MANAGEMENT OF AFRICAN BEES IN THE NEW WORLD

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African bees *Apis mellifera scutellata* (originally called *A. m. adansonii)* were introduced in Brazil in 1956. Due to their pre-adaptation to the tropical environment and probably to their mating advantage, these bees crossed with and displaced the European bees through most of the South and Central American tropical and subtropical regions as well as in Mexico. African swarms from mexico entered the United States of America through the state of Texas in 1990.

They are mainly characterized by defensive (non agressive) behavior, production of several reproductive swarms during a year, high absconding rates, and ability to survive and swarm in small cavities. They are also supposed to produce and store very little honey and not to adapt to the standard moveable Langstroth equipment (Towsend, G.P., unpublished) or not to build combs out of wax foundation layers designed for European bees.

The author has been working with African and Africanized colonies obtained from feral swarms since their arrival in Costa Rica (1983) and has found that they easily adapt to the standard framed hives, produce abundant honey and pollen and do not swarm or abscond if properly managed. The reproductive swarms are easy to collect and hive, they adapt and build normal combs when the frames are set with wax foundation for European bees.

To avoid swarming and absconding, and consequently to produce abundant honey and pollen, the hives must have two standard boxes as brood chambers and one, two or three standard boxes for honey storage during the honey flow (November to April); the hives must be fed every two weeks with a kilogram of sugar during the dearth period (from June to October); that is, during the rainy season and must be left with two brood chambers only. The african hives must be put in single stands, they respond to the use of little smoke, and the honey combs are easily taken by using bee repelents or bee scapes.

TABLE (5)

Mean acinal lenght (l.m.m.), width (w.m.m.) and surface (s.m.m2) of hypopharyngeal gland of 6, 9, 12, 15 and 18 days-old workers bees of both F1 Carniolan and F1 Italian during 1990/91

Age of worker	F1 Carniolan bees fed on										F1 Italian bees fed on									
	Sugar syrup			Sugar syrup + Pollen supplement			Unfed (control)			L.S.D	Sugar syrup			Sugar syrup + Pollen supplement			Unfed (control)			L.S.D
	L.	W.	S.	L.	W.	S.	L.	W.	S.		L.	W.	S.	L.	W.	S.	L.	W.	S.	
6	0.1847	0.1493	0.0434 n.s.	0.2004	0.1583	0.0498 n.s.	0.1905	0.1651	0.0495 n.s.	-	0.1919	0.1523	0.0461 n.s.	0.2430	0.1664	0.0534 n.s.	0.1978	0.1557	0.0487 n.s.	-
9	0.1978	0.1627	0.0512 n.s.	0.2190	0.1721	0.0584 n.s	0.2102	0.1620	0.0531 n.s.	-	0.2132	0.1589	0.0533 n.s.	0.2027	0.1722	0.0549 n.s.	0.2035	0.1543	0.0493 n.s.	-
12	0.2102	0.1804	0.0600 n.s.	0.2367	0.1785	0.0667 n.s.	0.2290	0.1686	0.0606 n.s.	-	0.2459	0.1612	0.0623 n.s.	0.2268	0.01867	0.0679 n.s.	0.2035	0.1600	0.0511 n.s.	-
15	0.1689	0.1277	0.0341 B	0.1773	0.1449	0.0407 A	0.1542	0.1264	0.0307 C	0.00207	0.1582	0.1410	0.0302 B	0.1825	0.1456	0.0428 A	0.1578	0.1343	0.0334 C	0.00207
12	0.1633	0.1231	0.0317 B	0.1642	0.1396	0.0362 A	0.1499	0.1238	0.0292 C	0.00218	0.1346	0.1346	0.0320 B	0.1865	0.1373	0.0405 A	0.1456	0.1251	0.0292 C	0.00218

TABLE (3)

Chemical composition of royal jelly produced from F1 Carniolan and F1 Italian bees colonies

	Composition %Year	Moisture	Carbohydrate	Protein	Lipids	Albumin
F1 Carniolan bees	1989/90	61.74	14.78	12.73	4.00	4.39
	1990/91	62.1	16.24	12.01	4.68	4.43
F1 Italian bees	1989/90	62.86	15.68	12.26	4.38	4.83
	1990/91	63.76	16.12	12.65	4.40	4.65

NOTE: insignificant differences were achieved

TABLE (4)

Chemical composition of royal jelly produced from fed and unfed F1 Carniolan and F1 Italian bees during 1989/90 and 1990/91.

Periods	F1 Carniolan bees fed on			F1 Italian bees fed on		
	SUGAR SYRUP	SUGAR SYRUP +POLLLEN SUPPL.	UNFED	SUGAR SYRUP	SUGAR SYRUP +POLLLE N SUPPL.	UNFED
	1989/90					
Moisture	63.15	60.93	61.74	63.67	62.08	62.86
Carbohydrate	15.37	14.86	14.78	15.53	16.27	15.68
Protein	12.14	13.52	12.73	12.17	13.7	12.26
Lipids	4.46	4.05	4.00	4.14	4.31	4.38
Albumin	3.96	4.27	4.39	3.88	4.36AB	4.83A
	1990/91					
Moisture	62.73	62.11	62.1	64.64	63.36	63.76
Carbohydrate	16.65	16.13	16.24	15.49	16.8	16.12
Protein	12.45	12.94	12.01	12.22	13.42	12.65
Lipids	4.21	3.94	4.68	3.91	4.31	4.40
Albumin	4.35	4.29	4.43	4.05	4.44	4.65

NOTE: Means marked with different letters were significantly differ at 0.05 level of probability.

TABLE (2)

Simple correlation values "r" between pollen supplement consumption and royal jelly production (gm.) during 1989/90 and 1990/91

	F1 Carniolan bees				F1 Italian bees			
	1989/90		1990/91		1989/90		1990/91	
MONTH	Consumption of pollen suppl. (gm/ colony)	Royal jelly (gm/colony)	Consumption of pollen suppl. (gm/	Royal jelly (gm/colony)	Consumption of pollen suppl. (gm/ colony)	Royal jelly (gm/colony)	Consumption of pollen suppl. (gm/ colony)	Royal jelly (gm/colony)
September	247.00	7.82	223.25	13.23	270.50	4.28	315.88	10.41
October	101.39	9.39	139.62	12.98	171.00	7.46	164.75	10.61
November	86.38	8.55	79.50	12.39	73.75	7.35	91.25	9.32
December	110.25	6.59	146.50	4.60	110.75	5.89	116.50	3.57
January	130.75	5.41	108.62	5.64	111.88	5.64	102.00	4.4
February	74.63	3.77	76.23	10.67	79.00	2.81	60.38	9.74
Mars	123.88	12.19	75.00	14.34	144.38	10.66	103.25	12.46
April	127.88	12.40	98.75	11.98	145.50	9.19	156.75	10.44
May	98.75	15.15	117.88	15.09	122.12	13.08	148.25	13.41
June	55.00	16.76	51.13	13.37	52.25	14.80	56.50	9.14
July	171.25	15.32	114.50	14.83	197.50	12.02	150.00	11.43
August	360.13	21.97	231.25	12.84	360.00	15.19	256.00	10.95
TOTAL	1687.29	135.32	1462.23	141.96	1838.63	108.37	1721.51	115.88
MEAN	140.61	11.28	121.85	11.83	153.22	9.03	143.46	9.66
"r" value	0.4716**		-0.0543		0.1637		0.2691*	

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F1 Italian workers 3 days revealed a decrease of 0.00126 mm² in acinal surface. These resuts agreed with those Szymas and Torgowsky, 1978; Atalla et al., 1983; Mcicka, 1987 and Darhoos, 1990.

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4.68% in royal jelly samples produced from unfed F1 Carniolan bee colonies in 1990/91, while it was 4.46% in samples produced from colonies fed on sugar syrup in the first year.
The albumin content showed the highest values in royal jelly samples produced from the unfed coloies of two hybrids in the two years.

Statistcally, no significant differences were existed between the composition of royal jelly produced under feeding treatments from F1 Carniolan and Italian during the two years of study except the albumin percentages of royal jelly of F1 Italian bees in 1989/90.
In general, feedin colonies increased protein content with low moisture while royal jelly of the unfed colonies had the highest percentages of lipids and albumin.

3- <u>Hypopharyngeal glands development:</u>

Table (5) showed that acinal surface(s) of hypopharyngeal glands of F1 Carniolan bee workers of 6, 9, 12 , 15 and 18 days old fed on sugar syrop + pollen supplement were the highest giving 0.0498, 0.0584, 0.0667, 0.0407 and 0.0362 mm^2, respectively comparing with those of other feeding treatments. On the other hand, worker bees from unfed colonies had larger acinal surfaces of 6, 9 and 12 days old than those of the sugar syrup fed workers. Significant differences of acinal surfaces were only achieved in worker bees 15 and 18 days old only. The same trend was noticed in F1 Italian bee workers where 6, 9, 12, 15 and 18 days old workers fed on sugar syrup + pollen supplement gave 0.0534, 0.0549, 0.0679, 0.0428 and 0.0405 mm^2, respectively. The lowest rares of acinal surfaces were noticed in worker bees of the unfed colonies. Honeybee workers of F1 Italian bees fed on sugar syrup and sugar syrup + pollen supplement showed the highest values of acinal surfaces comparing with that F1 Carniolan in the mentioned ages.

It was noticed that acinal surfaces increased gradually till 12 days old worker then decreased sharpelly till the end of measurment of 18 days old in two hybrids under feeding treatment.

Simple correlation "r" and regression "b$\chi\gamma$" between acinal surface and worker's age showed negative values (table 6).The "r" values were insignificant (-0.5667 and -0.6335) of F1 Carniolan and Italian, respectively.While, "b$\chi\gamma$" showed significant values of 0.001449 and -0.00126 of the two hybrids, respectively. Meanwhile, increasing the age of

where it consumed 360.0 gm/colony in August while in 1990/91 the respective value was 315.88 gm/colony in September. Colonies consumed higher amounts of food in August and September to rebuilt its strength before winter time and the colonies consumed lower amounts in June because foragers prefer to collect fresh pollen. Simple correlation "r" values between the mean quantities of pollen supplement consumed and royal jelly production (Table 2) showed significant positive correlation (0.4716) in the first year and negative insignificant (-0.0543) in the second year for F1 Carniolan bees. The "r" values of F1 Italian bees were positive and insignificant (0.1637) in the first year and significant (0.2691) in the second year.

2-A <u>Chemical composition of royal jelly</u>:

Percentages of moisture, carbohydrates, protein, lipids and albumin of royal jelly produced from F1 Carniolan colonies in 1989/90 were 61.74, 14.78, 12.73, 4.00, and 4.39 %, respectively. While those values of F1 Italian of the same year were 62.86, 15.68, 12.26, 4.38 and 4.83 %, respectively. These values were somewhat higher in the samples of royal jelly in the second year except protein for samples of F1 Carniolan and albumin for samples F1 Italian (table 3). The differences between percentages and also between years were not significant. Kröl and Börnus (1982) recorded significant differences. they attributed these differences to the differences in pollen sources visited by bees.

2-B <u>Effect of feeding honeybees on royal jelly composition:</u>

Table (4) showed that royal jelly samples produced from sugar syrop fed colonies of the two hybrids during two years of study had highest percentages of moisture. Also, these samples had the highest percentages of carbohydrates which gave 15.37 % in 1989/90 and 16.65 & in 1990/91 of F1 Carniolan. While F1 Italian showed the highest percentages (16.27 and 16.80) of carbohydrates in royal jelly samples produced from sugar syrup + pollen supplement fed colonies in two years, respectively.

Protein content of royal jelly produced from bee colonies in the two hybrids fed on sugar syrup + pollen supplement was higher than that of bee fed on sugar syrup and unfed ones. They were 13.52 and12.94 % for F1 Carniolan and 13.70 and 13.42 % for F1 Italian in the two years, respectively.

The highest percentages of lipids in royal jelly samples were 4.38% and 4.40% for the unfed F1 Italian bees in the two years, respectively and

RESULTS AND DISCUSSIONS

1-A <u>Royal jelly production from fed colonies</u>:

Data in table F1 showed means that quantities of royal jelly produced from Carniolan colonies fed on sugar syrup, sugar syrup + pollen supplement and unfed (control) were 8.50, 11.85 and 7.21 gm/colony/ month, while F1 Italian colonies gave 7.20, 9.66 and 6.00 gm/colony/month in 1990/91, respectively. These amounts were lower in 1989/90 than those of second year. Significant differences were existed between the production of royal jelly in two years. Generally, F1 Carniolan bees produced more royal jelly than F1 Italian and the artificial feeding especially pollen supplement encouraged bees to secrete more royal jelly than the unfed ones.

<u>TABLE (1)</u>

Mean quantities of royal jelly (gm/colonylmonth)produced from F1 Carniolan and F1 Italian bee colonies during 1989/90 and 1990/91.

Year	F1 Carniolan bees fed			F1 Italian bees fed on		
	SUGAR SYRUP	SUGAR SYRUP +POLLLEN SUPPL.	UNFED	SUGAR SYRUP	SUGAR SYRUP +POLLLE N SUPPL.	UNFED
1989/90	7.45 B	11.28 B	5.11 B	6.22 B	9.03 B	4.45 B
1990/91	8.50 A	11.85 A	7.21 A	7.20 A	9.66 A	6.00 A
TOTAL	15.95	23.13	12.32	13.42	18.74	10.46
MEAN	7.98	11.57	6.16	6.71	9.37	5.23
L.S.D.=	0.1334					

NOTE: Means marked with different letters were significantly differ at 0.05 level probability.

1-B <u>Pollen supplement consumption</u>:

Table (2) showed that F1 Carniolan bees consumed more amounts of pollen supplement 360.13 and 231.25 gm/colony during August of two years of study, respectively, while the lesser amounts were recorded in June of the two years. The same trend was noticed in F1 Italian in 1989/90

- 3- Crude protein determination :

Samples of royal jelly (0.1ml) in sodium chloride (2.5 ml, 150 m mol/L) were treated by Biuret reagent 2.5 ml (cupric sulfate 6 m mol/L, sodium potassium tartarate 21 m mol/L, and sodium hydroxide 750 m mol/L, potassium iodide 6 m mol/L and the reaction mixture was allowed to stand room temperature for 30 minutes. Then, measured at 550 nm against blank in the usual manner (Gornall et al., 1949).

- 4- Albunin determination:

Samples of royal jelly (0.1 ml) were treated by colour reagent 5 ml (bromo cresol green, 0.14 gm/L, succinate buffer pH 4.2 75 m mol/L, Brij 35 7 m mol/L) and the reaction mixture was allowed to stand at room temperature for 5 minutes. Then measured at 628 nm against blank in the usual manner (Doumas, 1971).

- 5-Lipids determination:

Samples of royal jelly (0.1 ml) in concentrated sulphuric acid 2 ml mix ell and let stand in boiling water bath for 10 minutes. Then cooled in a cold water bath and 0.1 ml from above solution was taken and treated by colour reagent 2.5 ml (phosphoric acid 14 m mol/L, vaniline 13 m mol/L). Mix throughly and let stand at 20° - 25° C for 30 minutes, Then measured at 530 nm against blank in usual manner (Thanhouser, 1958).

B- Hypopharyngeal gland development:

A number of newly hatched workers from the selected colonies were marked with coloured spray and released in the colonies. Twenty marked workers were collected at 6, 9, 12, 15, and 18 days and the hypopharyngeal glands were discarded out and measured (Darhoos, 1990). The maximum length and width of ten acini were measured using a micrometer eye piece. Acinal surface was calculated according to Maurizio (1954) formula;

$$\text{acinal surface} = T \frac{a \times b}{2}$$

where a= maximum length, b= maximum width and T= 3.14. Simple regression coefficient ($b\gamma\chi$) (Snedecor, 1959) and correlation "r" values (Fisher, 1950) were calculated with various ages.

MATERIALS AND METHODS

Four colonies of each F1 Carniolian and F1 Italian bees of equal strength were chosen in the apiary of Agric. College, Minia University for royal jelly production during the period from Autumn 1989 till the end of Autumn of 1991. Selected honeybee lavrae of 24 hrs. old (Chang, 1977) were used for queen rearing using grafting method (Doolittle, 1889) after removing the queens. Royal jelly was collected after 72 hrs. of grafting and kept in deep freeze condition for chemical analysis.

The effect of feeding on royal jelly production was studied using three groups of four colonies each F1 Carniolan was fed on sugar solution (1:1 w/v) 250ml/colony weekly. The second was fed on sugar solution 100 mg pollen supplement cakes (1 yeast: 2 defatted soybean flour mixed with sugar solution 1:1 w/v weekly) according to Abdel - Aziz (1992).

The third one was left as control. Food consumption was determined and simple correlation "r" value was calculated (Fisher, 1950) between food consumption and royal jelly production. Queen rearing was carried out in three groups of colonies by the same procedure and quantities of royal jelly was collected for chemical analysis.

A- Chemical analysis of royal jelly:

- 1- Moisture content:

Royal jelly samples were introduced into a previously weighed porcelain crucible and dried under high vacuum over phosphorus penta oxide for 7 days until constant weight.

- 2- Carbohydrate determination:

Anthrone reagent 2 ml; (0.2 % solution in concentrated sulphuric acid) was over layered by royal jelly sample in test tube and kept in cold water bath. Then, boiled for 16 minutes, removed and cooled again. The optical density of the resulting colour was measured at 625nm. Within one hour against the blank. The blank was prepared by adding water (1 ml) in anthrone reagent (2 ml) and similarly treated (Dreywood, 1946).