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EFFECT OF SOME POWDERS AND HIVE PRODUCTS ON LARVAL HAEMOLYMPH OF SILKWORM

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ABSTRACT

Two doses (5 and 10 gms) of 14 powders (hive products and plant materials) were added to mulberry leaves, and two levels (%) of 14 liquid treatments (hive products, honey, pollen, royal jelly and propolis and their mixtures) were sprayed on mulberry leaves which feed to 4th and 5th instar larvae of silkworm. Effects on haematological characters, Total Soluble Solids % (T.S.S.%), Total Haemocyte Counts/mm^3 haemolymph (T.H.C.), and Differential Haemocytes Counts % (D.H.C.%), were studied in 5th instar larval haemolymph. The best tested powders (gm), and liquids (%), with respect to (T.S.S.%) can be arranged desindinglly as follow: Palm Pollen, hand-collected (10 gm), Pollen from honey bee colonies (10 gm). Drone brood, dried (5 gm), Soya flour, defatted (10 gm), Pollen (0.3%), Pollen (5 gm), Royal Jelly (0.03%), and Honey (1%). This depends on % increment of these treatments over control. Concerning (T.H.C.), the best treatments were: Palm Pollen (10 or 5 gms), Pollen (10 gm), Royal Jelly (0.02%), Pollen (0.2%), Pollen + Propolis (0.2% + 0.1%), and Drone Brood (5 or 10 gms). Powder treatment was more effective as compared with liquid treatment, with respect to T.S.S.% and T.H.C. Prohaemocytes %, was higher in Pollen (0.2 & 0.3%) and its mixture with Royal Jelly (0.2% + 0.02%), Plasmatocytes %, Granular cells %, and Oenocytoides %, were in Pollen + Honey (0.2% + 2%); Pollen + Propolis (0.2% + 0.1%) and Honey + Royal Jelly (2% + 0.02%), treatments, respectively, while Spindle cells % were more in control, as compared with all tested liquid treatments. In powder treatments (gm), maximum % abundance of prohaemocytes was in Pollen (5 & 10 gms), Soya (5 & 10 gm), Palm Pollen (5 & 10 gms) and Drone Brood (10 gms). Maximum % abundance of other haemocytes types, was noticed with powders from Vasaka, Buddleia, and Spearmint leaves. Statistical analysis of obtained data revealed highly significant differences between treatments and used doses, and these data were discussed.

INTRODUCTION

Insect haemolymph contains haemocytes suspended in plasma. Haemocytes have essential roles in numerous physiological activities (Wigglesworth, 1959). This fluid reflects physiological or pathological condition of the insect (Kostecki, 1965).

Effects of different factors or treatments on the larval haemolymph of silkworms were studied by many researchers: Radwan, 1978; El-Deeb, 1981; Horrie and Watanbe, 1983; Salem *et al*., 1985a,b; Abd El-Naby, 1988; Reddy *et al*., 1991; Thyagaraja *et al*., 1991; Ashour, 1997; Eid *et al*., 1999; Abdellah, 2007; Rateb *et al*., 2010; Kumar and Michael, 2011 and Manjula *et al*., 2011.

This work aims to study the effects of 14 powders and hive products with mulberry leaves on total soluble solids (%), total counts of haemocytes/mm^3 in 5th (T.H.C.) and (D.H.C.%) instar larval haemolymph of local silkworm.

MATERIALS AND METHODS

Fourteen powder treatments were used with mulberry leaves in feeding of 4th and 5th instars of silkworm. They were: pollen (from pollen trap soya flour (defated), dried drone brood, palm pollen (hand-collected), ascorbic acid, lantana, eucalyptus, basil, spearmint, thyme, ziziphus, buddleia, Vasaka, and guava. Two levels, 5 and 10 gm, were used for each treatment.

Fourteen hive products liquid treatments were used with mulberry leaves for feeding of 4th and 5th instars of silkworm. They were: bee honey (1 and 2 gms); royal jelly (0.02 and 0.03 gm); propolis (0.1 and 0.2 gm); pollen (0.2 and 0.3 gm); pollen + royal jelly (0.2 + 0.02 gm); pollen + honey (0.2 + 2 gm); pollen + propolis (0.2 + 0.1 gm); honey + propolis (2 + 0.1 gm); honey + royal jelly (2+0.02 gm); and propolis + royal jelly (0.1+0.02 gm). Two concentrations were used for each treatment.

Every tested powder or liquid was replicated three times in three carton boxes, each contain 50 larvae. Feeding with treated leaves was conducted four times/day. Control larvae were fed with untreated mulberry leaves was used with 100 ml distilled water.

A simple method adopted by (Hussein, 1978) using hand refractometer was used for determination of total soluble solids (%) in 5 day-old of 5th instar larval haemolymph. Total counts of haemocytes in larval haemolymph was conducted as described by (Predtetshensky *et al*., 1950) and (D.H.C.%) as described by (Jones, 1967).

Means of tested haematological characters, and % over control readings, were calculated. Statistical analysis was carried out to compare the obtained means of studied parameters.

RESULTS AND DISCUSSION

Data of the effect of powder treatments on Total Soluble Solids % (T.S.S.%), Total Haemocytes Counts/mm^3 haemolymph (T.H.C./mm^3), and Differential Haemocytes Counts %, or types of haemocytes (D.H.C.%) and % over control of these data, in 5th instar larval haemolymph of silkworm are summarized in Table (1).

Maximum (T.S.S.%) in larval haemolymph, and (% over control), in five grams-powder treatments was 13.86%, or (31.25%); 13.74%, or (30.113%); and 12.9% or (22.159%), in palm pollen, soya flour, and pollen, respectively. While, in 10 grams-powder treatments, maximum mean (T.S.S.%) was 14.37% or (42.842%); 13.78%, or (36.978%); 13.3%, or (32.206%); and 13.29%, or (32.107%), in palm pollen, pollen, drones brood, and soya, respectively.

Higher figures of T.S.S.% in haemolympy, which reflects more active physiological condition was noticed in 10 grams-powder treatments, followed by 5 grams-treatments, with palm pollen, soya, pollen and drones brood. The effect of soya on increasing (T.S.S.%) in silkworm, was also noticed by Rateb *et al*. (2010), and by Manjula *et al*. (2011), with, other legume plant cowpea.

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(T.S.S.%) in larval haemolymph was less than control in the following treatments: basil (10 gm), spearmint (5 and 10 gms), Buddleio (5 and 10 gms), and vaska (5 gm). The same was noticed in (T.H.C.), with basil, spearmint and buddleia. During this work (T.S.S.%) was ranged from 9.02% to 14.37, while it ranged from 9.335% to 11.295% as reported by Ahmed (1999), and 7.640% to 10.073% as reported by Abdellah (2007) and 9.107 to 10.594% as reported by Rateb *et al*. (2010).

Maximum (T.H.C./mm^3 haemolymph) and (% over control) was 259 blood cells, or (119.39%), and 2736 cells, or (149.18%), in 5 gms, and 10-grams palm pollen treatments, respectively, followed by treatments of pollen, soya, and drone brood, in two tested levels. The same was observed in respect to T.S.S.%.

More positive effect on (T.S.S%) and (T.H.C.), as a result of using plant powders was noticed in case of eucalyptus they are, and guava treatments, as compared with other plant powders, such as lantana, ziziphus, basil, spearmint, buddleia and Vasaka.

(T.H.C./mm^3 haemolymph) was less than control figures in the following treatments basil (5 & 10 gms), spearmint (5 & 10 gms) and buddleia (10 gm). This reflects disturbance in physiological condition of silkworm. The same was noticed by Kumar and Michael (2011). They noticed that (T.H.C.) were decreased by 15% after infection of silkworm by flacherie.

Highly significant increment % in T.S.S. % was detected in pollen palm pollen, ascorbic acid and drone brood treatments, at 5 gm level, as compared with control.

T.H.C./mm^3 haemolymph increase in the aforementioned treatments, in addition to eucalyptus and guava treatments, as compared with control, at 5 and 10 gms levels. No significant differences in (T.H.C.) were observed between tested doses in all used powder treatments.

Concerning (D.H.C.%), maximum prohaemocytes %, or 83.1% and 84.5%, counts was detected in pollen (5 and 10 gms) treatment, respectively. It is well known that prohaemocytes formation leads to production of all other types of haemocytes. Prohaemocytes were increased also in soya (5 and 10 gms), palm pollen (5 and 10 gms), and drone brood (10 gms), treatments, while it was lower than control, which reflects less activation of physiological condition, in the following treatments: Lantana (5 gm), basil (5 and 10 gms), spearmint (5 and 10 gms), thyme (5 gm), buddleia (5 gm) and Vasaka (5 and 10 gms).

Maximum increment of plasmatocytes % was in basil (5 gm) and spearmint (10 gms) treatments. Maximum increase of spindle cells was noticed in Vasaka (5 gm), and buddleia (10 gms) treatments. Highest % abundance of granular cells was noticed in control of 5 gms dose treatments, and in vasaka (10 gms) treatment. Maximum percentage of oenocytoides, the largest blood cells types, was found in spearmint (10 gms) treatment.

It is of interest to note that increment of prohaemocytes in pollen (hive product), soya, palm pollen and drone brood (hive product) treatments leads to less abundance % of other four types of haemocytes.

Highly significant differences in prohaemocytes and granular cells were detected between all used treatments and concentrations.

Highly significant differences were detected between treatments with plasmatocytes, spindle cells and oenocytoides. Highly significant differences in prohaemocytes %, in palm pollen, soya and pollen treatments, at 5 gm and 10 gms level, and control. Significant differences between abundance of other types of haemocytes and control, were detected. Highly significant increase % of oenocytoids %, over control, were detected in treatments of buddleia, spearmint, basil and drone brood.

Data in Table 2 show the effect of hive products (honey, royal jelly, propolis, pollen and their mixture) on haematological characters (T.S.S.%, T.H.C. and D.H.C.%) of 5^{th} larval instar of silkworm.

Maximum (T.S.S.%) and (% over control) was 13.08%, or (30.019%), 12.27% or (21.998%); and 11.66%, or (15.904%), in pollen (0.3 gm), royal jelly (0.03 gm) and honey (1 gm), respectively, followed by pollen (0.2 gm), and its mixture with royal jelly (0.2 + 0.02 gm). Reading of T.S.S.%, were less than control in the following treatments: honey (2 gm), propolis (0.2 gm) and their mixture (2 + 0.1 gm).

Highly significant differences in (T.S.S.%) were noticed between control and all liquid treatments, except in honey (2 gm) and its mixture with royal jelly or propolis treatments.

Concerning total haemocytes counts/mm^3 haemolymph (T.H.C.), maximum numbers of haemocytes and (% over control) were: 2353 cell, or (99.237%); 2345 cell, or (98.56%); and 2333 cell, or (97.544%), in royal jelly (0.02 gm); pollen (0.2 gm) and pollen + propolis (0.2 + 0.1 gm) treatments, respectively.

(T.H.C.), were less than control in the following treatments: propolis (0.2 gm), honey (2 gm), and its mixture with pollen (0.2 gm), or propolis (0.1 gm), or royal jelly (0.02 gm).

Thus, depends on data of the effect of honey (2 gm, or 2%) concerning (T.S.S.%) and (T.H.C.), and its mixture with pollen (0.2%), propolis (0.1%), and royal jelly (0.02%), this dose of honey (2%), and its mixtures with other hive products, not recommended for using as additives to mulberry leaves for feeding of silkworm. This from the haematological point of view.

Highly significant increment in (T.H.C.), over control, in the following treatments: honey (1 and 1 gms), royal jelly (0.03 gm), pollen (0.2 gm), and propolis (0.1 gm). Significant decrease in (T.H.C.) was detected in royal jelly (0.02 gm), pollen + propolis, royal jelly plus pollen or propolis, as compared with control.

Maximum abundance % of prohaemocytes was noticed in pollen (0.2% and 0.3%), and its mixture with royal jelly (0.2% and 0.02%) treatments, and their % abundance in all tested treatments were more than control. Maximum % abundance of plasmatocytes, granula cells and oenocytoides, were in treatments of: pollen + honey (0.2% + 2%); pollen + propolis (0.2% + 0.1%); and honey + royal jelly (2% + 0.02%), respectively, while spindle cells % were more in control, as compared with tested treatments.

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Kumar and Michael (2011) reported that prohaemocytes and granular cells, which for the bulk of haemocytes, were not influenced by *Bacillus thuringensis*, while plasmatocytes were significantly increased.

Highly significant increase % in prohaemocytes was noticed in pollen (2%) treatment. Highly significant increment % in plasmatocytes in all treatments, except, pollen + honey, royal jelly + honey and propolis (0.1%), as compared with control. Highly significant increase %, as compared with control, was noticed in spindle cells, in all treatments, except: propolis (0.2%), and its mixture with pollen or honey. Granula cells were increased significantly in propolis (0.2%), honey (2%), and propolis + pollen treatments, as compared with control. Oenocytoids %, were significantly decreased, as compared with control, in propolis (0.2%), pollen (0.3%), pollen plus honey or propolis treatments.

From obtained data in Table 1 and 2, and with respect to (T.S.S.%) in silkworm larval haemolymph, and depending of % increase over control readings, the tested powders (gm) and liquids (%) can be arranged desindinglly as follow: palm pollen (10 gm), pollen (10 gm), drone brood (5 gm), soya (10 gm), palm pollen (5 gm), soya (5 gm), pollen (0.3%), pollen (5 gm), royal jelly (0.03%), and honey (1%).

Thus, it can be concluded that using of powders for fortification, or as additives, to mulberry leaves is better than using of liquids, with respect to (T.S.S.%), an indicator of insect physiological condition, in larvae of silkworm. The same conclusion was obtained by Rateb *et al*. (2010).

From Table 1 and 2, % over control, of T.H.C./mm^3, can be arranged desindinglly as follow: palm pollen (10 or 5 gms), pollen (10 gm), royal jelly (0.02%), pollen (0.2%); pollen + propolis (0.2% + 0.1%), and drone brood (5 or 10 gms).

It can be concluded, as with (T.S.S.%), that concerning (T.H.C.), using of powders is better than liquids as additives to mulberry leaves. The same was observed by Abdellah (2007) and Rashwan (2010).

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تأثير بعض المساحيق ومنتجات طائفة نحل العسل علي هيموليمف يرقات دودة القز

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تم استخدام جرعتين (5 جم و 10 جم) من 14 مسحوق (عبارة عن منتجات نحل ومواد نباتية) بإضافتها تعفير علي أوراق التوت وكذلك تركيزين (%) لأربعة عشرة معاملة سائلة (عبارة عن منتجات طائفة نحل العسل وهي: عسل ، حبوب لقاح ، غذاء ملكي ، وبروبوليس ومخاليطهم) رشاً علي أوراق التوت والمقدمة لتغذية العمر الرابع والخامس لدودة القز . تمت دراسة تأثير هذه المعاملات علي صفات الهيموليمف ليرقات العمر الخامس وهي: المواد الصلبة الذائبة الكلية % ، العدد الكلي لخلايا الدم / مم^3 هيموليمف وعلي العد التفريقي % أو أنواع خلايا الدم %. بالنسبة لمحتوي المواد الصلبة: كانت أفضل المعاملات للمساحيق والسوائل تنازلياً هي: حبوب لقاح النخيل المجموعة باليد (10 جم) ، حبوب لقاح من طوائف النحل (10 جم) ، حضنة ذكور النحل المجففة (5 جم) ، دقيق صويا منزوع الدهن (10 جم)، طلع النخيل (5 جم) ، صويا (5 جم) ، حبوب لقاح (0.3%)، حبوب لقاح (5 جم) ، غذاء ملكي (0.3%) وعسل نحل (1%) . كان هذا علي حساب الزيادة % في المواد الصلبة في المعاملات عن المقارنة. أما بالنسبة للعدد الكلي لخلايا الدم/مم^3 هيموليمف كانت أفضل المعاملات للمساحيق والسوائل هي: طلع النخيل (5 أو 10 جم) ، حبوب لقاح (10 جم) ، غذاء ملكي (0.2%) ، حبوب لقاح (0.02%)، حبوب لقاح + بروبوليس (0.2% + 0.1%) وحضنة ذكور (5 أو 10 جم). كانت معاملات المساحيق أكثر فعالية من معاملات السوائل بالنسبة لمحتوي المواد الصلبة الذائبة الكلية % وبالنسبة للعدد الكلي لخلايا الدم / مم^3 هيموليمف . كان محتوي الخلايا الأولية للدم (بروهيموسيتس) أعلي ما يمكن في المعاملات السائلة الآتية: حبوب اللقاح (0.2% و 0.3%) ومخلوط حبوب اللقاح مع الغذاء الملكي (0.2% + 0.02%) ، أما محتوي الخلايا البلازمية % والمحببة % والأونيسيتس %، كان أعلي ما يمكن في معاملات: حبوب لقاح + عسل (0.2 + 2%) ، حبوب لقاح + بروبوليس (0.2% + 0.1%) وعسل + غذاء ملكي (2% + 0.2%)، علي الترتيب، بينما كانت الخلايا المغزلية % ، أعلي ما يمكن في المقارنة بالنسبة لباقي المعاملات السائلة المستخدمة. بالنسبة لمعاملات المساحيق كان أعلي تواجد % للخلايا الأولية في معاملات: حبوب اللقاح (5 و 10جم) ، صويا (5 و 10 جم) ، طلع النخيل (5 و 10 جم) وحضنة الذكور (5جم) . كان أعلي تواجد لباقي أنواع خلايا الدم في معاملات مساحيق أوراق النباتات المجففة التالية: بستاشيا بيضاء ، بدليا والنعناع. أظهر التحليل الإحصائي للنتائج وجود فروق عالية المعنوية بين المعاملات والتركيزات المستخدمة ، كما تمت مناقشة النتائج المتحصل عليها.

قام بتحكيم البحث

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Table 1. Effect of tested powders on mean of haematological characters of 5th instar larvae of silkworm.

Characters (Dose) / Treatment	T.S.S. %				T.H.C./mm^3				Types of haemocytes (D.H.C.%)									
	(5 gms)		(10 gms)		(5 gms)		(10 gms)		(5 gms)					(10 gms)				
	Mean	% over control	Mean	% over control	Mean	% over control	Mean	% over control	Prophaem-ocytes	Plasmat-ocytes	Spindle cells	Granular cells	Oeno-cytoides	Prophaem-ocytes	Plasmat-ocytes	Spindle cells	Granular cells	Oeno-cytoides
1- Pollen	12.90 BC	22.159	13.78 AB	36.978	2295 BCD	94.326	2443 ABC	122.495	83.1 AB	3.9 J	5.8 I	4.3 LM	2.9 D-I	84.5 A	2.8 K	6.6 HI	3.7 M	2.4 G-J
2- Soya flour	13.74 AB	30.113	13.29 AB	32.107	2288 BCD	93.734	2020 DEF	83.970	81.4 BC	4.7 D-J	6.6 HI	5.2 KL	2.1 IJ	80.4 C	4.8 D-J	5.9 I	5.1 KL	3.8 A-D
3- Drones brood	12.52 BC	18.560	13.30 AB	32.206	2310 BCD	95.596	2125 CDE	93.533	77.1 D	5.5 A-G	6.9 HI	6.0 JK	4.5 A	79.7 CD	4.9 C-J	6.3 I	5.4 KL	3.7 A-D
4- Palm pollen	13.86 AB	31.250	14.37 A	42.842	2591 AB	119.390	2736 A	149.180	80.2 C	4.8 D-J	6.7 HI	5.9 JK	2.4 G-J	82.7 AB	3.9 J	6.5 HI	4.4 LM	2.5 E-J
5- Ascorbic acid	12.65 BC	19.791	11.96 CD	18.886	2193 CDE	85.690	1905 EF	73.497	77.7 D	4.6 E-J	7.6 H	6.6 IJ	3.5 B-E	74.0 EF	5.1 B-H	9.9 G	7.2 HI	3.8 A-D
6- Lantana	10.94 DEF	3.598	10.62 D-G	5.566	1695 FGH	43.522	1420 G-K	29.326	70.1 HIJ	5.0 B-I	12.5 ABC	9.2 CDE	3.3 B-G	73.5 EFG	5.3 A-H	10.5 FG	7.0 HIJ	3.7 A-D
7- Eucalyptus	11.16 DE	5.681	10.89 DEF	8.250	1740 FG	47.332	1401 G-K	27.595	70.7 HIJ	5.4 A-G	11.5 C-F	9.3 CDE	3.1 B-I	71.5 F-J	5.0 B-I	11.6 C-F	8.9 C-F	3.0 C-I
8- Basil	10.57 EFG	0.094	9.02 H	-	1068 KLM	-	850 M	-	69.6 IJ	6.0 AB	11.7 CDE	8.6 C-G	4.1 AB	70.0 HIJ	5.6 A-F	12.1 B-E	8.5 C-G	3.8 A-D
9- Spearmint	10.49 EFG	-	9.96 E-H	-	953 LM	-	918 LM	-	69.3 IJ	5.8 A-D	11.6 C-F	9.4 CD	3.9 A-D	69.6 IJ	6.4 A	11.8 CDE	8.2 E-H	4.0 ABC
10- Thyme	10.98 DEF	3.977	10.94 DEF	8.747	1368 H-K	15.834	1441 G-J	31.238	69.2 IJ	4.6 E-J	13.1 AB	9.7 BC	3.4 B-F	71.7 F-I	6.4 A	11.2 DEF	7.2 HI	3.5 B-E
11- Ziziphus	10.89 DEF	3.125	10.76 DEF	6.958	1391 G-K	17.781	1143 J-M	4.098	73.8 EF	4.3 G-J	10.4 FG	8.4 D-G	3.1 B-I	72.4 E-H	5.1 B-H	12.4 A-D	7.8 F-I	2.3 G-J
12- Buddleia	9.64 FGH	-	9.32 GH	-	1190 I-M	0.762	930 LM	-	69.9 HIJ	5.9 ABC	11.6 C-F	8.7 C-G	3.9 A-D	71.1 G-J	4.7 D-J	12.4 A-D	9.5 CD	2.3 G-J
13- Vasaka	10.08 E-H	-	10.18 E-H	1.192	1266 IJKL	7.197	1146 J-M	4.371	68.9 J	4.6 E-J	13.3 A	9.8 BC	3.4 B-F	70.4 HIJ	4.2 HIJ	12.0 B-E	10.9 A	2.5 E-J
14- Guava	10.80 DEF	2.272	11.08 DE	10.139	1535 GHI	29.974	1700 FGH	54.826	74.4 E	4.3 G-J	11.5 C-F	7.6 GHI	2.2 HIJ	73.5 EFG	5.4 A-G	10.9 EFG	8.5 C-G	1.7 HIJ
15- Control	10.56 EFG	0	10.06 E-H	0	1181 J-M	0	1098 J-M	0	70.2 HIJ	4.6 E-J	12.0 B-E	10.7 AB	2.5 E-J	71.0 HIJ	5.7 A-E	11.9 CDE	8.2 E-H	3.2 B-H
LSD 0.05	**1.171**				**303.4**				**2.181**	**0.9368**	**1.029**	**1.052**	**0.8642**	**2.181**	**0.9368**	**1.029**	**1.052**	**0.8642**

Means in a column followed by the same letter are not significantly different at 0.05 level of probability.

Table 2. Effect of hive products liquids on mean of haematological characters of 5th instar larvae of silkworm.

Hive products (con., gm/100 ml distilled water)	T.S.S. %		T.H.C./mm^3		Types of haemocytes (D.H.C.%)				
	Mean	% over control	Mean	% over control	Prophaem-ocytes	Plasmat-ocytes	Spindle cells	Granular cells	Oeno-cytoides
1- Honey (1 gm)	11.66 ABC	15.904	2133 AB	80.609	76.5 CD	4.6 CDE	8.2 D	6.8 EF	3.9 AB
2- Honey (2 gm)	10.05 CD	-	1810 CD	53.259	73.8 FGH	4.3 D-G	10.4 C	8.8 B	2.7 DEF
3- Royal jelly (0.02 gm)	10.50 CD	4.373	2353 A	99.237	80.9 B	4.5 C-F	5.8 E	5.1 G	3.7 ABC
4- Royal jelly (0.03 gm)	12.27 AB	21.998	2046 BC	73.243	76.4 CD	4.8 CDE	7.9 D	7.1 DE	3.8 AB
5- Propolis (0.1 gm)	10.08 CD	0.198	1670 D	41.405	76.6 CD	5.0 BCD	8.1 D	6.3 EF	4.0 AB
6- Propolis (0.2 gm)	9.62 D	-	1160 E	-	72.4 GHI	3.7 FGH	11.8 AB	9.8 AB	2.3 EFG
7- Pollen (0.2 gm)	11.48 BCD	14.15	2345 A	98.560	85.2 A	3.3 H	5.1 E	3.6 H	2.8 CDE
8- Pollen (0.3 gm)	13.08 A	30.019	1940 BC	64.267	82.6 B	4.2 D-G	6.0 E	5.4 G	1.8 FG
9- Pollen + Royal jelly (0.2 + 0.02 gm)	11.41 BCD	13.449	2093 AB	77.222	81.0 B	3.5 GH	7.7 D	5.1 G	2.7 DEF
10- Pollen + Honey (0.2 + 2 gm)	10.60 CD	5.427	1138 E	-	74.1 EFG	5.8 A	10.2 C	7.6 CD	2.3 EFG
11- Pollen + Propolis (0.2 + 0.1 gm)	11.03 BCD	9.671	2333 A	97.544	72.0 HI	4.2 D-G	12.3 A	10.0 A	1.5 G
12- Pollen + Propolis (2 + 0.1 gm)	9.80 D	-	973 E	-	74.7 DEF	4.8 CDE	11.1 BC	6.0 FG	3.4 A-D
13- Propolis + Royal Jelly (2 + 0.02 gm)	10.54 CD	4.771	1163 E	-	76.0 CDE	5.1 ABC	8.1 D	6.6 EF	4.2 A
14- Propolis + Royal Jelly (0.1 + 0.02 gm)	10.26 CD	2.047	2043 BC	72.988	77.0 C	5.7 AB	8.4 D	4.9 FG	4.0 AB
15- Control	10.06 CD	0	1181 E	0	71.0 I	5.7 AB	11.9 AB	8.2 C	3.2 BCD
LSD 0.05	0.972		244.1		1.888	0.7646	0.9252	0.8329	0.8707

Means in a column followed by the same letter are not significantly different at 0.05 level of probability.

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