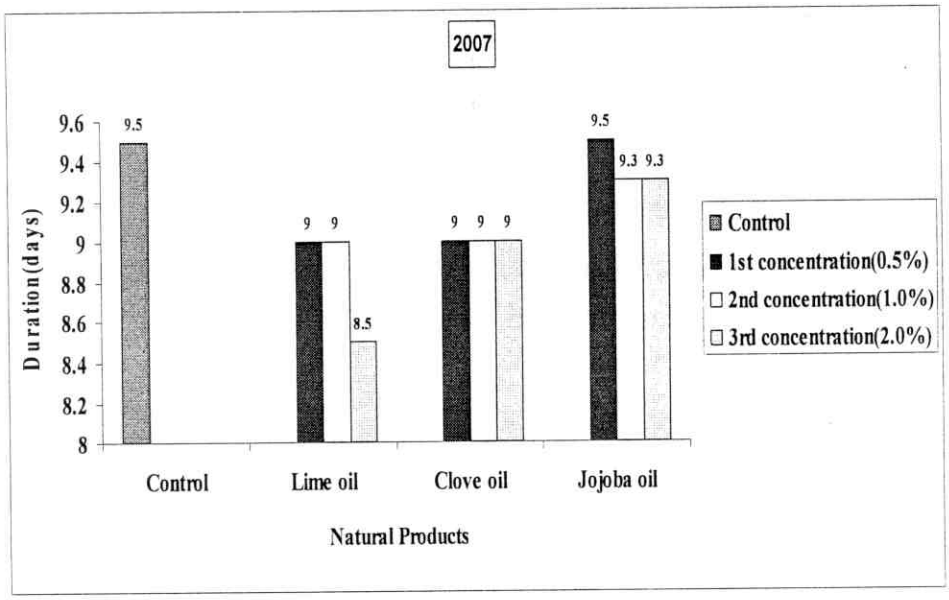

Fig. 6: Effect of some plant extracted oils on larval duration for 5th instar of *B. mori*.

control group recorded the highest duration period (7.00 days). The three concentrations of lime oil exhibited the shortest duration period (6.0, 5.8 and 5.6 days) respectively, followed by the 2nd concentration of clove oil recorded (6.1days). All the concentrations of jojoba oil recorded the same result (7 days). Statistical analysis revealed non significant differences ($p>0.05$) within the concentrations of the extracted oils under study.

The 5th instar:

Data tabulated in table (3) and fig. (6) indicated that significant differences ($P<0.05$) within means of the duration period of the 5th larval instar as response to extracted oils. Lime oil exhibited the shortest duration period (8.83) days in the 5th larval instar, followed by clove oil recorded (9.00) days, then jojoba oil recorded (9.38) days, while control group recorded the highest duration period (9.50) days. The 3rd concentration of lime oil recorded (8.5 days) and the three concentrations of clove oil recorded the same result (9.0 days) showed the shortest duration period. Then, the 2nd and 3rd concentrations of jojoba oil recorded (9.3 days) exhibited the same result. Statistical analysis revealed non significant differences ($P>0.05$) within the concentrations of the extracted oils.

b. Season 2008:

The 4th instar:

Statistical analysis of data in table (4) and fig. (7) revealed significant differences ($P<0.05$) within means of duration period of fourth larval instar as response to extracted oils. Lime oil exhibited the shortest duration period (5.77) days in the 4th larval instar, followed by clove oil recorded (5.83)

Table (4): Effect of some plant extracted oils on larval duration (days) of mulberry silkworm *B. mori* for season 2008.

Concentrations / Compounds	4th				5th			
	0.5%	1%	2%	Mean	0.5%	1%	2%	Mean
Lime oil	6.0	5.8	5.5	5.77	8.0	8.0	8.0	8.00
Clove oil	6.0	5.8	5.6	5.83	8.1	8.0	8.0	8.16
Jojoba oil	6.1	6.1	6.8	6.38	8.6	8.8	9.0	8.83
Control	7.0				9.0			
F Compounds	70.44***				156.0***			
L.S.D Compounds	0.198				0.114			

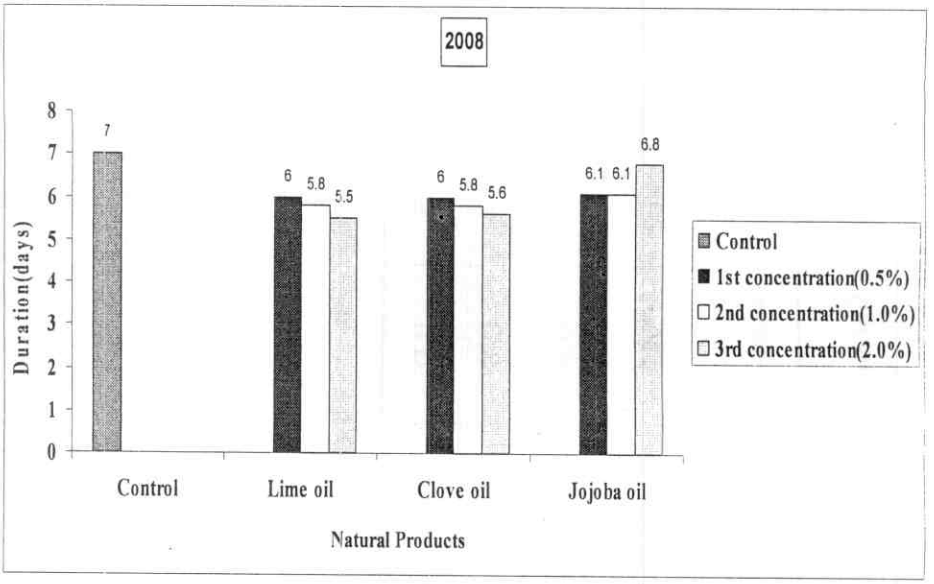

Fig. 7: Effect of some plant extracted oils on larval duration for 4th instar of *B. mori.*

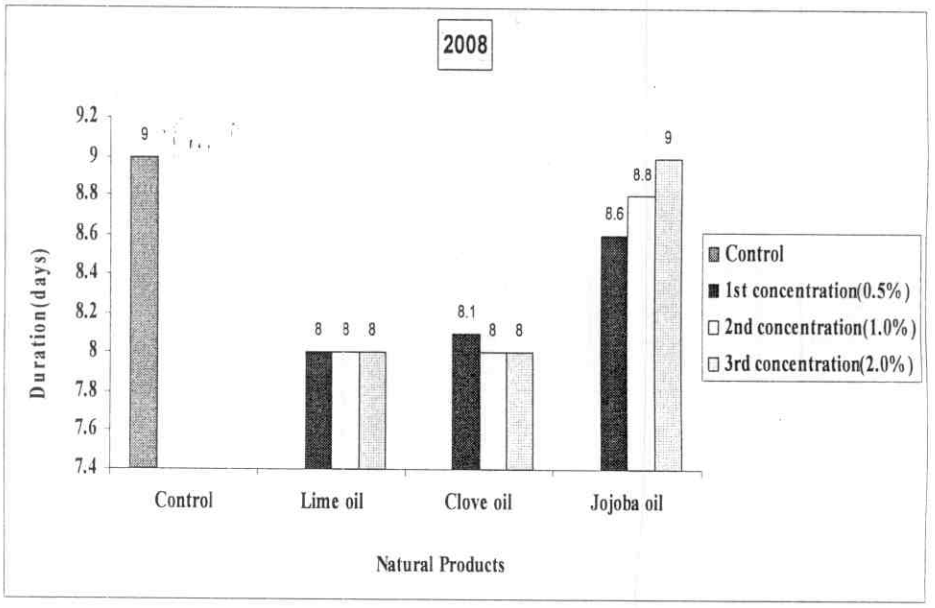

Fig. 8: Effect of some plant extracted oils on larval duration for 5th instar of *B. mori.*

days, then jojoba oil recorded (6.38) days, while control group recorded the highest duration period (7.00) days. The 3rd concentration (2.0%) of lime and clove oils recorded (5.5and 5.6 days) respectively showed the shortest duration period followed by the 2nd concentration (1.0%) of them each recorded (5.8 days).the 1st and 2nd concentrations of jojoba oil exhibited the same result each recorded (6.1 days). Statistical analysis revealed non significant differences ($p>0.05$) within the concentrations of the extracted oils.

The 5th instar:

Data presented in table (4) and fig. (8) indicated that significant differences ($P<0.05$) within means of duration period of the fifth larval instar as response to extracted oils. Lime oil exhibited the shortest duration period (8.00) days in the 5h larval instar, followed by clove oil recorded (8.16) days, then jojoba oil recorded (8.83) days, while control group recorded the highest duration period (9.00) days. The three concentration of lime oil and the 2nd and 3rd concentration of clove oil each recorded (8.0 days) showed the shortest duration period. The 1st concentration of jojoba oil exhibited (8.6 days) showed also the shortest duration period. Statistical analysis revealed non significant differences ($p>0.05$) within the concentrations of the extracted oils.

3- Cocooning percentage:-

a. Season 2007:

As shown in table (5) and fig. (9) statistical analysis revealed significant differences ($P<0.05$) within means of cocooning percentage as response to extracted oils. Lime oil

exhibited the highest cocooning percentage (83.55%) followed by clove oil recorded (78.44%) then jojoba oil which recorded (72.22%), while control group exhibited the least cocooning percentage (72.00%). The three concentrations of lime oil recorded (84.66, 82.66 and 83.33%) respectively showed the highest cocooning percentage, followed by the three concentrations of clove oil recorded (79.33, 79.00 and 77.00%) respectively, followed by the 1st concentration of jojoba oil recorded (75.00%). Statistical analysis revealed non-significant differences ($P>0.05$) within the concentrations of the extracted oils.

b. Season 2008:

As shown in table (5) and fig. (10) statistical analysis revealed significant differences ($P<0.05$) within means of cocooning percentage as response to extracted oils. Lime oil exhibited the highest cocooning percentage (83.22%) followed by clove oil recorded (79.77%) then jojoba oil which recorded (75.22%), while control group recorded the least cocooning percentage (75.00%). The three concentration of the lime oil exhibited (84.66 and 81.66, 83.33%) respectively showed the highest percentage, followed by the three concentrations of clove oil recorded (80.00, 80.33 and 79.00%) respectively, followed by the 1st concentration of jojoba oil recorded (76.00%). Statistical analysis revealed non significant differences ($P>0.05$) within the concentrations of the extracted oils.

Table (5): Effect of some plant extracted oils on cocooning percentage of mulberry silkworm *B. mori*

Concentrations / Compounds	2007				2008			
	0.5%	1%	2%	Mean	0.5%	1%	2%	Mean
Lime oil	84.66	82.66	83.33	83.55	84.66	81.66	83.33	83.22
Clove oil	79.33	79.00	77.00	78.44	80.00	80.33	79.00	79.77
Jojoba oil	75.00	73.66	68.00	72.22	76.00	75.66	74.00	75.22
Control	72.00				75.00			
F Compounds	19.89***				11.80****			
L.S.D Compounds	3.625				3.354			

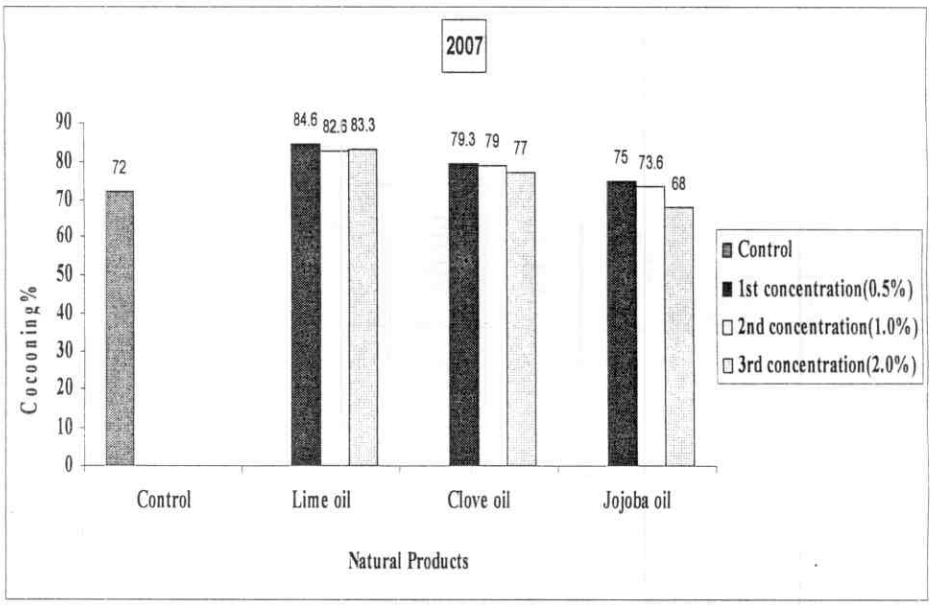

Fig. 9: Effect of some plant extracted oils on cocooning % of *B. mori.*

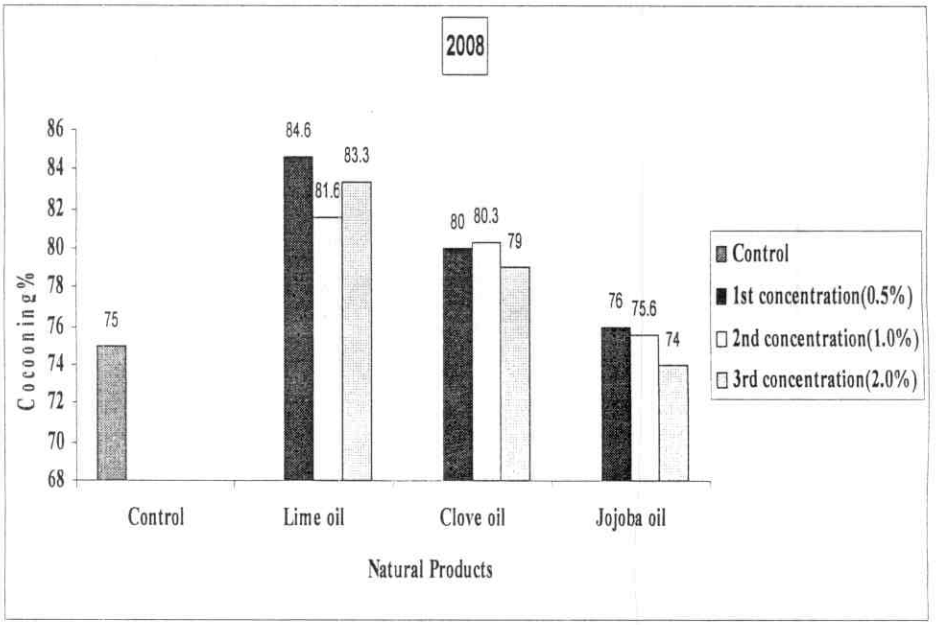

Fig. 10: Effect of some plant extracted oils on cocooning % of *B. mori.*

4- Adult emergence:

A. Season 2007:

Data tabulated in table (6) and fig. (11) showed that, statistical analysis revealed significant differences ($P<0.05$) within means of adult emergence as response to extracted oils. Lime oil exhibited the highest adult emergence (85.55%) followed by clove oil recorded (79.44%) then jojoba oil which recorded (77.21%), while control group recorded the least result (73.33%). The three concentrations of lime oil exhibited (86.66, 85.00 and 85.00%) respectively followed by the 1st concentration of clove oil recorded (83.33%) showed the highest percentage, and then the 2nd concentration of jojoba oil which recorded (81.66%). Statistical analysis revealed non significant differences ($P>0.05$) within the concentrations of the extracted oils.

b. Season 2008:

Data tabulated in table (6) and fig. (12) referred that, statistical analysis revealed significant differences ($P<0.05$) within means of adult emergence as response to extracted oils. Lime oil exhibited the highest adult emergence (83.33%) followed by clove oil recorded (79.99%) then jojoba oil which recorded (77.22%), while control group recorded the least adult emergence (73.33%). The 1st concentration of the clove extracted oil recorded (86.66%) showed the highest percentage, followed by the 3rd concentration (2.0%) of the lime extracted oil exhibited (85.00%). The 2nd concentration (1.0%) of the jojoba extracted oil recorded (80.00%) showed also high percentage. Statistical

Table (6): Effect of some plant extracted oils on adult emergence percentage of mulberry silkworm *B. mori.*

Concentrations / Compounds	2007				2008			
	0.5%	1%	2%	Mean	0.5%	1%	2%	Mean
Lime oil	86.66	85.00	85.00	85.55	81.66	83.33	85.00	83.33
Clove oil	83.33	76.66	78.33	79.44	86.66	78.33	75.00	79.99
Jojoba oil	78.33	81.66	71.66	77.21	76.66	80.00	75.00	77.22
Control	73.33				73.33			
F Compounds	9.96***				8.93***			
L.S.D Compounds	4.727				4.212			

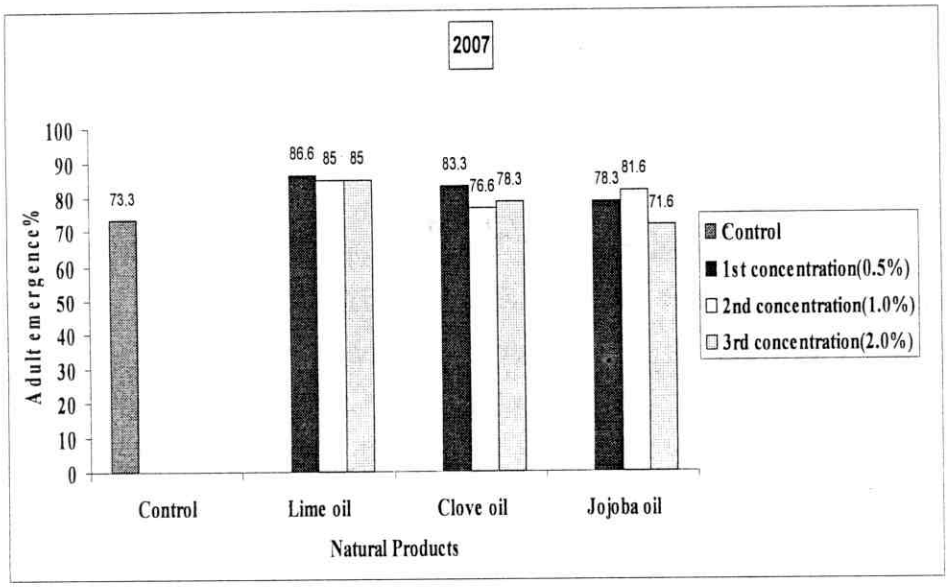

Fig. 11: Effect of some plant extracted oils on adult emergence % of *B. mori*

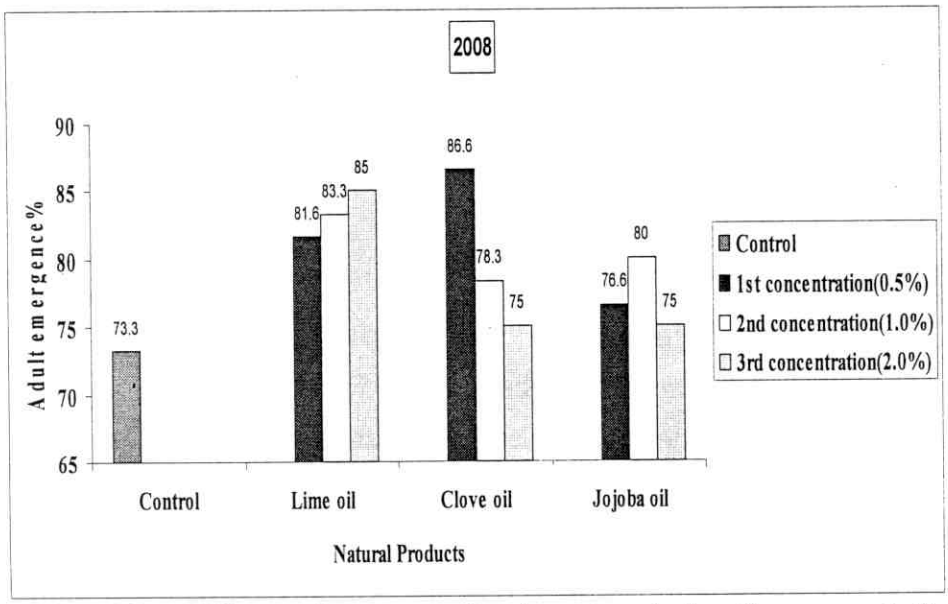

Fig. 12: Effect of some plant extracted oils on adult emergence % of *B. mori*

analysis revealed non significant differences (p>0.05) within the concentrations of the extracted oils.

5- Fecundity:

a. Season 2007:

As illustrated in table (7) and fig. (13) statistical analysis revealed significant differences (P<0.05) within means of the number of eggs deposited per one female as response to the extracted oils and its concentrations. Lime oil exhibited the highest number of deposited eggs/moth (387.8) followed by clove oil recorded (370.5) eggs/moth, then jojoba oil which recorded (329.9) eggs/moth, while control group recorded the least number of deposited eggs/moth (308). The three concentrations of the lime oil exhibited (397, 384.6and 382) eggs/moth respectively showed the highest fecundity, followed by the three concentrations of clove oil recorded (378.3, 377.3and 356) eggs/moth respectively. The 1st concentration of jojoba oil recorded also high fecundity score (339.6). Statistical analysis revealed non significant differences (P>0.05) within the concentrations of the extracted oils.

b. Season 2008:

As illustrated in table (7) and fig. (14) statistical analysis revealed significant differences (P<0.05) within means of the number of eggs deposited per one female as response to the extracted oils. Lime oil exhibited the highest number of deposited eggs/moth (378.33) followed by clove oil recorded (360.10) eggs/moth, then jojoba oil which recorded (354.66) eggs/moth, while control group recorded the least number of deposited eggs/moth (328.66). The three concentrations of the

Table (7): Effect of some plant extracted oils on fecundity (egg /female) of *B. mori.*

Concentrations / Compounds	2007				2008			
	0.5%	1%	2%	Mean	0.5%	1%	2%	Mean
Lime oil	397	384.6	382	387.8	383	379	373	378.33
Clove oil	378.3	377.3	356	370.5	366.66	359.33	354.33	360.10
Jojoba oil	339.6	327.6	322.6	329.9	356.66	356.33	351	354.66
Control	308				328.66			
F Compounds	64.35***				45.51***			
L.S.D Compounds	12.873				8.986			

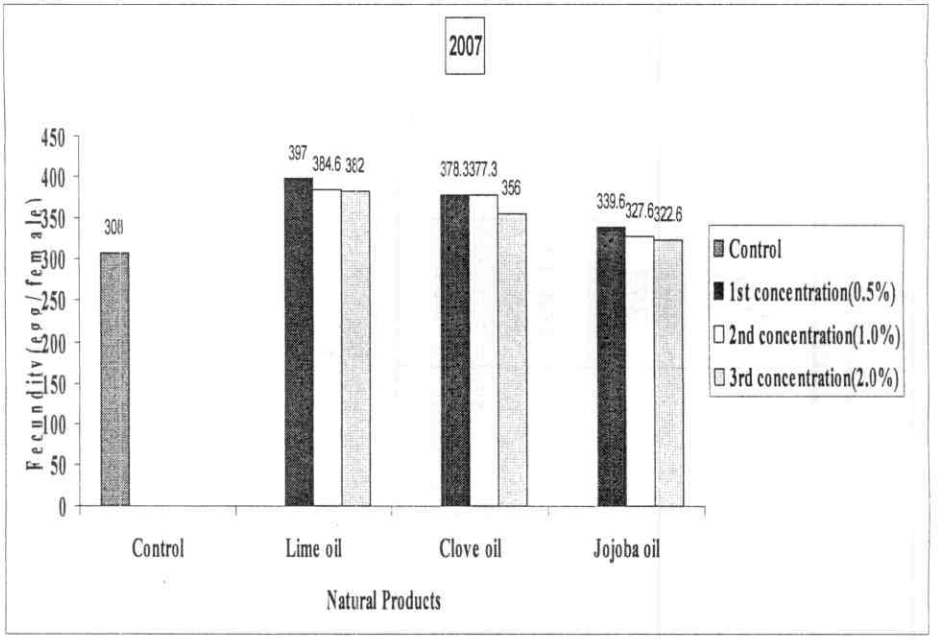

Fig. 13: Effect of some plant extracted oils on fecundity (egg/female) of *B. mori*

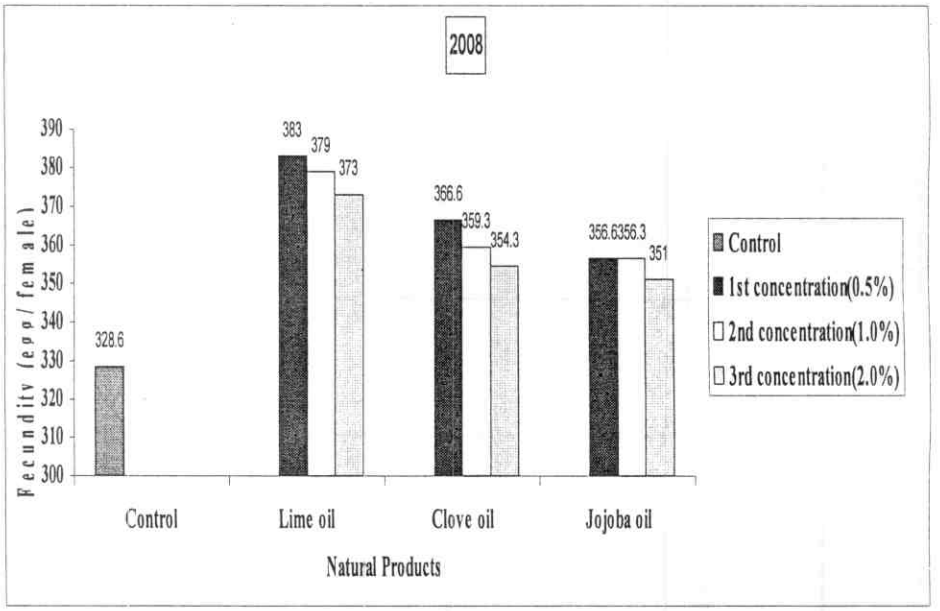

Fig. 14: Effect of some plant extracted oils on fecundity (egg/female) of *B. mori*

lime oil exhibited (383, 379, and 373) eggs/moth respectively showed the highest fecundity of female. Followed by the 1st and 2nd concentrations of clove oil recorded (366.66 and 359.33) eggs/moth respectively. Then the 1st and 2nd concentrations of jojoba oil recorded (356.66 and 356.33) eggs/moth respectively. Statistical analysis revealed non significant differences ($p>0.05$) within the concentrations of the extracted oils.

B. Technological results:

1-Cocoon indices:

I- Weight of fresh cocoon.

a. Season 2007:

Data in table (8) and fig. (15) referred that, the statistical analysis revealed significant differences ($P<0.05$) within means of weight fresh cocoon as response to the extracted oils. Lime oil exhibited the highest weight of fresh cocoon (0.932 g) followed by clove oil recorded (0.902 g), then control group which recorded (0.856 g), while jojoba oil recorded the least weight of fresh cocoon (0.843 g). The three concentrations of the lime oil exhibited (0.926, 0.930 and 0.942g) respectively showed the highest weight of fresh cocoons, followed by the three concentrations of clove oil. Then the 3rd concentration of jojoba oil which recorded (0.858g). Statistical analysis revealed non significant differences ($P>0.05$) within the concentrations of the extracted oils.

b. Season 2008:

Data in table (8) and fig. (16) referred that, statistical analysis revealed non significant differences ($P>0.05$) within

Table (8): Effect of some plant extracted oils on fresh cocoon weight (g) of *B. mori.*

Concentrations / Compounds	2007				2008			
	0.5%	1%	2%	Mean	0.5%	1%	2%	Mean
Lime oil	0.926	0.930	0.942	0.932	0.904	0.897	0.888	0.896
Clove oil	0.878	0.923	0.906	0.902	0.905	0.873	0.880	0.886
Jojoba oil	0.852	0.821	0.858	0.843	0.830	0.873	0.871	0.858
Control	0.856				0.872			
F Compounds	8.81***				ns			
L.S.D Compounds	0.0419							

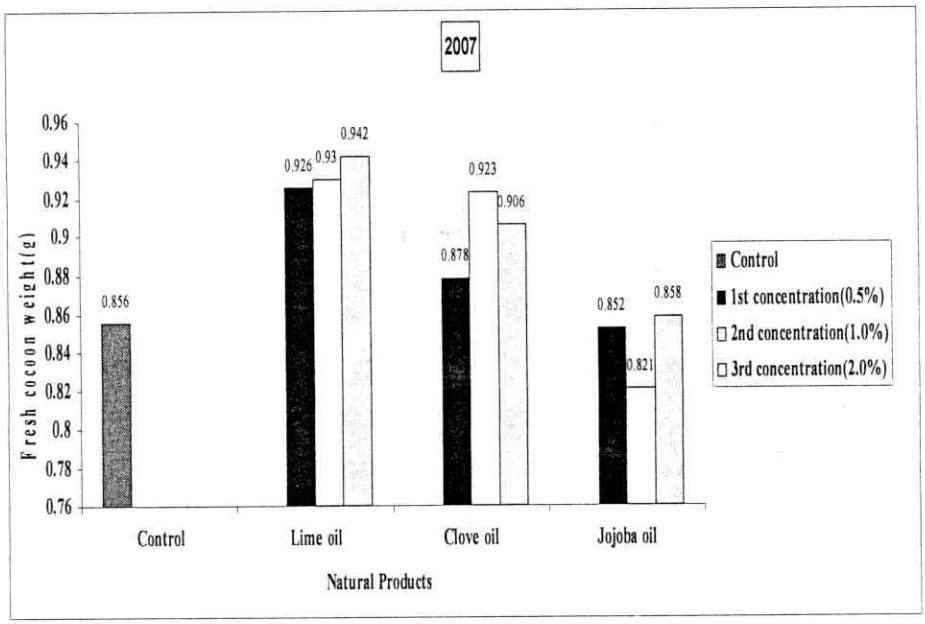

Fig. 15: Effect of some plant extracted oils on cocoon weight (g) of *B. mori*

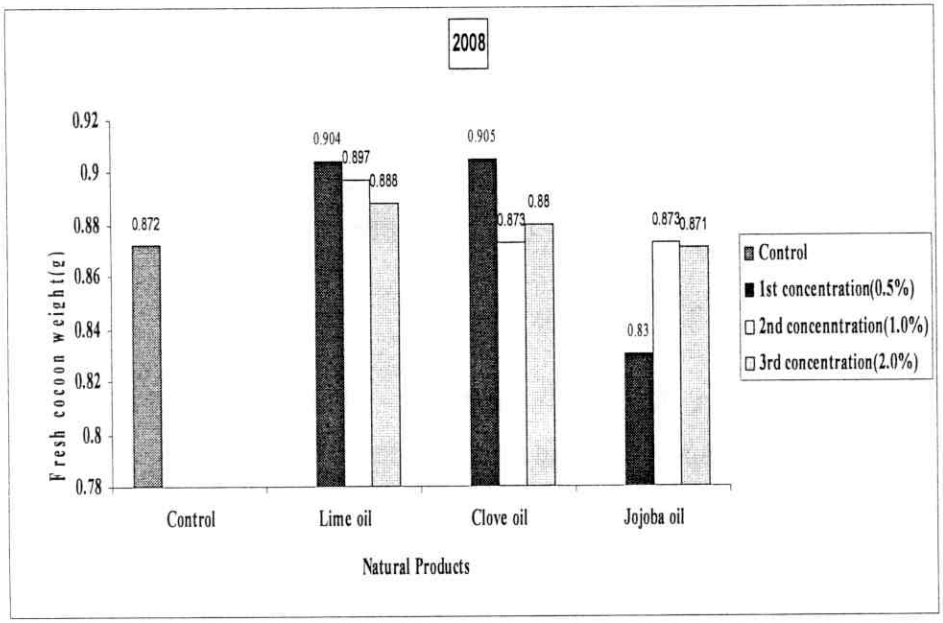

Fig. 16: Effect of some plant extracted oils on cocoon weight (g) of *B. mori*

means of weight fresh cocoon as response to the extracted oils. Also statistical analysis revealed non significant differences (P>0.05) within the concentrations of the extracted oils.

II- Cocoon shell weight:

a. Season 2007:

Results in table (9) and fig. (17) cleared that, the statistical analysis revealed significant differences (P<0.05) within means of cocoon shell weights as response to the extracted oils. Lime oil exhibited the highest weight of cocoon shell (0.166 g) followed by clove oil recorded (0.156 g), then jojoba oil which recorded (0.152 g), while control group recorded the least weight of cocoon shell (0.146 g). The three concentrations of lime oil exhibited (0.166, 0.163and 0.170g) respectively showed the highest weight of cocoon shell, followed by the 1st and 3rd concentration of clove oil recorded (0.160, and 0.156g) respectively. The 1st and 2nd concentrations of jojoba oil each recorded (0.153g) showed higher weight than control group. Statistical analysis revealed non significant differences (P>0.05) within the concentrations of the extracted oils.

b. Season 2008:

Results in table (9) and fig. (18) cleared that, the statistical analysis revealed significant differences (P<0.05) within means of cocoon shell weight as response to the extracted oils. Lime oil exhibited the highest weight of cocoon shell (0.179 g) followed by clove oil recorded (0.171 g), then jojoba oil which recorded (0.165 g), while control group recorded the least weight of cocoon shell (0.153 g). The three concentrations of

Table (9): Effect of some plant extracted oils on shell cocoon weight (g) of *B. mori.*

Concentrations / Compounds	2007				2008			
	0.5%	1%	2%	Mean	0.5%	1%	2%	Mean
Lime oil	0.166	0.163	0.170	0.166	0.176	0.183	0.180	0.179
Clove oil	0.160	0.153	0.156	0.156	0.176	0.163	0.176	0.171
Jojoba oil	0.153	0.153	0.150	0.152	0.160	0.173	0.163	0.165
Control	0.146				0.153			
F Compounds	25.77***				18.78***			
L.S.D Compounds	0.0048				0.0076			

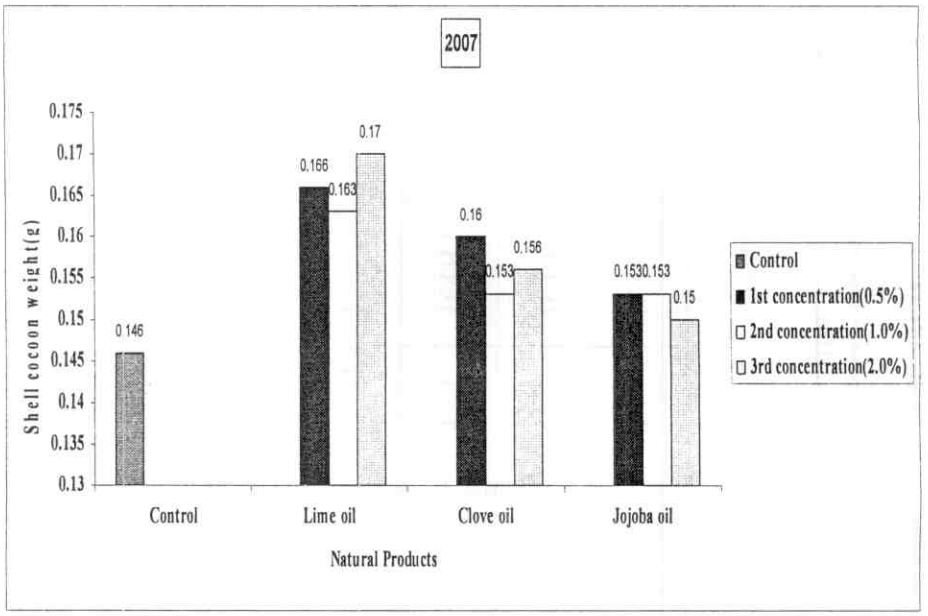

Fig. 17: Effect of some plant extracted oils on shell cocoon weight (g) of *B. mori*

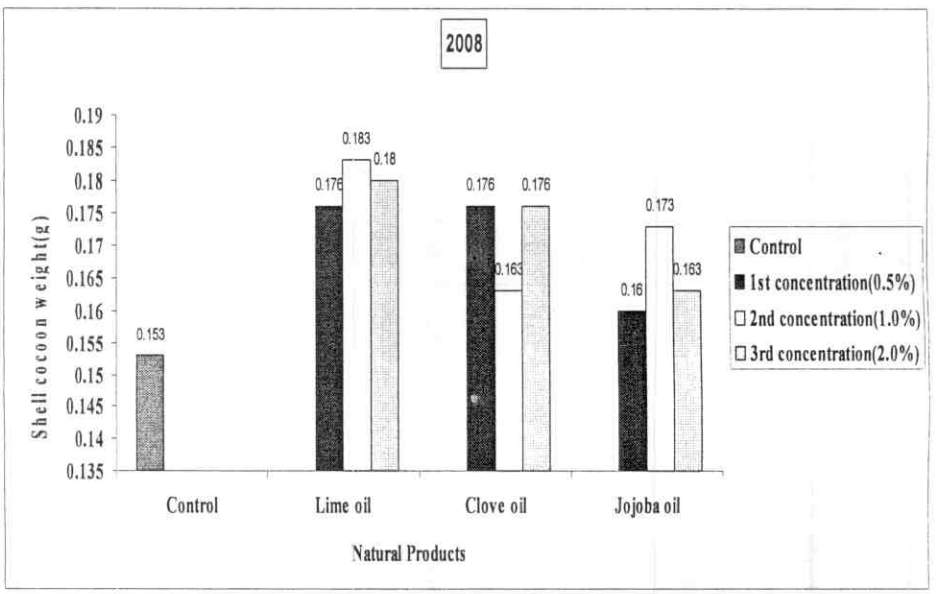

Fig. 18: Effect of some plant extracted oils on shell cocoon weight (g) of *B. mori*

Lime extracted oil exhibited (0.176, 0.183and 0.180g) respectively and the 1st and 3rd concentration of clove oil recorded (0.176 and 0.176g) showed the highest weights of shell cocoon. The 2nd concentration of jojoba oil recorded (0.173g) also showed high weight of cocoon shell than control. Statistical analysis revealed non significant differences ($p>0.05$) within the concentrations of the extracted oils.

III. Silk content %:

a. Season 2007:

Data tabulated in table (10) and fig. (19) and statistical analysis revealed non significant differences ($P>0.05$) within means ratio of silk content of fresh cocoon as response to extracted oils. Also statistical analysis revealed non significant differences ($p>0.05$) within the concentrations of the extracted oils.

b. Season 2008:

Data tabulated in table (10) and fig. (20) and statistical analysis revealed significant differences ($P<0.05$) within means of silk content ratio of fresh cocoons as response to extracted oils. Lime oil exhibited the highest ratio of silk content (19.55%) followed by clove oil recorded (19.08%), then jojoba oil which recorded (18.55%), while control group recorded the least ratio of silk content (17.00%). The 2nd and 3rd concentrations of lime oil exhibited (20.00 and 19.66%) respectively and the 3rd concentration of clove oil recorded (19.66%) showed the highest ratio of silk content, followed by the 1st concentration of clove oil recorded (19.30%) and the 2nd concentration of jojoba oil exhibited (19.00%). Statistical analysis revealed non significant differences ($P>0.05$) within the concentrations of the extracted oils.

Table (10): Effect of some plant extracted oils on silk content ratio of *B. mori*.

Concentrations / Compounds	2007				2008			
	0.5%	1%	2%	Mean	0.5%	1%	2%	Mean
Lime oil	17.33	17.66	17.66	17.55	19.00	20.00	19.66	19.55
Clove oil	17.66	16.33	17.00	16.99	19.30	18.30	19.66	19.08
Jojoba oil	17.66	18.33	17.00	17.33	18.66	19.00	18.00	18.55
Control	16.66				17.00			
F Compounds	ns				8.56***			
L.S.D Compounds					1.1116			

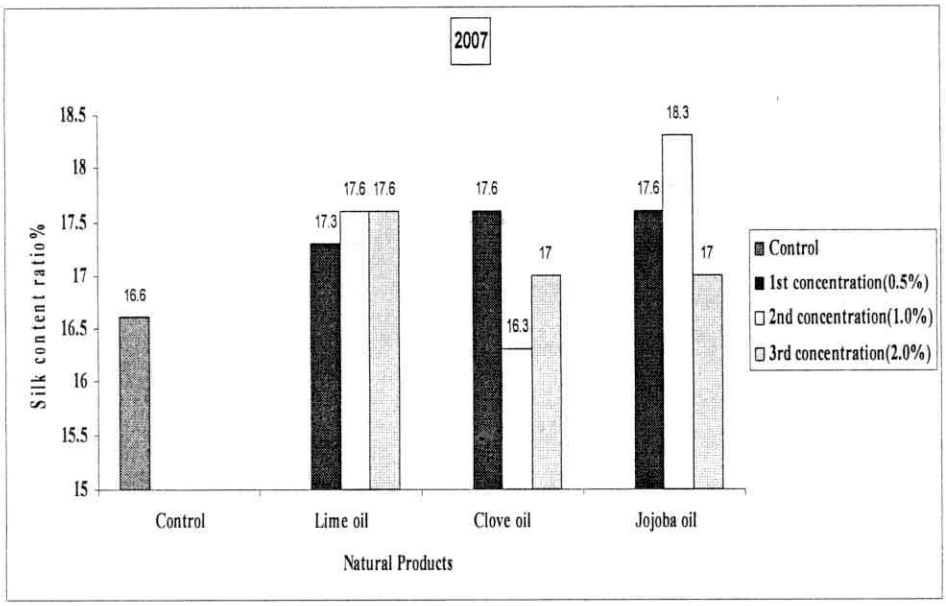

Fig. 19: Effect of some plant extracted oils on silk content ratio of *B. mori*

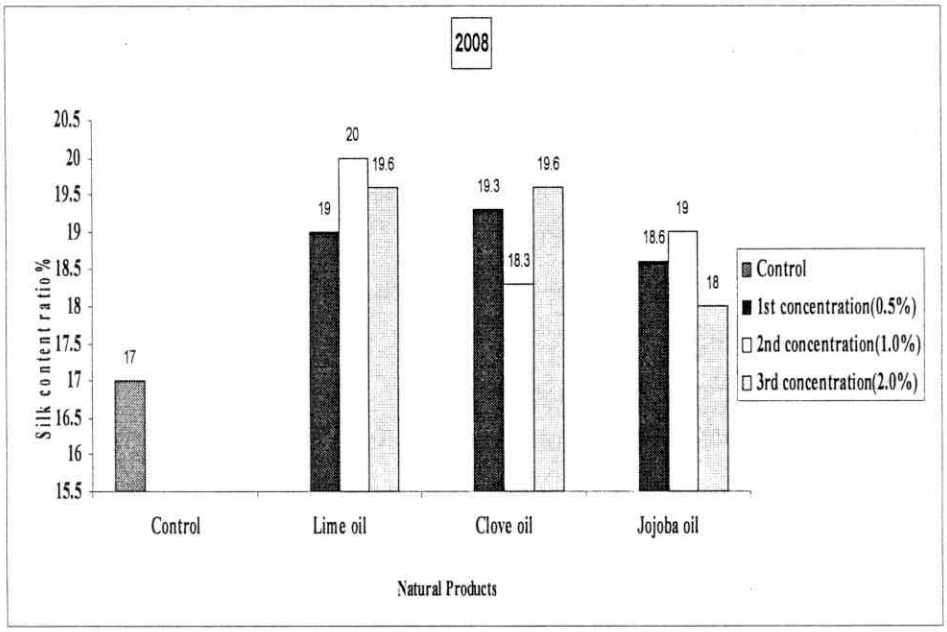

Fig. 20: Effect of some plant extracted oils on silk content ratio of *B. mori*

2-Reeled silk filament parameters:

I-Length of reeled filament (m):

a. Season 2007:

As shown in table (11) and fig. (21) statistical analysis revealed significant differences ($P<0.05$) within means of length of reeled silk filament as response to extracted oils. Lime oil exhibited the highest length of reeled silk filament (1629.7 m) followed by clove oil recorded (1524.6 m) then jojoba oil which recorded (1445.3 m), while control group recorded the least length of reeled silk filament (1207.3 m). The three concentrations of lime oil recorded (1666, 1607 and 1616m) respectively and the 1st and 3rd concentrations of clove oil recorded (1598.6 and 1537m) respectively, followed by the 3rd concentration of jojoba oil recorded (1504.3m). Statistical analysis revealed non significant differences ($p>0.05$) within the concentrations of the extracted oils.

b. Season 2008:

As shown in table (11) and fig. (22) statistical analysis revealed significant differences ($P<0.05$) within means of length of reeled silk filament as response to extracted oils. Lime oil recorded the highest length of reeled silk filament (1667.7 m), followed by clove oil exhibited (1565.5 m), then jojoba oil recorded (1397.4 m), while control group exhibited the least length of reeled silk filament (1228.3 m). The three concentrations of lime oil exhibited (1716.3, 1647 and 1639.3m) respectively showed the highest length of reeled silk filament, followed by the 1st concentration of clove oil recorded (1590.3m). Then the 1st concentration of jojoba oil recorded

Table (11): Effect of some plant extracted oils on silk filament length (m) of *B. mori.*

Concentrations / Compounds	2007				2008			
	0.5%	1%	2%	Mean	0.5%	1%	2%	Mean
Lime oil	1666	1607	1616	1629.7	1716.3	1647.6	1639.3	1667.7
Clove oil	1598.6	1438.3	1537	1524.6	1590.3	1580.3	1526	1565.5
Jojoba oil	1415	1416.6	1504.3	1445.3	1491.6	1419.3	1281.3	1397.4
Control	1207.3				1228.3			
F Compounds	65.02***				170.13***			
L.S.D Compounds	65.041				43.199			

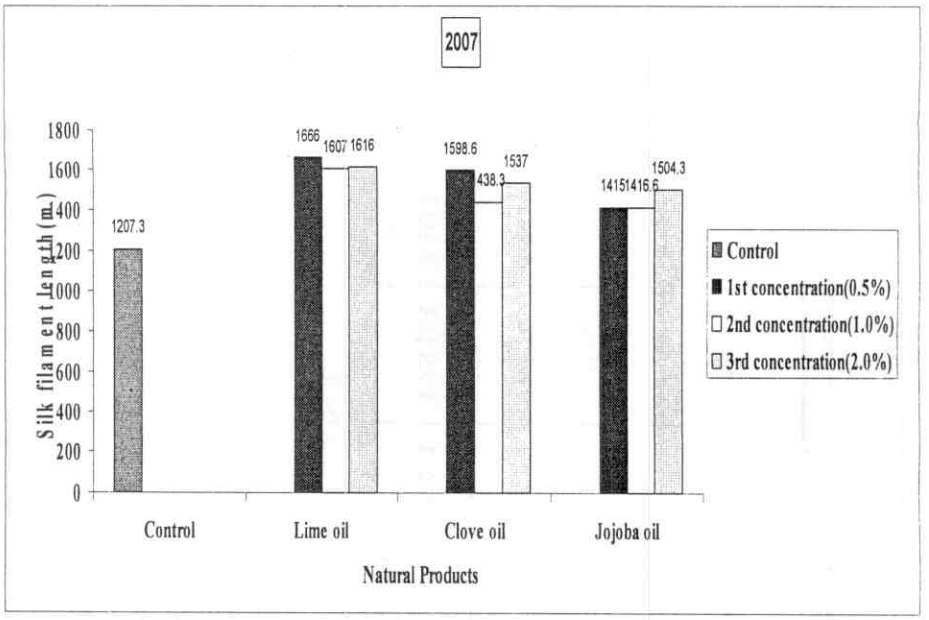

Fig. 21: Effect of some plant extracted oils on silk filament length (m) of *B. mori*

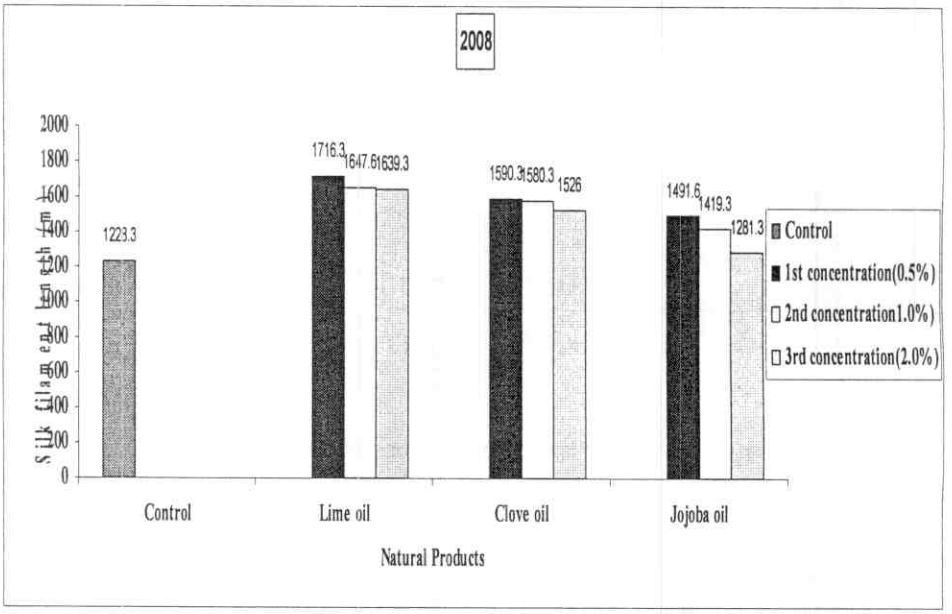

Fig. 22: Effect of some plant extracted oils on silk filament length (m) of *B. mori*

(1491.6m). Statistical analysis revealed significant differences ($P<0.05$) within the concentrations of the extracted oils.

II-Weight of silk filament:

a- Season 2007:

Data presented in table (12) and fig. (23) referred that statistical analysis revealed significant differences ($P<0.05$) within means of weights of silk filament as response to extracted oils. Lime oil exhibited the highest weight of silk filament (0.33 g) followed by clove oil recorded (0.31 g), then jojoba oil which recorded (0.28 g), while control group recorded the least weight of silk filament (0.26 g). The 1st and 3rd concentrations of lime oil each recorded (0.33g) and the 1st and 3rd concentrations of clove oil (0.32g) showed the highest weight of silk filament. Then the 3rd concentration of the jojoba extracted oil recorded (0.29g) showed higher weight of silk filament than the control group. Statistical analysis revealed non significant differences ($P>0.05$) within the concentrations of the extracted oils.

B- Season 2008:

Data presented in table (12) and fig. (24) showed that statistical analysis revealed significant differences ($P<0.05$) within means weight of silk filament as response to extracted oils. Lime oil exhibited the highest weight of silk filament (0.33 g), followed by clove oil recorded (0.30 g), then jojoba oil exhibited (0.27 g), while control group recorded the least weight of silk filament (0.25 g). The three concentrations of lime oil recorded (0.34, 0.33 and 0.32g) showed the highest weight of silk filament, followed by the 1st and 2nd concentrations of clove oil each recorded (0.31g). Statistical analysis revealed non significant differences ($P>0.05$) within the concentrations of the extracted oils.

Table (12): Effect of some plant extracted oils on silk filament weight (g) of *B. mori*.

Concentrations / Compounds	2007				2008			
	0.5%	1%	2%	Mean	0.5%	1%	2%	Mean
Lime oil	0.33	0.32	0.33	0.33	0.34	0.33	0.32	0.33
Clove oil	0.32	0.29	0.32	0.31	0.31	0.31	0.28	0.30
Jojoba oil	0.27	0.28	0.29	0.28	0.27	0.27	0.27	0.27
Control	0.26				0.25			
F Compounds	37.50***				31.00***			
L.S.D Compounds	0.0161				0.0742			

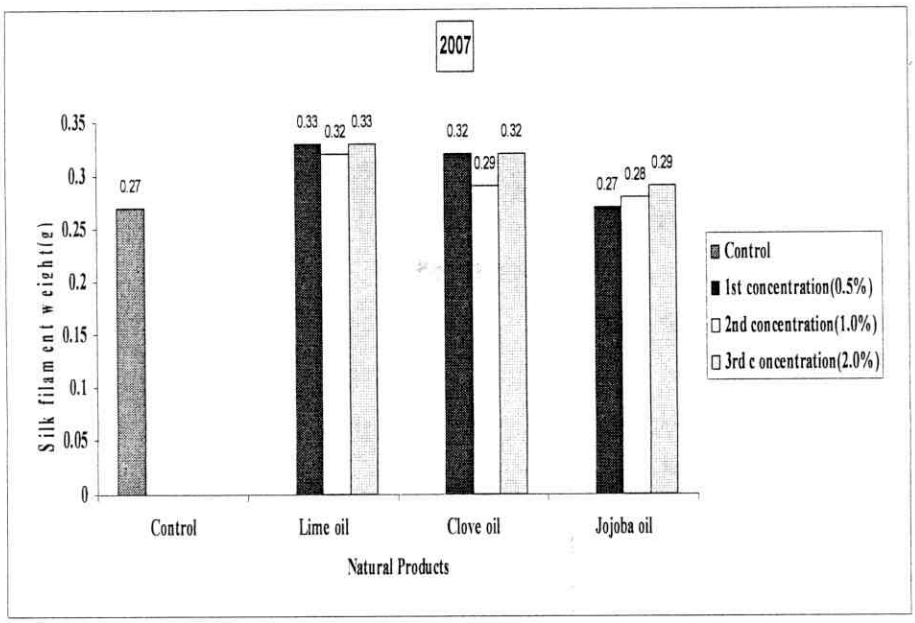

Fig. 23: Effect of some plant extracted oils on silk filament weight (mg) of *B. mori*

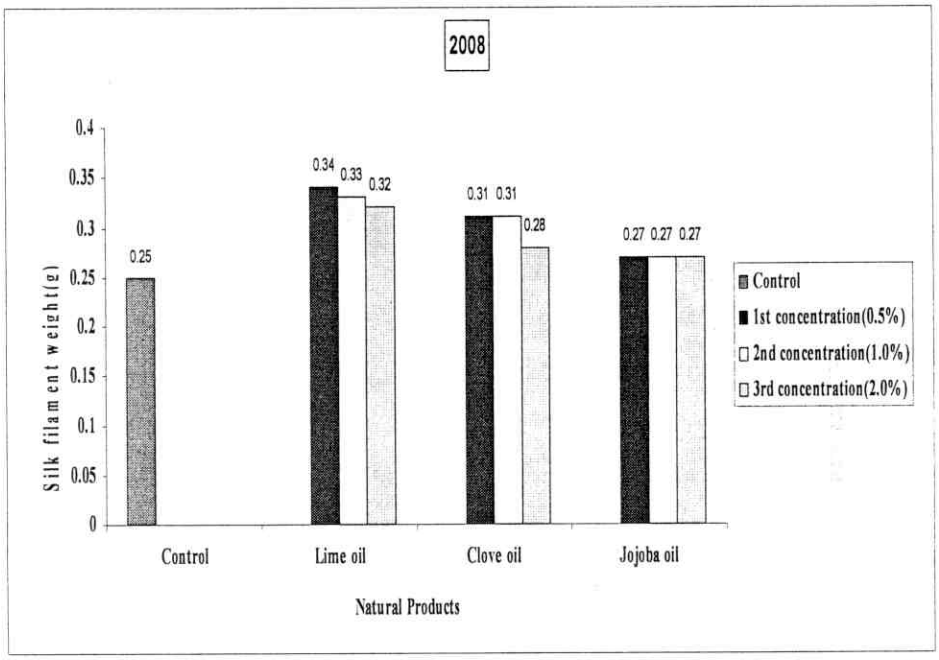

Fig. 24: Effect of some plant extracted oils on silk filament weight (mg) of *B. mori*

III-Size of silk filament:

a- Season 2007:

Table (13) and fig. (25) showed that statistical analysis revealed significant differences ($P<0.05$) within means of size of reeled silk filament as response to extracted oils. Lime oil exhibited the highest size of reeled silk filament (1.783 dn) followed by clove oil recorded (1.669 dn), then jojoba oil recorded (1.474 dn) while control group recorded the least size of reeled silk filament (1.286 dn). The three concentrations of lime oil recorded (1.769, 1.807 and 1.775dn) showed the highest size of reeled silk filament. Followed by the 2^{nd} concentration of clove oil exhibited (1.712dn). The 1^{st} concentration of jojoba oil recorded (1.577dn) showed higher silk size than control group. Statistical analysis revealed non significant differences ($P>0.05$) within the concentrations of the extracted oils concentrations.

b- Season 2008:

Table (13) and fig. (26) showed that statistical analysis revealed significant differences ($P<0.05$) within means of size of reeled silk filament as response to extracted oils. Lime oil recorded the highest size of reeled silk filament (1.781 dn) followed by clove oil exhibited (1.770 dn), then jojoba oil recorded (1.564 dn) while control group recorded the least size of reeled silk filament (1.344 dn). The 2^{nd} concentration of lime extracted oil exhibited (1.821dn.) and the 1^{st} concentration of clove oil recorded (1.805dn.) showed the highest size of reeled silk filament. Statistical analysis revealed non significant differences ($P>0.05$) within the concentrations of the extracted oils.

Table (13): Effect of some plant extracted oils on silk filament size (dn) of *B. mori.*

Concentrations / Compounds	2007				2008			
	0.5%	1%	2%	Mean	0.5%	1%	2%	Mean
Lime oil	1.769	1.807	1.775	1.783	1.777	1.821	1.745	1.781
Clove oil	1.628	1.712	1.667	1.669	1.805	1.755	1.752	1.770
Jojoba oil	1.577	1.466	1.380	1.474	1.624	1.554	1.514	1.564
Control	1.286				1.344			
F Compounds	78.06***				133.32***			
L.S.D Compounds	0.0724				0.0521			

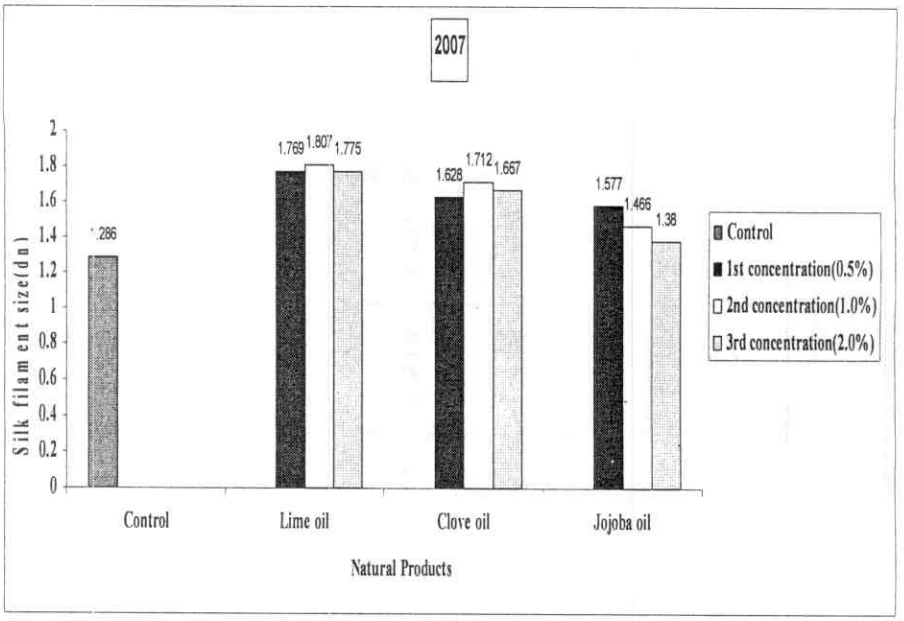

Fig. 25: Effect of some plant extracted oils on silk filament size (dn)of *B. mori*

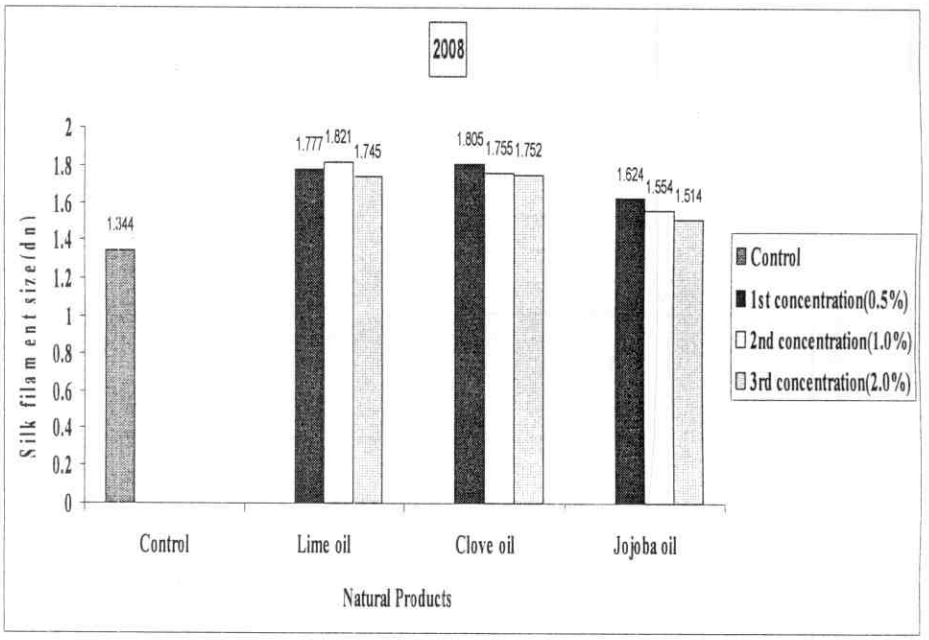

Fig. 26: Effect of some plant extracted oils on silk filament size (dn)of *B. mori*

C-Physiological studies:

1-Determining the activities of glutamic oxaloacetic transaminase (GOT) and glutamic pyruvic transaminase (GPT) enzymes in haemolymph:

I -GPT activity:

a. Season 2007:

Results in table (14) and fig. (27) cleared that the mean activity of GPT enzyme in the larval haemolymph fed on mulberry leaves supplemented with 3 extracted oils of lime, clove and jojoba and its concentrations. Some treatments showed higher results than control, lime oil exhibited the highest activity of GPT recorded (106.0 um) pyruvate separated/60 min/g haemolymph, followed by jojoba oil recorded (102.6um) pyruvate separated/ 60min/g haemolymph, then the control group recorded (100um) pyruvate separated /60 min/g haemolymph. While clove oil recorded the least activity of GPT (90.99 um) pyruvate separated/60 min/g haemolymph. The 2nd concentration of lime oil and the 1st concentration of clove oil showed the highest activity of GPT recorded (111.3 and 107.6 um) respectively.

b. Season 2008:

Results in table (14) and fig. (28) cleared that the mean activity of GPT enzyme as responses to extracted oils and its concentrations, some treatments showed higher results than control such as lime oil which exhibited the highest activity of GPT (105.7 um) pyruvate separated /60 min/g haemolymph, followed by the control group recorded (100 um) pyruvate separated/60 min/g haemolymph, then jojoba oil recorded

Table (14): Effect of some plant extracted oils on protein enzyme (GPT) presented in larval haemolymph of mulberry silkworm *B.mori* for seasons 2007 and 2008.

Concentrations / Compounds	2007				2008			
	0.5%	1%	2%	Mean	0.5%	1%	2%	Mean
Lime oil	103.4	111.3	103.4	106.0	104.6	111.1	101.5	105.7
Clove oil	107.6	80.46	84.93	90.99	90.66	104.25	96.98	97.29
Jojoba oil	85.56	94.46	69.67	102.6	102.6	89.36	100.0	97.35
Control	100				100			

Data were compared versus the control and expressed as percentages.

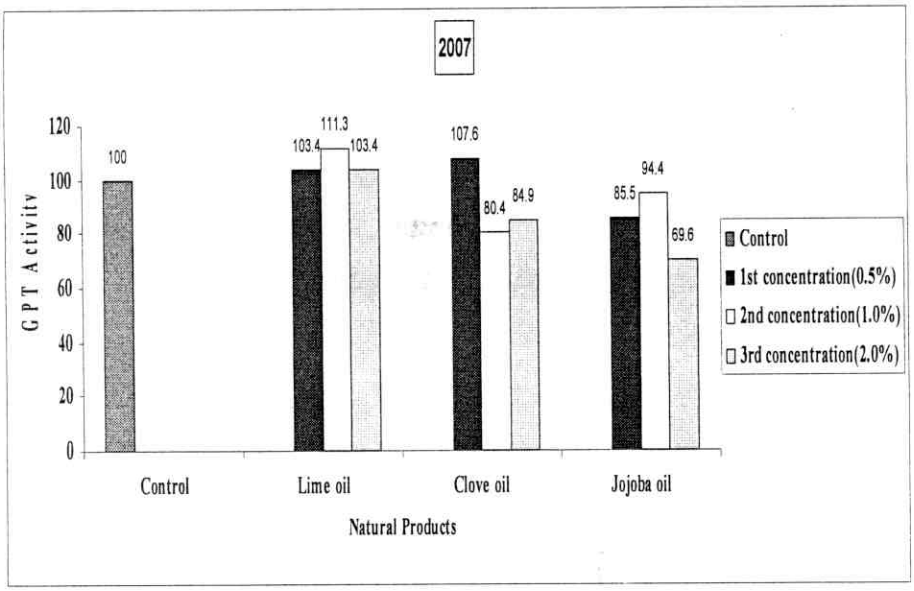

Fig. 27: Effect of some plant extracted oils on activity of GPT enzyme of *B. mori*

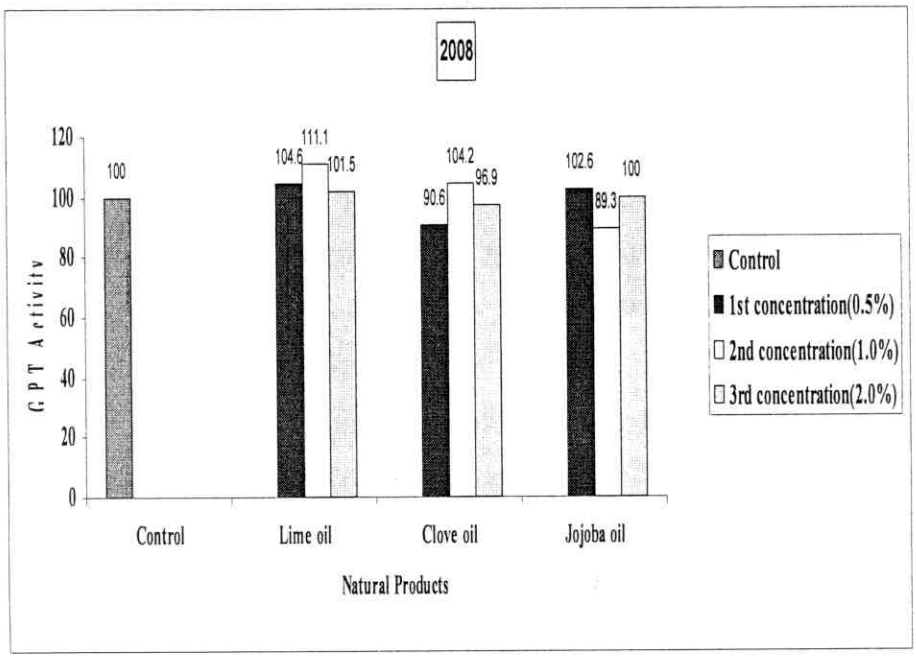

Fig. 28: Effect of some plant extracted oils on activity of GPT enzyme of *B. mori*

(97.35um) pyruvate separated/60 min/g haemolymph, while clove oil exhibited the least activity of GPT (97.29 um) pyruvate separated/60 min/g haemolymph.. The 2nd concentration of lime and clove oil recorded (111.1 and 104.2um) respectively showed the highest activity of GPT. While the 1st concentration of jojoba oil showed higher activity of GPT than control group.

II-GOT activity:

a. Season 2007:

Data tabulated in Table (15) and fig. (29) showed that the mean activity of GOT enzyme as responses to extracted oils and its concentrations, all treatments showed higher results than control, clove oil exhibited the highest activity of GOT recorded (312.8um) pyruvate separated/60 min/g haemolymph, followed by lime oil recorded (301.2) um pyruvate separated/60 min/g haemolymph. Then jojoba oil which recorded (263.9 um) pyruvate separated/60 min/g haemolymph. While control group recorded the least activity of GOT (100um) pyruvate separated/60 min/g haemolymph .The 3rd concentration of lime and clove showed the highest activity of GOT recorded (616.6 and 633.3um) respectively.

b. Season 2008:

Data tabulated in Table (15) and fig. (30) showed the mean activity of GOT enzyme as responses to extracted oils and its concentrations. Some treatments showed higher results than control such as lime oil exhibited the highest activity of GOT was recorded (120.5um) pyruvate separated/60 min/g haemolymph, followed by clove oil recorded (117.9um) pyruvate separated/60 min/g haemolymph. Then the control

Table (15): Effect of some plant extracted oils on protein enzyme (GOT) in larval haemolymph of mulberry silkworm *B.mori* for seasons 2007 and 2008.

Concentrations / Compounds	2007				2008			
	0.5%	1%	2%	Mean	0.5%	1%	2%	Mean
Lime oil	164.7	123.3	616.6	301.2	118.5	92.33	150.8	120.5
Clove oil	169.1	136.2	633.3	312.8	109.1	114.1	130.5	117.9
Jojoba oil	76.47	80.00	107.5	263.9	119.4	79.42	94.97	97.93
Control	100				100			

Data were compared versus the control and expressed as percentages.

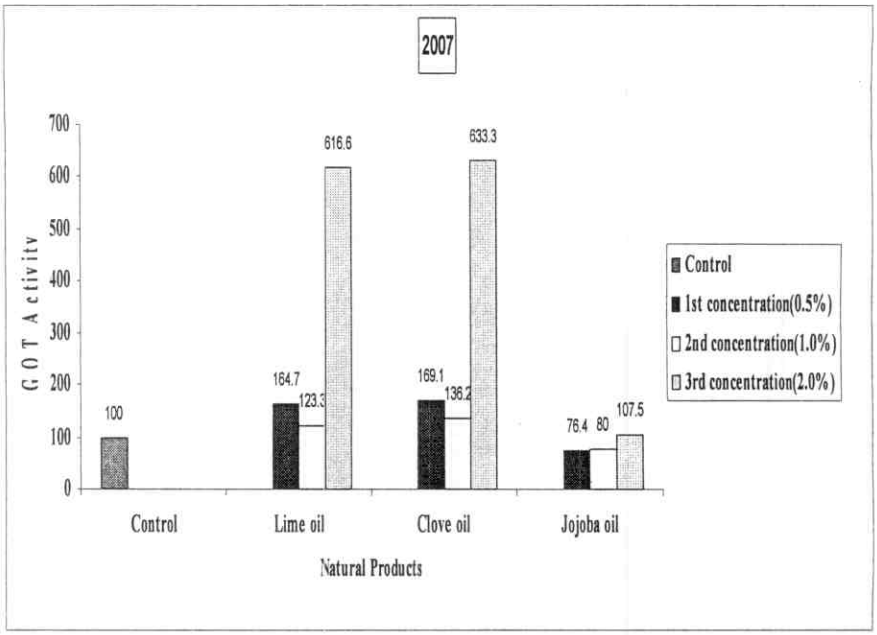

Fig. 29:Effect of some plant extracted oils on activity of GOT enzyme of *B. mori*

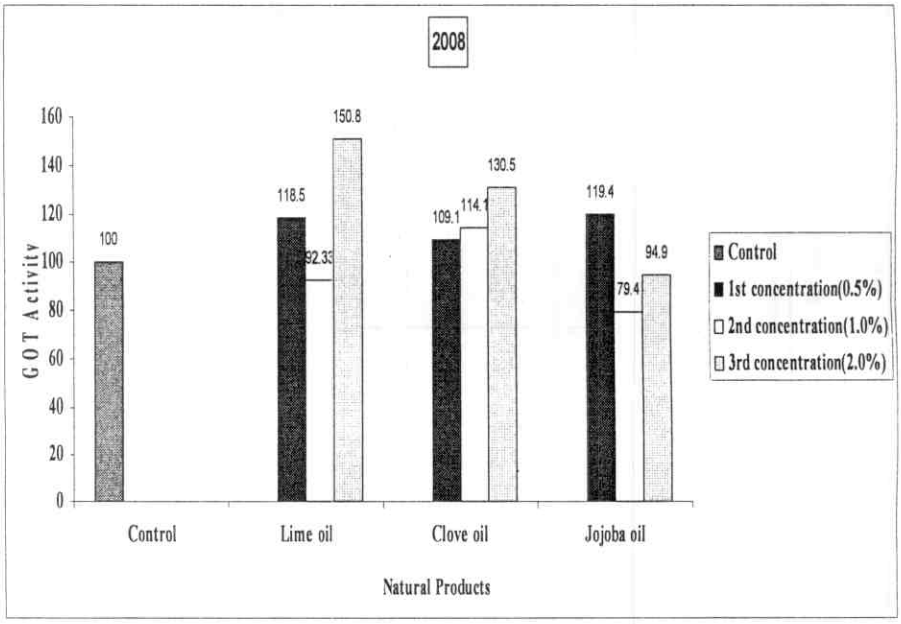

Fig. 30:Effect of some plant extracted oils on activity of GOT enzyme of *B. mori*

group recorded (100um) pyruvate separated/60 min/g haemolymph, while jojoba oil exhibited the least activity of GOT (97.93um) pyruvate separated/60min/g haemolymph. The 3rd concentration of lime and clove oil showed the highest activity of GOT recorded (150.8 and 130.5um) respectively, also the 1st concentration of jojoba oil showed high activity of GOT.

2- Soluble protein content in larval haemolymph:

a. Season 2007:

Data tabulated in Table (16) and fig. (31) showed the mean soluble protein content in larval haemolymph as responses to extracted oils and its concentrations. All treatments showed higher results than control such as lime oil exhibited the highest soluble protein content in larval haemolymph (149.2mg/h.), followed by clove oil recorded (137.36mg/g h.). Then jojoba oil recorded (108.5mg/gh.). While control group recorded the least soluble protein content in the haemolymph (100 mg/gh). The 2nd concentration of lime and clove oil recorded(220 and 180um) respectively showed the highest soluble protein content in the haemolymph, The 3rd concentration of jojoba oil showed high soluble protein content in the haemolymph.

b. Season 2008:

Results in table (16) and fig. (32) cleared the mean soluble protein content in larval haemolymph as responses to extracted oils and its concentrations. All treatments showed higher results than control such as clove oil which exhibited the highest soluble protein content in larval haemolymph (122.2 mg/gh.), followed by lime oil recorded (121.7mg/gh.) then jojoba oil recorded (116.6mg/gh.), while control group recorded the least soluble

Table (16): Effect of some plant extracted oils on soluble protein content in larval haemolymph of mulberry silkworm *B. mori* for seasons 2007 and 2008.

Concentrations / Compounds	2007				2008			
	0.5%	1%	2%	Mean	0.5%	1%	2%	Mean
Lime oil	116.6	220	111.1	149.2	122.2	125	118.1	121.7
Clove oil	133.3	180	100	137.3	111.1	137.5	118.1	122.2
Jojoba oil	83.33	120	122.2	108.5	100	150	100	116.6
Control	100				100			

Data were compared versus the control and expressed as percentages.

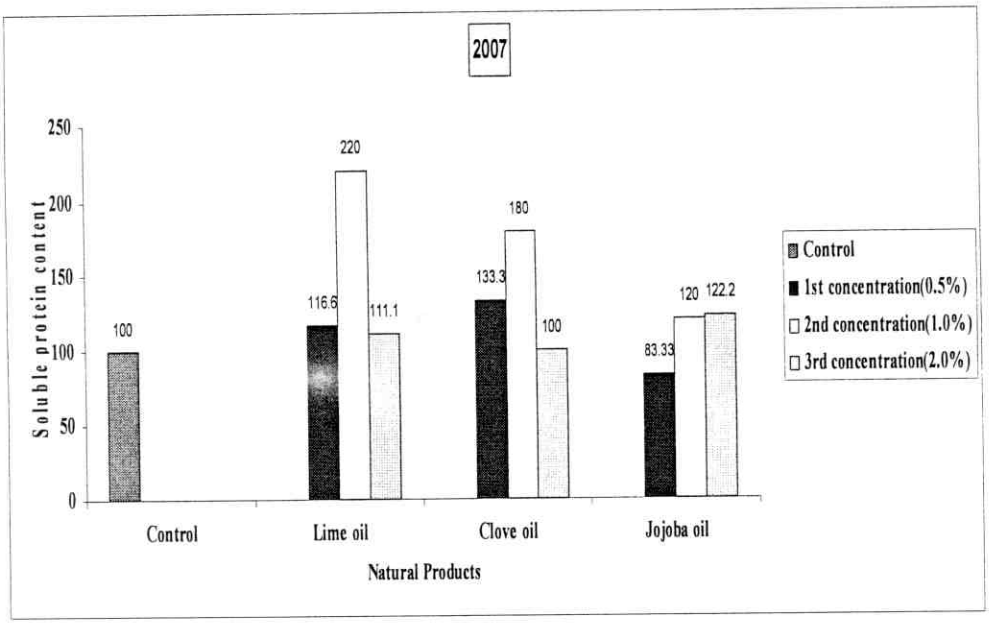

Fig. 31: Effect of some plant extracted oils on soluble protein content of *B. mori*

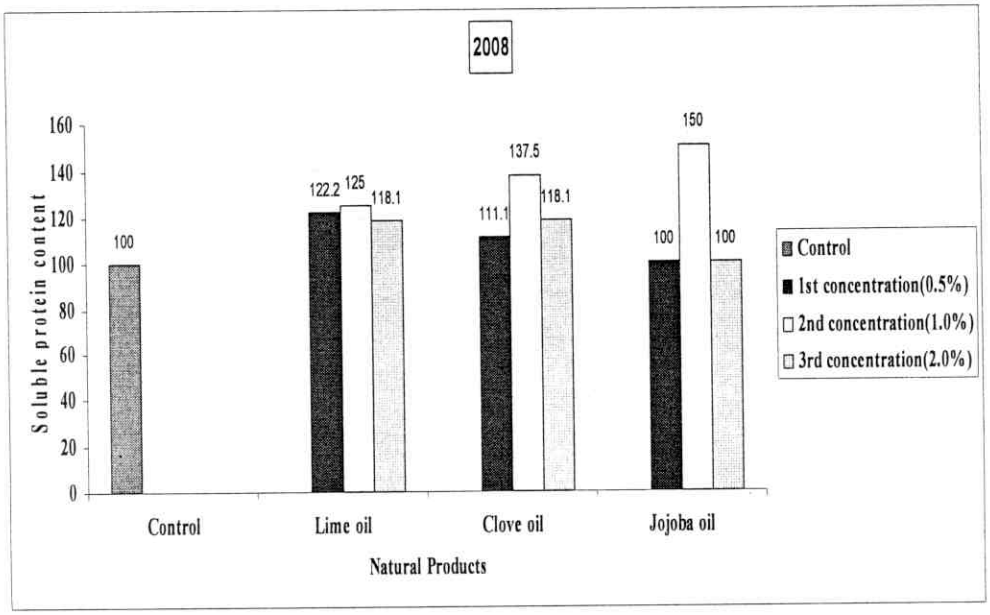

Fig. 32: Effect of some plant extracted oils on soluble protein content of *B. mori*

protein content in the haemolymph (100 mg/gh.). The 2nd concentration of lime and clove showed high soluble protein content in the haemolymph. While the 2nd concentration of jojoba showed the highest soluble protein content in the haemolymph recorded (150 mg/gh).