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The effect of social interactions on the production of mandubular gland signals in female african honeybees (apis mellifera adansoni)

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Appendix Table 1. Raw data. Amounts of eight chemicals in hexane extracts of groups of queenright *A.m. adersonii* workers (Nov. 1978)

Worker description		Total chemical (µg/head average of 3 heads)								
Age	Sample no.	DAA	pHBA	8HDAA	9HDA	4JHPE	9HDA	10HDAA	10HDA	Total Secretion
6-18 hrs	G01	1.8		7.9		7.4	4.4	8.4	12.1	42.0
	G02	1.2		1.9		1.4	4.3	5.4	6.1	20.3
	G03	1.3		3.9		1.9	4.5	7.9	10.8	30.3
	Y01	2.5		3.1		2.1	5.3	6.3	24.9	44.2
	Y02	1.1		2.6		3.0	5.0	6.0	11.1	28.8
	Y03	0.8		3.8		3.0	4.8	7.1	18.5	38.0
2 days	Y11	0.7		2.5		2.9	6.4	11.1	24.7	48.4
	Y12	0.5		1.4		2.1	5.4	8.1	36.0	53.5
	Y13	1.4	1.5	6.1		2.1	9.1	9.5	44.7	74.4
3 days	G11	1.4		5.2		3.0	7.1	16.7	47.2	80.6
	G12	0.8		2.3		2.5	5.6	15.1	46.7	73.0
	G13	1.6		4.2		6.1	8.2	13.8	84.3	118.2
5 days	G21	2.6		7.6		4.3	12.6	32.8	43.3	103.2
	G22	1.5		7.3		1.6	7.7	23.5	17.9	59.5
7 days	Y21	2.7		3.7		6.1	6.8	19.1	22.1	60.5
	Y22	0.8		1.7		2.5	4.9	24.1	24.7	58.7
	Y23	0.8		1.3		1.8	2.7	7.7	30.9	45.2
9 days	Y31	2.9		8.0		5.7	9.8	15.9	15.8	58.1
	Y32	0.8		5.3		2.1	5.3	17.9	18.4	49.8
	Y33	7.9		6.6		5.9	8.3	16.0	12.3	57.0
10 days	G31	1.7	8.4	5.2		3.0	6.7	22.0	19.5	58.5
	G32	1.0		1.7		3.4	5.5	16.3	14.1	42.0
	G33	3.5		7.5		8.1	11.7	22.3	28.1	81.2
12 days	G41	6.8		9.5		1.9	9.3	31.9	33.9	93.3
	G42	9.9		9.3		4.5	13.3	21.4	31.2	89.6
	G43	9.9	8.9	7.6		3.8	11.3	21.8	11.2	66.5
	Y41	2.7		3.3		0.7	3.1	24.0	52.9	86.7
	Y42	7.6		5.5		3.7	6.7	18.9	22.9	65.3
	Y43	5.9		5.1		2.5	5.4	26.7	50.4	96.0
15 days	G51	14.3		5.5		2.5	5.6	24.4	47.4	99.7
	G52	12.8		5.0		1.5	4.9	26.5	50.2	100.1
	Y51	11.5		2.7		2.3	4.5	15.5	43.2	79.7
	Y52	14.3		5.9		6.1	6.8	19.4	50.4	102.9

Appendix Table 1. Continued

Marker description		Total Chemical (µg/head average of 3 heads)								
Age	Sample no.	DAA	pNDA	6NDAA	5NDA	4,5NPE	5NDA	10NDAA	10NDA	Total Secretion
18 days	G61	9.9		5.7		3.1	9.3	10.5	9.9	48.4
	G62	12.3	0.5	8.7		5.8	13.8	16.6	15.1	72.8
	Y61	24.1		8.5		3.1	10.7	21.1	26.7	94.2
	Y63	31.2	1.1	12.9		6.8	17.1	29.9	38.0	137.0
21 days	G71	19.1		4.6		7.0	10.3	7.8	28.8	77.6
	G72	13.8		3.2		5.0	6.7	4.2	16.4	49.3
	Y71	16.4		5.8		6.0	3.9	19.0	40.2	91.3
	Y72	8.1		2.8		2.3	2.9	12.2	21.4	49.7
24 days	G81	18.4		5.8		2.9	8.7	27.0	59.2	122.0
	G82	12.3		0.6		0.8	1.5	16.1	20.5	51.8
	Y81	22.9		7.8		4.9	10.1	14.3	19.7	79.7
	Y82	18.1	1.9	10.0		5.1	11.6	25.7	16.3	88.7
	Y83	15.8		5.5		2.7	5.9	17.7	11.0	58.6
27 days	G91	15.5		11.3		8.9	14.2	22.5	16.6	89.0
	G92	13.4		3.4		3.3	4.1	14.3	17.4	55.9
	G93	11.6	2.8	6.0		6.7	3.7	21.0	25.7	77.5

Appendix Table 2. Raw data. Percentages of eight chemicals in need extracts of groups of queenright *A.m. adansonii* workers (November 1978)

Worker description		Percentage chemical (average of 3 heads)							
Age	Sample no.	DAA	pHBA	8HDAA	9HDA	43HPE	9HDA	10HDAA	10HDA
2-18 hrs	G01	4.3		18.6		17.3	10.2	20.6	29.0
	G02	6.1		9.4		6.8	21.1	26.7	29.9
	G03	4.4		12.8		6.4	14.8	25.9	35.7
	Y01	5.7		7.0		4.8	11.9	14.2	56.4
	Y02	4.0		9.0		10.5	17.4	20.7	38.4
	Y03	2.0		10.1		7.9	12.7	18.6	48.7
2 days	Y11	1.5		5.4		5.9	13.2	22.9	51.1
	Y12	1.0		2.6		3.9	10.1	15.1	67.3
	Y13	1.9	2.0	8.2		2.8	12.2	12.9	60.0
3 days	G11	1.8		6.4		3.8	8.8	20.7	58.5
	G12	1.1		3.2		3.4	7.7	20.7	63.9
	G13	1.4		3.6		5.1	7.0	11.7	71.3
5 days	G21	2.5		7.4		4.1	12.2	31.8	42.0
	G22	2.6		12.1		2.7	13.0	39.3	30.1
7 days	Y21	4.4		6.1		10.2	11.2	31.6	36.5
	Y22	1.4		2.9		4.3	8.4	41.0	42.0
	Y23	1.7		2.8		4.0	6.1	17.0	68.4
9 days	Y31	5.0		13.6		9.8	17.0	27.4	27.2
	Y32	1.6		10.6		4.3	10.6	35.9	37.0
	Y33	13.8		11.5		10.4	14.6	28.1	21.6
10 days	G31	3.0	8.1	8.9		5.2	11.6	37.8	33.5
	G32	2.4		4.1		8.1	13.1	38.9	33.4
	G33	4.3		9.2		10.0	14.4	27.5	34.6
12 days	G41	7.3		10.2		2.1	10.0	34.1	36.3
	G42	11.1		10.3		5.1	14.8	23.9	34.8
	G43	15.0	1.4	11.3		5.7	17.0	33.1	16.7
	Y41	3.2		3.8		0.8	3.6	27.7	61.0
	Y42	11.6		8.4		5.7	10.5	28.8	34.9
	Y43	6.1		5.3		2.6	5.6	27.8	52.5
15 days	G51	14.4		5.5		2.5	5.6	24.5	47.6
	G52	12.0		5.8		1.5	4.9	26.5	50.1
	Y51	14.4		3.3		2.8	5.7	19.6	54.2
	Y52	13.6		5.3		6.0	6.9	18.8	49.4

Appendix Table 2. Continued

Marker description		Percentage chemical (average of 3 heads)							
Age	Sample no.	DAA	pHBA	8HDAA	9HDA	4,5EPE	9NDA	10HDAA	10HDA
18 days	B61	25.6	8.8	8.9		3.3	11.4	22.4	28.4
	B62	22.8		9.4		5.0	12.4	21.9	27.7
	Y61	20.4		11.8		6.4	19.3	21.6	20.5
	Y63	16.9	8.7	12.0		8.0	19.0	22.7	20.7
21 days	G71	24.6		6.0		9.1	13.2	10.0	37.1
	G72	27.9		6.5		10.1	13.6	8.6	33.3
	Y71	18.0		6.4		6.6	4.2	15.8	44.0
	Y72	16.2		5.7		4.7	5.9	24.6	43.1
24 days	G81	15.2		4.6		2.3	6.8	22.2	48.9
	G82	23.7		1.2		1.5	3.0	31.1	39.5
	Y81	28.7		9.8		6.2	12.7	17.9	24.7
	Y82	20.4	2.1	11.4		5.8	13.0	29.0	18.3
	Y83	26.9		5.4		4.5	10.1	30.3	18.8
27 days	B91	17.4		12.8		10.0	15.9	25.2	13.7
	B92	23.9		6.2		6.0	7.3	25.6	31.0
	B93	15.0	3.6	7.8		8.6	4.8	27.1	33.1

Appendix Table 3. Raw data. Amounts of eight chemicals in head extracts of queenless A.m. adansonii workers (Feb. 1979)

Age (days)	Worker description: Heads/sample	Queenless period (days)	Ovarial development	Total chemical (µg/head): DAA	pHBA	9HDAA	9HDA	4,3HPE	9HDA	10HDAA	10HDA	Total secretion
5	5	0	0/0	1.5	1.8	4.0		1.7	6.3	0.6	18.3	34.1
5	5	0	0/0	2.0	2.6	6.7		5.9	9.1	5.4	7.5	39.3
10	5	0	0/0	1.8	2.3	9.4		4.8	12.1	7.1	26.1	63.7
10	5	0	0/0	2.4		6.8		5.6	14.4	9.2	46.5	84.9
10	5	0	0/0	3.6	2.6	9.0		5.7	14.5	8.6	82.0	126.1
20	5	0	0/0	4.7		8.2		5.0	12.7	7.4	24.3	62.2
20	5	0	0/0	3.6	2.1	7.7		4.0	12.4	6.8	8.1	44.7
30	5	0	0/0	5.9		4.6		3.8	13.7	7.5	8.4	43.8
30	5	0	0/0	6.1		8.6		5.2	13.2	7.9	6.3	47.4
30	5	0	0/0	5.0		12.5		4.1	12.7	6.8	5.8	46.9
5	6	3	0/0		0.8	1.5		0.6	4.4	1.3	2.4	10.9
10	5	3	1/0	0.9	0.4	1.9		1.4	5.4	7.5	11.6	29.1
20	5	3	0/0	0.9		2.1		0.6	5.6	2.2	4.0	14.7
30	5	3	0/0	13.3		0.6		1.3	4.5	3.5	3.4	26.6
5	5	5	1/1	0.4	0.9	2.0		1.6	1.8	0.6	1.5	8.7
5	5	5	0/0	1.8	2.2	6.9		6.1	8.2	8.2	6.9	40.5
10	5	5	1/0	0.2	0.6	0.2		0.7	6.3	2.5	7.1	17.6
20	5	5	0/0	1.1	0.2	2.4		0.7	6.4	9.5	5.3	25.7
20	5	5	0/0	5.0		7.7		5.1	16.2	14.3	11.0	59.4
30	5	5	0/0	21.8		4.2		1.6	6.7	8.6	11.7	54.8
30	5	5	0/0	17.5		14.5		6.3	15.3	14.5	11.5	80.0
5	5	7	0/0	2.2	2.2	1.7		2.4	5.2	5.2	6.3	25.3
5	5	7	0/0	1.6	2.5	5.5		6.7	11.6	4.2	17.4	49.4
8	1	7	2/3*	2.2	1.5	2.6		4.2	12.8	9.1	6.9	39.2
8	1	7	4/3		0.3	1.3		1.0	7.2	3.3	3.1	16.1
10	5	7	0/0	2.6	2.6	4.2		6.1	16.0	4.4	7.3	43.2
10	2	7	2/2	1.8		8.5		6.8	8.0	13.3	6.3	44.9
10	1	7	3/2*	1.8		6.5	43.2	6.8	12.8	5.7	5.4	82.1
12	1	7	3/2*	1.6		7.4		5.3	7.8	14.2	21.9	58.1

* Bees were showing laying behaviour

Appendix Table 3. Raw data. Amounts of eight chemicals in head extracts of queenless *A.m. adansonii* workers (Feb. 1979)

Worker description				Total chemical (µg/head)								
Age (days)	Heads/ sample	Queenless period (days)	Ovarial development	DAA	pHBA	8HDAA	9HDA	43HPE	9HDA	10HDAA	10HDA	Total secretion
5	5	0	0/0	1.5	1.8	4.0		1.7	6.3	0.6	18.3	34.1
5	5	0	0/0	2.0	2.6	6.7		5.9	9.1	5.4	7.5	39.3
10	5	0	0/0	1.8	2.3	9.4		4.8	12.1	7.1	26.1	63.7
10	5	0	0/0	2.4		6.8		5.6	14.4	9.2	46.5	84.9
10	5	0	0/0	3.6	2.6	9.0		5.7	14.5	8.6	82.0	126.1
20	5	0	0/0	4.7		8.2		5.0	12.7	7.4	24.3	62.2
20	5	0	0/0	3.6	2.1	7.7		4.0	12.4	6.8	8.1	44.7
30	5	0	0/0	5.9		4.6		3.8	13.7	7.5	8.4	43.8
30	5	0	0/0	6.1		8.6		5.2	13.2	7.9	6.3	47.4
30	5	0	0/0	5.0		12.5		4.1	12.7	6.8	5.8	46.9
5	6	3	0/0		0.8	1.5		0.6	4.4	1.3	2.4	10.9
10	5	3	1/0	0.9	0.4	1.9		1.4	5.4	7.5	11.6	29.1
20	5	3	0/0	0.9		2.1		0.6	5.6	2.2	4.0	14.7
30	5	3	0/0	13.3		0.6		1.3	4.5	3.5	3.4	26.6
5	5	5	1/1	0.4	0.9	2.0		1.6	1.8	0.6	1.5	8.7
5	5	5	0/0	1.8	2.2	6.9		6.1	8.2	8.2	6.9	40.5
10	5	5	1/0	0.2	0.6	0.2		0.7	6.3	2.5	7.1	17.6
20	5	5	0/0	1.1	0.2	2.4		0.7	6.4	9.5	5.3	25.7
20	5	5	0/0	5.0		7.7		5.1	16.2	14.3	11.0	59.4
30	5	5	0/0	21.8		4.2		1.6	6.7	8.6	11.7	54.8
30	5	5	0/0	17.5		14.5		6.3	15.3	14.5	11.5	60.0
5	5	7	0/0	2.2	2.2	1.7		2.4	5.2	5.2	6.3	25.3
5	5	7	0/0	1.6	2.5	5.5		6.7	11.6	4.2	17.4	49.4
8	1	7	2/3*	2.2	1.5	2.6		4.2	12.8	9.1	6.9	39.2
8	1	7	4/3		0.3	1.3		1.0	7.2	3.3	3.1	16.1
10	5	7	0/0	2.6	2.6	4.2		6.1	16.0	4.4	7.3	43.2
10	2	7	2/2	1.8		8.8		6.8	8.0	13.3	6.3	44.9
10	1	7	3/2*	1.8		6.5	43.2	6.8	12.8	5.7	5.4	82.1
12	1	7	3/2*	1.6		7.4		5.3	7.8	14.2	21.9	58.1

* Does seem showing laying behaviour

Appendix Table 3. Continued

Worker description				Total chemical (µg/head)								
Age (days)	Heads/ sample	Queenless period (days)	Ovarial development	DAA	pHBA	8HOAA	9KDA	43HPE	9HDA	10HDAA	10HDA	Total secretion
20	5	7	0/0	3.0	0.2	3.6		3.7	13.3	18.1	17.8	59.6
20	3	7	0/0	6.6	0.4	5.7		3.2	7.3	6.2	5.3	34.7
20	2	7	1/1	1.5		0.8		0.6	2.3	4.6	4.0	13.8
20	1	7	2/2	4.3		12.1		9.5	10.7	22.1	14.6	73.2
28	1	7	2/2	1.9		7.0		6.7	6.6	8.7	5.9	36.8
30	5	7	0/0	15.2		4.8		3.2	9.2	10.4	14.3	56.8
30	4	7	2/2	3.8		6.1		3.1	7.2	7.6	6.2	33.8
9	1	8	4/3*			4.0		5.1	7.3	14.3	7.4	38.0
10	1	8	3/2			1.2	25.5	2.8	5.7	1.8	4.4	41.2
16	1	12	3/3*	2.2		1.4		6.3	7.4	11.0	9.2	37.5
16	1	12	3/3			1.5		3.5	5.3	8.4	6.9	25.5
28	1	12	2/2*	3.6		8.6		5.7	7.9	17.2	5.9	48.9
10	2	13	1/1	1.7		3.4		4.4	6.1	8.2	4.6	28.4
13	1	13	3/2*	1.8		5.5		6.4	8.4	8.9	6.9	37.9
28	1	13	3/2	4.0		6.5		6.4	8.4	12.1	6.6	43.9
32	1	13	4/4*	1.6		1.7		2.8	4.0	11.4	4.0	25.5
32	1	13	4/4	4.5	1.4	10.4		8.3	9.6	18.7	8.5	61.4
5	5	14	0/0	1.4		4.0		4.3	6.1	2.6	17.0	35.3
5	5	14	0/0	1.8	0.9	5.3		6.1	8.4	3.8	20.7	47.1
10	7	14	0/0	1.4	0.9	3.6		4.5	8.4	3.7	6.1	28.7
10	1	14	1/1			1.2		2.0	4.3	4.2	3.6	15.2
10	2	14	3/2	2.6		5.2		5.6	8.8	9.1	6.7	38.0
20	3	14	0/0	10.7		4.3		4.3	5.7	3.5	4.5	33.6
20	2	14	2/2	3.1	0.4	5.8		6.5	9.2	5.1	6.6	36.3
30	1	14	1/1	6.9		11.0		11.2	16.2	23.9	11.8	83.0
40	2	14	0/0	13.6	2.1	2.0		7.6	10.8	15.2	10.9	60.8
40	5	14	0/0	20.8	0.8	6.1		4.1	10.3	6.3	10.2	59.7
40	2	14	1/1	18.1	1.8	8.6		7.7	11.0	19.5	20.2	85.2
40	1	14	2/2	12.5		10.7		8.7	10.4	20.5	11.7	74.6

* Bees seen showing laying behaviour

Appendix Table 3. Continued

Worker description				Total chemical (µg/head)								
Age (days)	Heads/ sample	Queenless period (days)	Ovarial development	DAA	pHBA	8HDAA	9KDA	43HPE	9HDA	10HDAA	10HDA	Total secretion
54	1	18	0/0	14.0		4.5		7.7	11.5	26.7	9.9	74.4
14	5	19	0/0	2.6	1.1	5.0		6.4	9.2	4.1	7.7	36.0
15	2	19	0/0	1.5	0.9	2.4		5.0	6.5	8.9	13.9	39.2
15	1	19	1/1	3.2		4.8		8.8	11.5	10.9	46.0	85.3
25	2	19	0/0	8.1		3.3		3.5	5.5	8.2	7.4	36.1
35	3	19	1/1	11.1	1.5	4.6		4.3	9.3	7.6	44.2	82.5
29	10	38	–	4.3	0.4	4.8	2.8	3.8	7.7	9.7	7.8	41.5
29	10	38	–	3.7	1.0	4.5	3.0	3.6	22.5	15.3	10.0	63.6
29	10	38	–	3.4	0.2	2.3	1.8	1.8	5.1	2.5	4.1	21.0
29	10	38	–	6.1		4.2	3.2	3.7	9.0	8.3	8.3	42.8
36	10	38	–	2.7	0.2	1.9	1.7	1.9	4.5	3.7	3.0	19.6
36	11	38	–	8.0	1.3	4.1	3.1	3.4	8.3	13.9	12.9	54.9
36	11	38	–	4.4	1.2	4.8	3.8	4.3	10.0	8.5	9.1	46.1
36	11	38	–	6.1	1.1	3.6	2.7	4.0	8.1	7.3	6.9	39.9
43	1	38	4/4	3.1		8.4		5.3	8.7	12.0	14.0	51.1
43	4	38	1/2/3	15.2	1.2	5.1		3.2	7.4	11.1	9.0	52.4
43	4	38	1/2/3	15.9	1.4	6.7		3.3	9.5	12.4	9.7	58.8
43	4	38	1/2/3	19.1	1.6	7.4		3.4	10.6	13.9	8.0	64.0
43	8	38	0/1/2	21.7	1.9	6.5		4.0	12.8	12.0	13.3	72.1
43	9	38	–	5.5	1.2	5.0		4.2	10.9	10.1	19.8	57.4
50	4	38	1/2/3	7.2	0.4	6.0		3.8	10.8	12.2	6.4	46.8
50	8	38	0/1/2	25.7	2.0	11.7	4.7	13.3	27.1	23.9	32.5	140.9
50	9	38	–	13.0		5.7	4.6	10.9	15.1	23.8	18.6	91.6
50	4	38	–	9.5	0.5	8.3		4.7	15.6	17.3	14.8	71.0
57	5	38	1/2/3	8.5		8.4		2.7	10.4	15.4	4.5	49.9
57	7	38	0/1/2	16.0	1.7	8.0		4.5	13.3	10.9	11.5	65.8
57	1	38	4/4	4.5		3.9		2.5	2.9	14.8	18.6	47.2
57	1	38	4/4	10.9	1.7	10.2		5.6	10.3	27.5	35.5	101.6

Appendix Table 3. Continued

Worker description				Total chemical (µg/hard)								
Age (days)	Heads/ sample	Queenless period (days)	Ovarial development	DAA	pHBA	8HBAA	9HDA	43HPE	5HDA	10HDAA	10HDA	Total secretion
54	1	18	0/0	14.0		4.5		7.7	11.5	26.7	9.9	74.4
14	5	19	0/0	2.6	1.1	5.0		6.4	9.2	4.1	7.7	36.0
15	2	19	0/0	1.5	0.9	2.4		5.0	6.5	8.9	13.9	39.2
15	1	19	1/1	3.2		4.8		8.8	11.5	10.9	46.0	85.3
25	2	19	0/0	8.1		3.3		3.5	5.5	8.2	7.4	36.1
35	3	19	1/1	11.1	1.5	4.6		4.3	9.3	7.6	44.2	82.5
29	10	38	-	4.3	0.4	4.3	2.8	3.8	7.7	9.7	7.8	41.5
29	10	38	-	3.7	1.0	4.5	3.0	3.6	22.5	15.3	10.0	63.6
29	10	38	-	3.4	0.2	2.3	1.8	1.8	5.1	2.5	4.1	21.0
29	10	38	-	6.1		4.2	3.2	3.7	9.0	8.3	8.3	42.8
36	10	38	-	2.7	0.2	1.9	1.7	1.9	4.5	3.7	3.0	19.6
36	11	38	-	8.0	1.3	4.1	3.1	3.4	8.3	13.9	12.9	54.9
36	11	38	-	4.4	1.2	4.8	3.8	4.3	10.0	8.5	9.1	46.1
36	11	38	-	6.1	1.1	3.6	2.7	4.0	8.1	7.3	6.9	39.9
43	1	38	4/4	3.1		8.4		5.3	8.7	12.0	14.0	51.1
43	4	38	1/2/3	15.2	1.2	5.1		3.2	7.4	11.1	9.0	52.4
43	4	38	1/2/3	15.9	1.4	6.7		3.3	9.5	12.4	9.7	58.8
43	4	38	1/2/3	19.1	1.6	7.4		3.4	10.6	13.9	8.0	64.0
43	8	38	0/1/2	21.7	1.9	6.5		4.0	12.8	12.0	13.3	72.1
43	9	38	-	5.5	1.2	5.8		4.2	10.9	10.1	19.8	57.4
50	4	38	1/2/3	7.2	0.4	6.0		3.8	10.8	12.2	6.4	46.8
50	8	38	0/1/2	25.7	2.0	11.7	4.7	13.3	27.1	23.9	32.5	140.9
50	9	38	-	13.0		5.7	4.6	10.9	15.1	23.8	18.6	91.6
50	4	38	-	9.9	0.5	8.3		4.7	15.6	17.3	14.8	71.0
57	5	38	1/2/3	8.5		8.4		2.7	10.4	15.4	4.5	49.9
57	7	38	0/1/2	16.0	1.7	8.0		4.5	13.3	10.9	[illegible]	65.8
57	1	38	4/4	4.5		3.9		2.5	2.9	14.8	18.[illegible]	47.2
57	1	38	4/4	10.9	1.7	10.2		5.6	10.3	27.5	35.5	101.6

Appendix Table 4. Raw data. Percentages of eight chemicals in head extracts of queenless A.m. adansonii workers (Feb.1979)

Worker description				Percentage chemical							
Age (days)	Hours/ sample	Queenless period (days)	Ovarial development	OAA	pHBA	4HBAA	9HDA	4,9HPE	9HDA	10HDAA	10HDA
5	5	0	0/0	4.2	5.2	11.7		5.0	18.5	1.7	53.7
5	5	0	0/0	5.2	6.8	17.1		14.9	23.1	13.5	19.1
10	5	0	0/0	2.9	3.7	14.8		7.6	18.9	11.1	41.0
10	5	0	0/0	2.9		8.0		6.6	16.9	10.8	54.8
10	5	0	0/0	2.9	2.1	7.1		4.5	11.5	6.8	65.0
20	5	0	0/0	7.5		13.1		8.0	20.4	11.8	39.1
20	5	0	0/0	8.1	4.8	17.2		9.0	27.8	15.1	18.1
30	5	0	0/0	13.4		18.4		8.7	31.3	17.0	19.2
30	5	0	0/0	12.8		18.3		11.0	27.9	16.7	13.3
30	5	0	0/0	10.7		26.6		8.7	27.0	14.5	12.4
5	6	3	0/0		7.5	13.3		5.1	40.4	11.7	22.0
10	5	3	1/0	3.1	1.3	6.7		4.7	18.7	25.9	39.7
20	5	3	0/0	5.7		9.6		4.2	38.0	15.4	27.1
30	5	3	0/0	50.1		2.2		4.9	16.8	13.3	12.8
5	5	5	1/1	4.5	9.7	22.5		13.0	20.4	6.7	17.2
5	5	5	0/0	4.5	5.6	17.1		14.9	20.4	20.4	17.1
10	5	5	1/0	1.1	3.2	1.3		3.6	36.2	14.1	40.6
20	5	5	0/0	4.5	0.8	9.2		2.6	24.9	37.1	20.9
20	5	5	0/0	8.5		12.9		8.8	27.3	24.1	18.5
30	5	5	0/0	39.9		7.7		3.1	12.3	15.6	21.4
30	5	5	0/0	29.3		12.1		5.2	16.9	24.0	12.4
5	5	7	0/0	8.9	8.6	6.9		9.7	20.6	20.7	24.7
5	5	7	0/0	3.4	5.8	11.1		13.5	23.3	8.4	35.3
8	1	7	2/3	5.5	3.9	6.7		10.7	32.6	23.1	17.5
8	1	7	4/5*	-	1.7	7.8		5.9	44.8	20.3	19.4
10	5	7	0/0	6.8	6.1	9.8		14.2	37.8	10.8	16.9
10	2	7	2/2	3.9		19.7		15.8	17.7	29.5	14.8
10	1	7	3/2*	2.2		7.9	32.6	8.2	15.6	6.3	6.6
12	1	7	3/2*	2.7		12.7		9.1	13.5	24.6	37.7

*Have never standing laying behaviour

Appendix Table 4.. Continued

Ovarian description						Percentage chemical					
Age (days)	Hemin/ sample	Quiescence period (days)	Ovarial development	DAA	pHBA	8HDAA	9HDA	4,9HPE	9HOA	10HDAA	10HOA
20	5	7	0/0	5.8	0.2	6.2		5.8	22.4	30.4	29.6
20	3	7	0/0	19.0	1.1	16.4		9.3	21.0	17.9	15.2
20	2	7	1/1	11.8		5.4		4.5	16.6	33.6	29.0
20	1	7	2/2	5.9		16.5		12.9	14.6	30.2	19.9
20	1	7	2/2	5.1		19.0		18.3	17.9	23.7	16.1
30	5	7	0/0	26.7		8.3		5.5	16.1	18.3	25.1
30	4	7	2/2	11.1		18.0		9.0	21.3	22.5	18.2
9	1	8	4/3*			10.5		13.4	19.2	37.5	19.4
12	1	8	3/2			2.8	61.7	6.8	13.7	4.2	10.6
16	1	12	3/3*	8.8		3.7		16.8	19.7	29.5	24.5
16	1	12	3/3			5.8		13.6	20.8	32.9	26.9
16	1	12	2/2*	7.3		17.7		11.7	16.2	35.1	12.0
18	2	13	1/1	6.1		12.0		15.5	21.3	29.8	16.1
18	1	13	3/2*	4.9		14.5		16.8	22.8	23.5	18.3
18	1	13	3/2	8.0		14.7		14.8	20.0	27.4	15.0
18	1	13	4/4*	6.1		6.5		11.0	15.8	44.9	15.7
18	1	13	4/4	7.4	2.3	16.9		13.5	15.6	30.5	13.8
5	5	14	0/0	3.9		[illegible]		12.2	17.1	7.3	48.3
5	5	14	0/0	4.8	1.9	11.3		13.0	17.8	8.1	43.9
8	7	14	0/0	5.0	3.2	12.7		15.7	29.2	13.0	21.2
8	1	14	1/1			7.6		13.3	28.2	27.4	23.5
8	2	14	3/2	6.9		13.6		14.7	23.3	23.8	17.7
8	3	14	0/0	31.8	1.3	12.8		13.0	17.1	10.5	13.5
8	2	14	2/2	8.5		16.0		18.1	25.2	14.0	18.2
8	1	14	1/1	8.3	2.6	13.2		13.5	19.5	28.7	14.2
8	2	14	0/0	22.4	1.3	3.2		12.5	17.8	24.9	17.8
8	5	14	0/0	35.0	3.0	10.2		6.8	17.3	10.6	17.0
45	2	14	1/1	21.2		10.0		9.1	12.9	22.3	23.8
45	1	14	2/2	16.7		16.4		11.7	14.0	27.5	15.7

* Some ovaries showing laying behaviour

Appendix Table 9g. A summary of the social activities of workers in Cage No.7 (February 1980).

Social activity		Bee Number 1	2	3	4	5
Bee offers to others	(A)	18	22	26	23	28
Others accept offering	(B)	0	0	2	0	0
Others offer to bee	(C)	18	30	23	20	26
Bee accepts offering	(D)	0	0	0	1	1
Bee begs from others	(E)	8	4	1	6	14
Others give in response	(F)	2	2	0	2	7
Others beg from bee	(G)	10	8	5	5	5
Bee gives in response	(H)	6	3	2	0	2
Total times others feed bee	(D+F)	2	2	0	3	8
Opportunities bee had of feeding from others	(C+E)	26	34	24	26	40
Total times bee feeds others	(B+H)	6	3	4	0	2
Opportunities bee had of feeding others	(A+G)	28	30	31	28	33
Degree of Subordination		0.21	0.10	0.13	0.00	0.06
Degree of Dominance		0.08	0.06	0.00	0.12	0.20
Social Index		0.36	0.59	-	-	3.30
Age at death		A	9*	9*	9*	9*

*Bees killed on ninth day

Appendix Table 4. Continued

Marker description				Percentage chemical							
Age (days)	Heads/ sample	Queenless period (days)	Overall development	DAA	pHDA	8HDAA	9HDA	43HPE	9HDA	10HDAA	10HDA
14	5	19	0/0	7.1	3.1	13.8		17.8	25.5	11.3	21.3
15	2	19	0/0	3.9	2.4	6.2		12.6	16.7	22.8	35.4
15	1	19	1/1	3.8		5.7		10.3	13.5	12.8	53.9
25	2	19	0/0	22.4		9.1		9.8	15.2	22.9	20.6
35	3	19	1/1	13.4	1.8	5.6		5.2	11.3	9.2	53.6
54	1	19	0/0	18.9		6.1		10.4	15.5	35.9	13.3
29	10	38	-	10.5	1.1	11.7	6.9	9.1	18.6	23.4	18.8
29	10	38	-	5.8	1.6	7.1	4.8	5.7	35.3	24.8	15.6
29	10	38	-	15.9	1.2	10.9	8.3	8.4	24.2	11.7	19.3
29	10	38	-	14.3		9.9	7.6	8.5	21.1	19.3	19.3
36	10	38	-	13.4	1.0	9.8	8.5	9.7	23.3	18.7	15.5
36	11	38	-	14.5	2.3	7.6	5.6	6.2	15.1	25.3	23.5
36	11	38	-	9.5	2.5	10.4	8.3	9.3	21.7	18.5	19.8
36	11	38	-	15.3	2.8	9.0	6.9	10.0	20.4	18.2	17.3
43	1	38	4/4	6.0		16.3		10.3	16.9	23.3	27.2
43	4	38	1/2/3	29.9	2.5	11.6		5.3	16.6	21.7	12.5
43	4	38	1/2/3	29.0	2.4	9.8		6.1	14.2	21.2	17.3
43	4	38	1/2/3	27.1	2.3	11.3		5.7	16.1	21.0	16.5
43	8	38	0/1/2	30.1	2.5	9.0		5.5	17.8	16.7	18.4
43	9	38	-	9.5	2.1	10.1		7.3	18.9	17.5	34.5
50	4	38	1/2/3	15.5	0.8	12.9		8.2	23.1	26.0	13.6
50	8	38	0/1/2	18.2	1.4	8.3	3.3	9.4	19.2	17.0	23.1
50	9	38	-	14.1		6.2	5.0	11.9	16.5	25.9	20.3
50	4	38	-	13.9	8.7	11.7		6.5	21.9	24.4	20.9
57	5	38	1/2/3	17.0		16.9		5.4	20.8	31.0	9.0
57	7	38	0/1/2	24.3	2.6	12.1		6.8	20.1	16.6	17.6
57	1	38	4/4	5.4		8.3		5.3	6.2	31.3	39.5
57	1	38	4/4	10.7	1.6	10.0		5.5	10.1	27.1	34.9

Appendix Table 5. Raw data. Amounts of nine chemicals in head extracts of queenless *A. m. adansonii* workers (Nov. 1979)

Hauda/ Sample	Ovarial development	Ovarioles per ovary	Total chemical (µg/head)									
			OAA	pHBA	8HOAA	9HDA	AJHPE	9HDA	10HDAA	10HDA	Total Acid Secretion	2-hept.
1	0/0	-	9.5	1.0					4.0	17.0	31.5	-
1	0/0	-	4.5	1.0					3.5	9.5	18.5	-
1	0/0	0/0	2.5	1.0	1.8	tr	1.0	1.5	9.5	28.0	44.5	-
1	0/0	3/4	18.5	1.0				tr	6.0	23.0	40.5	-
1	0/0	0/3	12.0	0.0	2.9	0.0	3.1	3.4	9.9	28.7	60.1	18.0
1	0/0	0/3	3.9	0.0	0.2	0.0	0.4	1.1	7.4	22.5	35.5	0.0
1	0/0	1/2	6.8	0.0	0.6	0.0	1.7	1.2	3.1	6.6	19.9	19.1
1	0/0	2/1	7.0	1.0			0.5		2.0	6.0	16.5	30.5
1	0/0	5/1	10.2	0.0	0.2	0.0	0.5	0.8	6.5	26.1	44.4	21.9
1	0/1	3/3	9.5	1.0				tr	4.0	14.0	28.5	-
1	0/1	3/3	2.2	0.8	1.1	0.0	0.5	1.1	9.9	41.6	56.4	-
1	1/0	4/5										9.5
1	1/0	1/4	18.4	0.0	0.9	0.0	2.2	2.0	7.2	15.7	46.5	27.0
1	1/0	4/3	13.8	0.0	2.3	0.0	2.9	3.7	16.6	43.9	83.4	20.0
1	1/0	3/3	3.2	1.2	1.4	0.0	2.3	2.4	14.5	36.6	61.6	0.0
1	0/1	1/1	8.9	0.0	2.7	tr	2.4	2.2	10.6	37.1	63.9	6.7
1	1/1	4/2	1.0						2.5	19.0	22.5	-
1	1/1	2/3	10.0	2.5					3.0	15.0	30.5	-
1	1/1	2/2	9.8	0.0	1.5	0.0	1.3	1.6	5.0	21.7	40.9	17.5
1	1/1	4/2	6.5	0.0	0.1	0.0	1.0	0.9	6.1	24.4	38.0	14.0
1	1/2	-	3.0	1.0					2.5	7.5	14.0	-
1	1/2	-	6.5	1.5					2.5	9.5	20.0	-
1	1/2	5/4	1.5					1.0	7.5	24.0	34.0	-
1	1/2	1/1	9.5	2.0	1.5	1.0	2.0	2.0	10.0	35.0	63.0	0.0
1	1/2	3/3	3.9	0.0	0.7	0.0	0.3	0.2	0.8	4.0	9.9	15.0
1	2/1	3/2	6.7	0.9	1.3	0.7	2.6	1.5	7.3	17.7	38.6	15.0
1	2/1	4/3	10.1	0.6	0.1	tr	1.6	0.5	6.6	24.9	44.7	6.5
1	1/2	1/1	8.8				1.5	2.5	21.0	86.0	113.0	0.0
1	1/1	1/2	5.4		0.9		0.2	0.2	1.7	8.0	15.7	9.8
1	2/0	3/0	1.9		0.9		0.7	0.6	9.0	28.1	41.3	0.0
1	2/2	-	5.5	2.8	4.0			2.5	7.0	28.0	49.0	-
1	2/2	-										-
1	2/2	-	1.0		1.5			1.0	8.5	17.0	29.0	-
1	2/2	4/3	2.9	1.4	2.1		3.3	5.9	13.4	64.9	95.9	0.0
1	2/2	3/2	7.3		0.2		0.5	0.6	3.8	13.4	25.8	23.8
1	2/2	5/3	8.8		0.1		0.6	0.1	1.1	1.9	4.6	3.9
1	2/2	5/4	7.8		1.2		1.8	1.7	9.1	22.3	43.9	8.8
1	2/2	5/2	6.7		0.4		0.4	1.3	17.4	57.5	77.8	2.1
1	2/2	3/2	1.4		0.7		2.3	1.1	20.7	80.0	106.1	0.0
1	2/2	5/2	9.9	1.8	3.5		4.0	4.2	17.4	64.6	105.5	4.2
1	2/2	5/1	8.8	0.5			1.0	1.5	10.8	29.8	50.8	5.8
1	2/2	5/2	2.4	1.1	5.3		3.4	4.3	25.8	68.8	102.6	0.0

Appendix Table 5. Continued

Marker description			Total chemical (μg/head)									
Heads/ sample	Ovarial development	Ovarioles per ovary	DAA	pMBA	8MDAA	9MDA	4,9MPE	9MDA	10MDAA	10MDA	Total acid secretion	Z-hept
1	2/3	-	2.5	1.0	1.5			1.5	9.5	26.0	42.0	-
1	2/3	-	2.0		0.5			0.5	8.5	23.0	34.5	-
1	3/2	-	19.0	0.9	0.5		0.6	1.2	2.4	10.8	35.3	-
1	1/3	1/1	7.5	1.0					7.0	28.0	43.5	-
1	2/3	6/4	6.0		0.5		0.3	0.7	1.9	6.9	16.3	-
1	0/3	0/6	1.5		tr			tr	15.0	41.0	57.5	-
1	3/2	5/4	1.3		0.6		0.4	0.7	12.1	44.0	59.2	-
1	3/1	3/3	0.3		0.2		2.2	0.3	9.2	21.0	33.2	0.0
1	2/3	3/2	10.8	0.6	2.7		2.9	2.0	5.7	17.7	42.3	11.5
1	3/1	4/2	10.3	1.4	0.7	1.4	1.9	1.6	8.2	20.8	44.9	11.8
1	3/1	1/3	3.5	1.2			5.3	3.1	12.5	30.1	57.0	0.8
1	2/3	3/1	5.5		0.9		0.2	0.6	4.8	16.8	28.9	3.0
1	3/2	5/4	1.3		0.3		0.9	0.6	8.3	14.5	25.9	0.0
1	3/0	1/1	5.7		1.3		1.3	1.6	15.7	63.6	89.3	1.0
1	0/3	0/2	5.0	0.9	2.1		2.8	2.9	16.7	58.7	88.9	0.0
1	2/3	5/4	0.5				1.5	0.5	8.5	30.0	41.0	0.0
1	3/0	3/1	9.0	1.0	1.8		1.5	0.5	8.0	44.0	65.0	2.7
1	0/3	0/4	6.3	0.2	1.7		0.5	1.9	12.8	57.1	80.6	1.5
1	3/3	3/1	6.1	1.0	1.5		2.6	3.1	18.9	33.5	58.7	0.8
1	3/3	4/4	4.5					0.5	4.5	21.0	30.5	3.3
1	3/3	3/3	12.0	1.8				tr	8.0	36.0	56.0	7.5
1	3/3	6/2	6.8		0.6		2.1	0.7	13.6	50.3	74.2	0.5
1	3/3	5/3										0.3
1	3/3	5/3	10.7		1.1	tr	0.8	3.0	16.0	107.9	139.5	3.4
1	3/3	5/1	5.7		3.0		4.1	5.4	17.5	139.3	174.9	0.5
1	3/3	4/3	2.7	1.8	2.8		0.6	0.6	5.6	18.5	29.3	0.0
1	3/3	4/4	10.2	1.7	1.1	0.6	1.1	3.0	11.5	45.1	74.4	2.7
1	3/3	4/2	3.9		2.3		4.2	1.7	7.5	16.9	36.5	0.0
1	3/3	2/2	7.7		4.3		5.4	4.5	18.3	47.4	87.7	2.2
1	3/3	4/4	12.1		3.4		4.5	3.3	18.3	43.6	85.1	0.4
1	-/0	-/2	10.2	1.2	1.1	tr	0.6	1.1	8.0	30.0	52.2	2.7
1	4/4	-	3.0						3.0	10.5	16.5	-
1	4/3	-	2.0		1.0			1.0	5.5	23.0	32.5	-
1	4/3	-	2.0					0.5	6.0	17.0	25.5	-
1	3/4	3/3	10.8						4.0	18.0	32.0	-
1	2/4	3/6	1.1		0.7		0.6	0.6	7.6	18.9	29.5	0.8
1	0/4	0/4	4.3	1.7	5.1		4.3	4.6	23.1	64.6	107.7	0.0
1	4/4	3/4	2.8	1.3	0.4		1.3	1.0	11.8	26.7	45.5	0.0
1	4/4	4/4	2.7	1.4	2.4		2.7	2.0	10.7	24.1	45.9	0.0
1	4/	4/3	1.9		4.2		0.9	3.2	9.8	31.0	51.0	0.0
1	4/3	3/2	7.6		0.6	tr	1.0	0.6	4.2	24.0	38.1	1.5
1	4/4	2/2	7.1		5.2	tr	3.4	3.2	10.2	37.5	66.6	1.0
1	3/4	3/3	5.2	1.4	1.3	tr	0.9	1.4	9.2	46.6	65.9	0.9

Appendix Table 5. Continued

Worker description			Total chemical (µg/head)									
Heads/ sample	Ovarial development	Ovarioles per ovary	DAA	pHBA	8HDAA	9HDA	4,3HPE	9HOA	10HDAA	10HDA	Total acid secretion	2-hept
6	2/1	4/2	8.2	0.5	1.4		4.5	3.3	15.5	45.1	76.6	1.2
4	3/3	4/3	5.7		1.1		8.9	1.2	11.1	40.6	60.7	13.1
4	2/2	3/2	5.3		0.8		1.2	1.5	8.3	27.1	42.1	11.3
3	3/2	3/3	8.0	2.0	2.0		2.0	2.0	11.0	22.0	49.0	7.4
3	2/1	3/2	7.0	1.0	1.5		1.0	1.5	9.0	32.0	53.0	13.2
4	3/3	5/5	6.0	1.0	0.5		1.0	1.0	8.5	33.0	51.0	6.7
5	0/0	1/1	7.0	1.0	1.0		0.5	2.0	10.0	35.0	56.5	2.7
7	2/2	-	4.6	0.2	0.7	0.2	0.3	1.1	5.8	21.5	34.5	6.0
6	2/3	-	7.6	0.4	0.7	0.3	0.6	1.1	7.2	27.1	44.9	-
8	2/2	-	6.1	0.2	0.5	0.2	0.3	0.8	5.7	23.1	37.8	-
7	-	-	6.2	0.3	0.6	0.3	0.5	1.3	9.8	40.1	59.8	-
7	-	-	5.1	0.2	0.6	0.2	0.3	0.9	7.6	30.1	45.0	-
8	-	-	3.7	0.3	0.7		0.2	0.5	6.8	26.4	38.5	-
6	-	-	6.2	0.4	1.1	tr	0.4	1.2	7.9	33.4	50.6	-
8	-	-	4.8	0.3	0.7	0.4	0.5	1.0	7.4	28.8	43.9	-

Appendix Table 6.. Raw data.. Percentages of eight chemicals in head extracts of queenless A. m. adansonii workers (Nov 1979)

Marker description			Percentage chemical							
Mandib/ sample	Ovarial development	Ovarioles per ovary	DAA	pHBA	8HDAA	9HDA	4,5HPE	9HDA	10HDAA	10HDA
1	0/0	-	38.2	3.2					12.7	54.0
1	0/0	-	24.3	5.4					18.9	51.4
1	0/0	0/0	5.6	2.2	2.2	tr	2.2	3.4	21.3	62.9
1	0/0	3/4	25.9	2.5					14.8	56.8
1	0/0	0/3	20.0		4.8		5.2	5.7	16.5	47.7
1	0/0	0/3	11.0		0.5		1.0	3.2	20.8	63.4
1	0/0	1/2	34.0		2.9		8.6	5.9	15.5	33.1
1	0/0	2/1	42.4	6.0			3.0		12.1	36.4
1	0/0	5/1	23.1		0.5		1.2	1.8	14.6	58.9
1	0/1	3/3	33.3	3.5					14.0	49.1
1	0/1	3/3	3.9		1.9		0.8	1.9	17.6	73.8
1	1/0	4/5								
1	1/0	1/4	39.7		2.0		4.8	4.3	15.4	33.7
1	1/0	4/3	16.5		2.8		3.5	4.5	19.9	52.7
1	1/0	3/3	5.1	2.0	2.3		3.7	4.0	23.5	59.3
1	0/1	1/1	13.9		4.3	tr	3.7	3.4	16.6	58.0
1	1/1	4/2	4.4						11.1	84.4
1	1/1	8/3	32.8	8.2					9.8	49.2
1	1/1	2/2	23.9		3.7		3.1	4.0	12.2	53.1
1	1/1	4/2	16.7		0.3		2.6	2.3	15.6	62.5
1	1/2	-	21.4	7.1					17.9	53.6
1	1/2	-	32.5	7.5					12.5	47.5
1	1/2	5/4	4.4					2.9	22.1	70.6
1	1/2	1/1	15.1	3.2	2.4	1.6	3.2	3.2	15.9	55.6
1	1/2	3/3	38.9		7.8		3.2	2.0	8.4	40.5
1	2/1	3/3	17.2	2.2	3.4	1.9	6.6	3.8	19.0	45.8
1	2/1	4/3	22.6		1.3	0.2	4.1	1.2	14.9	55.7
1	1/2	1/1	1.8				1.3	2.2	18.6	76.1
1	-/1	-/2	34.4		0.6		1.3	1.4	11.1	51.2
1	2/0	3/0	4.7		2.2		1.7	1.5	21.8	68.1
1	2/2	-	11.2	4.1	8.2			5.1	14.3	57.1
1	2/2	-								
1	2/2	-	3.4		5.2			3.4	29.3	58.6
1	2/2	4/3	3.1	1.5	2.2		5.5	6.2	13.9	67.6
1	2/2	3/2	28.3		0.9		1.9	2.4	14.7	51.8
1	2/2	6/5	17.4		2.9		13.7	2.9	24.5	38.6
1	2/2	4/4	17.7		2.7		4.1	4.0	20.6	50.9
1	2/2	8/2	8.9		8.5		0.6	1.7	22.4	73.9
1	2/2	3/2	1.3		8.7		2.2	1.8	19.5	75.4
1	2/2	4/2	9.4	1.7	3.3		3.8	4.8	16.5	61.3
1	2/2	2/1	16.8	1.8			2.0	3.8	28.8	38.8
1	2/2	3/2	2.4	1.8	5.4		3.3	4.2	25.3	58.4

Appendix Table 6. Continued

Header description			Percentage chemical							
Needle/ sample	Ovarial development	Ovarioles per ovary	DAA	pHBA	BHDAA	9HDA	4,5EPE	9HOA	TDHDAA	TDHOA
1	2/3	-	6.0	2.4	3.6			3.6	22.6	61.9
1	2/3	-	5.8		1.4			1.4	24.E	66.7
1	3/2	-	53.8	2.6	1.4		1.6	3.3	6.7	30.7
1	1/3	1/1	17.2	2.3					16.1	64.4
1	2/3	6/4	36.6		3.1		2.1	4.3	11.6	42.4
1	0/3	0/6	2.6						26.1	71.3
1	3/2	5/4	2.3		1.1		0.6	1.2	20.5	74.3
1	3/1	3/3	1.1		0.5		6.6	0.9	27.8	63.2
1	2/3	3/2	25.6	1.4	6.3		6.8	4.6	13.4	41.8
1	3/1	4/2	22.9		3.1	1.5	4.2	3.6	18.3	46.3
1	3/1	1/3	6.1	2.1	2.4		9.3	5.4	21.9	32.8
1	2/3	3/1	18.9		3.2		0.9	2.1	16.8	58.1
1	3/2	5/4	5.2		1.2		3.4	2.4	31.9	56.0
1	3/8	1/1	6.4		1.5		1.5	1.8	17.6	71.2
1	0/3	0/2	5.6	1.0	2.3		3.1	3.2	18.8	66.0
1	2/3	5/4	1.2				3.7	1.2	20.7	73.2
1	3/0	3/1	13.8	1.5	1.5		2.3	0.8	12.3	67.7
1	0/3	0/4	7.9	0.3	2.0		0.6	2.3	15.9	70.9
1	3/3	3/1	10.4	1.8	2.5		4.5	5.2	18.5	57.1
1	3/3	4/4	14.8					1.6	14.8	68.9
1	3/3	3/3	21.4	1.8					14.3	64.3
1	3/3	6/2	9.1		0.9		2.9	1.0	18.4	67.8
1	3/3	5/3								
1	3/3	5/3	7.7		0.8	tr	0.5	2.1	11.5	77.3
1	3/3	5/1	3.3		1.7		2.3	3.1	10.0	79.6
1	3/3	4/3	9.2	3.4	1.0		2.1	2.1	19.1	63.2
1	3/3	4/4	13.7	2.3	1.5	0.8	1.5	4.1	15.5	60.7
1	3/3	4/2	18.7		6.3		11.6	4.6	20.5	46.4
1	3/3	2/2	8.8		4.9		6.2	5.1	20.9	54.1
1	3/3	4/4	14.2		4.0		5.2	3.9	21.5	51.2
1	4/8	4/2	19.5	2.4	2.0	tr	1.2	2.1	15.3	57.5
1	4/4		18.2				-		18.2	63.6
1	4/3	- -	6.1		3.1		-	3.1	16.9	70.8
1	4/3	-	7.8				-	2.8	23.5	66.7
1	3/4	3/5	31.2				-		12.5	56.2
1	2/4	3/6	3.7		2.2		1.9	2.2	25.8	64.2
1	4/4	8/4	4.8	1.6	4.7		4.0	4.3	21.4	60.0
1	4/4	3/4	6.2	3.3	0.8		2.8	2.4	26.0	58.7
1	4/4	4/4	5.8	3.8	5.3		5.8	4.4	23.2	52.5
1	4/3	4/3	3.7		8.3		1.8	6.3	19.2	60.8
1	4/3	3/2	28.8		1.6	tr	2.7	1.5	11.0	63.1
1	4/4	2/2	18.7		7.7	tr	5.8	4.8	15.4	56.3
1	3/4	3/3	7.9	2.1	2.8	tr	4.3	2.1	14.8	70.7

Appendix Table 6. Continued

Marker description			Percentage chemical							
Heads/ sample	Ovarial development	Ovarioles per ovary	DAA	pHBA	8HPAA	9HDA	43HPE	9HDA	10HDAA	10HDA
6	2/1	4/2	8.1	0.7	1.9		5.8	4.4	20.3	58.9
4	3/3	4/3	9.4		1.8		1.5	2.0	18.3	66.9
4	2/2	3/2	12.6		1.8		2.9	3.5	19.6	59.5
3	3/2	3/3	16.3	4.1	4.1		4.1	4.1	22.4	44.9
3	2/1	3/2	13.2	1.9	2.8		1.9	2.8	17.0	60.4
4	3/3	5/5	11.8	2.0	1.0		2.0	2.0	16.7	64.7
5	0/0	1/1	12.4	1.8	1.8		0.9	3.5	17.7	61.9
7	2/2	–	13.4	0.6	1.9	0.7	0.9	3.1	16.8	62.5
6	2/3	–	16.8	0.8	1.5	0.6	1.4	2.5	15.9	60.4
8	2/2	–	16.4	0.6	1.4	0.6	0.9	2.0	15.5	62.5
7	–	–	10.6	0.5	1.1	0.4	0.6	2.2	16.6	67.9
7	–	–	11.2	0.5	1.2	0.5	0.7	1.9	16.8	67.0
8	–	–	9.7	0.7	1.8		0.4	1.3	17.6	68.6
6	–	–	12.3	0.7	2.2		0.9	2.4	15.5	66.1
8	–	–	10.9	0.7	1.6	0.9	1.0	2.4	16.8	65.7

Appendix Table 7. Raw data. Amounts of eight chemicals in head extracts of individuals from small groups of queenless *A. m. adansonii* workers (Feb 1980)

Worker description					Total chemical (μg/head)								
Cage No.	No. of social interactions	Social index	Age (days)	Ovarioles per ovary	DAA	pHBA	BHDAA	9HDA	43HPE	7HDA	10HDAA	10HDA	Total secretion
1	39	0.29	8	6/7	0.1	0.1	7.3	1.5	0.4	4.6	10.2	44.2	68.4
	32	1.14	9*	4/3	2.6	0.2	3.4		1.4	3.7	9.0	43.5	63.8
	37	3.25	9*	7/3	0.8		4.5		5.5	3.1	18.5	19.9	44.2
	36	1.09	8	9/7	1.4		1.8		0.2	0.7	7.0	23.9	35.0
	23	0.33	9	–	0.3	0.1	1.6		7.7	0.6	7.4	16.9	37.6
2	15	3.00	6	2/9	0.4		0.4		1.7	0.2	5.0	14.4	20.6
	12	0.13	6	5/7	0.3		0.3		0.4	0.2	5.0	14.9	20.8
	18	–	7	5/4	0.2		0.5		0.1	0.1	4.9	13.9	19.7
	10	0.60	7	5/4	0.5	0.1	1.0		0.1	0.2	3.4	11.5	16.8
	25	–	4	4/3							2.0	3.0	5.0
3	74	2.66	9*	7/7	0.4	0.6	5.9		1.0	2.6	18.0	54.1	82.8
	134	1.16	9*	4/6	0.5	0.6	2.9		0.5	2.2	12.8	35.7	55.2
	94	1.15	9*	6/6	1.2		3.2		0.1	2.5	13.6	33.2	53.8
	71	0.58	9*	4/6	3.3	0.2	3.6		2.0	2.3	12.9	29.2	53.5
	78	0.36	9*	2/4	1.8	0.9	7.3		1.6	3.7	10.9	25.8	50.4
4	49	1.74	8	5/4	0.9	0.2	2.9		0.2	1.1	12.9	38.4	56.7
	37	0.11	9*	7/5	1.3	0.5	3.5		0.8	1.8	13.7	21.1	42.7
	19	0.86	9*	6/6	0.9	0.5	6.9	1.3	3.4	4.0	8.4	13.8	39.3
	30	0.92	9	5/7	0.5		2.3		0.2	0.6	7.3	21.8	32.7
	42	4.08	8	5/5	1.1		1.1		0.1	0.2	5.4	16.7	24.6
5	78	1.22	9*	5/4	0.5	0.6	5.7		1.8	2.0	11.5	26.3	48.3
	62	1.14	9*	4/5	0.5	0.5	3.1		1.7	1.5	9.1	21.6	38.0
	47	0.54	9*	2/3	3.4	0.5	2.4		1.4	1.4	7.5	5.9	22.5
	37	1.05	9*	3/3	1.0		3.1		1.6	1.5	8.5	6.3	22.0
	19	1.62	6	6/8	0.4		0.4		0.1	0.2	4.4	15.3	20.8

* Females have then survived until study terminated on ninth day

Appendix Table 7. Continued

Cage No.	Mother description				Total chemical (μg/head)								
	No. of social interactions	Social index	Age (days)	Ovarioles per ovary	DMA	pHBA	4HBAA	5HDA	4,5HPE	5HDA	10HDAA	10HDA	Total secretion
6	23	5.00	9*	1/0	0.6	0.2	6.8		4.0	2.4	13.8	28.6	56.4
	15	0.98	9	5/6	1.5	0.4	3.6		1.2	3.7	10.7	29.1	50.1
	24	0.69	7	5/9	0.1		2.3		0.3	0.7	10.8	32.5	46.5
	24	0.58	9	2/5	0.1	0.1	2.2		0.3	1.1	11.7	25.4	40.7
	21	0.67	9*	5/3	1.1		6.9		2.9	2.1	9.8	10.6	33.5
7	30	-	9*	2/5	1.8		3.3		2.5	2.4	12.5	33.4	55.9
	29	0.59	9*	7/7	0.6		6.9	1.2	1.6	5.6	8.5	28.8	53.1
	29	-	9*	4/1	1.1		3.6		1.6	1.9	8.8	20.6	37.6
	45	3.38	9*	3/4	1.8		4.1		2.0	2.3	7.5	16.1	33.0
	32	0.36	8	-	0.3		1.5		0.4	0.5	8.1	21.1	31.9
8	35	0.80	7	3/4	1.0		3.2		0.9	0.6	15.8	38.0	59.5
	27	0.59	6	4/4	0.1		3.1		0.1	1.8	9.7	33.9	48.8
	52	0.67	9*	7/6	2.1		3.9		8.8	2.3	12.8	13.9	43.8
	106	1.09	9*	5/6	0.7		4.2		3.4	1.7	12.6	18.6	41.1
	87	3.25	6	-/3	0.1		1.3		-	0.4	6.3	16.3	24.3
9	69	16.00	9*	4/9	1.2		7.3		8.8	5.1	12.4	16.3	52.4
	46	1.37	9*	3/3	1.2		3.1		2.4	1.7	11.1	22.2	41.7
	62	0.31	9*	7/5	0.8		7.4		4.4	3.2	10.4	10.7	36.8
	49	0.16	9*	4/2	2.0		2.6		4.5	0.5	6.7	8.6	25.8
	69	0.35	8	4/5	0.3		1.4		1.3	0.7	6.8	12.8	21.6
10	57	8.85	8	4/5	0.7		4.6		0.1	1.4	8.7	23.2	38.7
	55	0.33	9*	4/2	2.4		2.3		2.9	1.3	8.3	11.4	28.8
	36	8.64	8	5/12	1.6		1.5		0.1	0.2	4.1	14.1	21.6
	39	1.06	9*	9/6	0.5		0.9		3.1	0.2	3.8	8.9	13.6
	33	-	4	5/4	-		-	-	-	-	-	-	-

* Females lones that survived until study terminated on ninth day

Appendix Table 8. Raw data. Percentages of eight chemicals in head extracts of individuals of small groups of queenless *A. m. adansonii* workers (Feb 1980)

Worker description					Percentage chemical							
Cage No	No. of social interactions	Social index	Age (days)	Overlaps per ovary	8AA	pHBA	8HOAA	9HDA	43HPE	9HDA	10HDAA	10HDA
1	39	0.29	8	6/7	0.1	0.2	1.1	2.2	0.1	6.7	15.0	64.6
	32	1.14	9*	4/3	4.0	0.4	5.3		2.2	5.8	14.1	68.3
	37	3.25	9*	7/3	1.8		10.1		12.4	7.0	23.6	45.0
	36	1.09	8	9/7	4.1		5.0		0.6	2.1	20.1	68.2
	23	0.33	9	-	1.1	0.4	5.8		2.6	2.0	27.0	61.0
2	15	3.00	6	2/9	1.2		2.0		0.9	1.1	24.1	70.0
	12	-	6	5/7	1.6		1.5		0.2	0.9	24.2	71.6
	18	0.13	7	5/4	1.1		2.7		0.5	0.7	24.7	70.3
	10	0.60	7	5/4	3.2	0.3	6.1		0.3	1.2	20.4	68.4
	25	-	4	4/3							40.5	59.5
3	74	2.66	9*	7/7	0.5	0.8	7.1		1.2	3.2	21.8	65.4
	134	1.16	9*	4/6	0.9	1.1	5.2		1.0	4.0	23.2	64.7
	94	1.15	9*	6/6	2.2		6.0		0.3	4.7	25.2	61.7
	71	0.58	9*	4/6	6.2	0.4	6.8		3.7	4.3	24.1	54.6
	78	0.36	9*	2/4	1.9	1.7	14.6		3.2	7.4	21.6	49.7
4	49	1.74	8	5/4	1.6	0.4	5.0		0.3	2.0	22.8	67.8
	37	0.11	9*	7/5	3.1	1.2	8.2		2.0	4.1	32.0	49.4
	19	0.86	9*	6/6	2.2	1.2	17.7	3.3	8.7	10.2	21.5	35.1
	30	0.92	9	5/7	1.4	-	7.1		0.6	1.9	22.3	66.7
	42	4.08	8	5/5	4.6		4.6		0.2	1.0	21.8	67.8
5	78	1.22	9*	5/4	1.0	1.2	11.3		3.7	4.1	23.8	54.3
	62	1.14	9*	4/5	1.3	1.3	8.2		4.5	4.1	23.9	56.8
	47	0.54	9*	2/3	15.0	2.3	10.8		6.4	6.2	33.2	26.1
	37	1.05	9*	3/3	4.5		17.9		7.2	7.0	38.6	28.8
	19	1.62	6	6/8	1.7		1.8		0.3	0.9	21.4	73.8

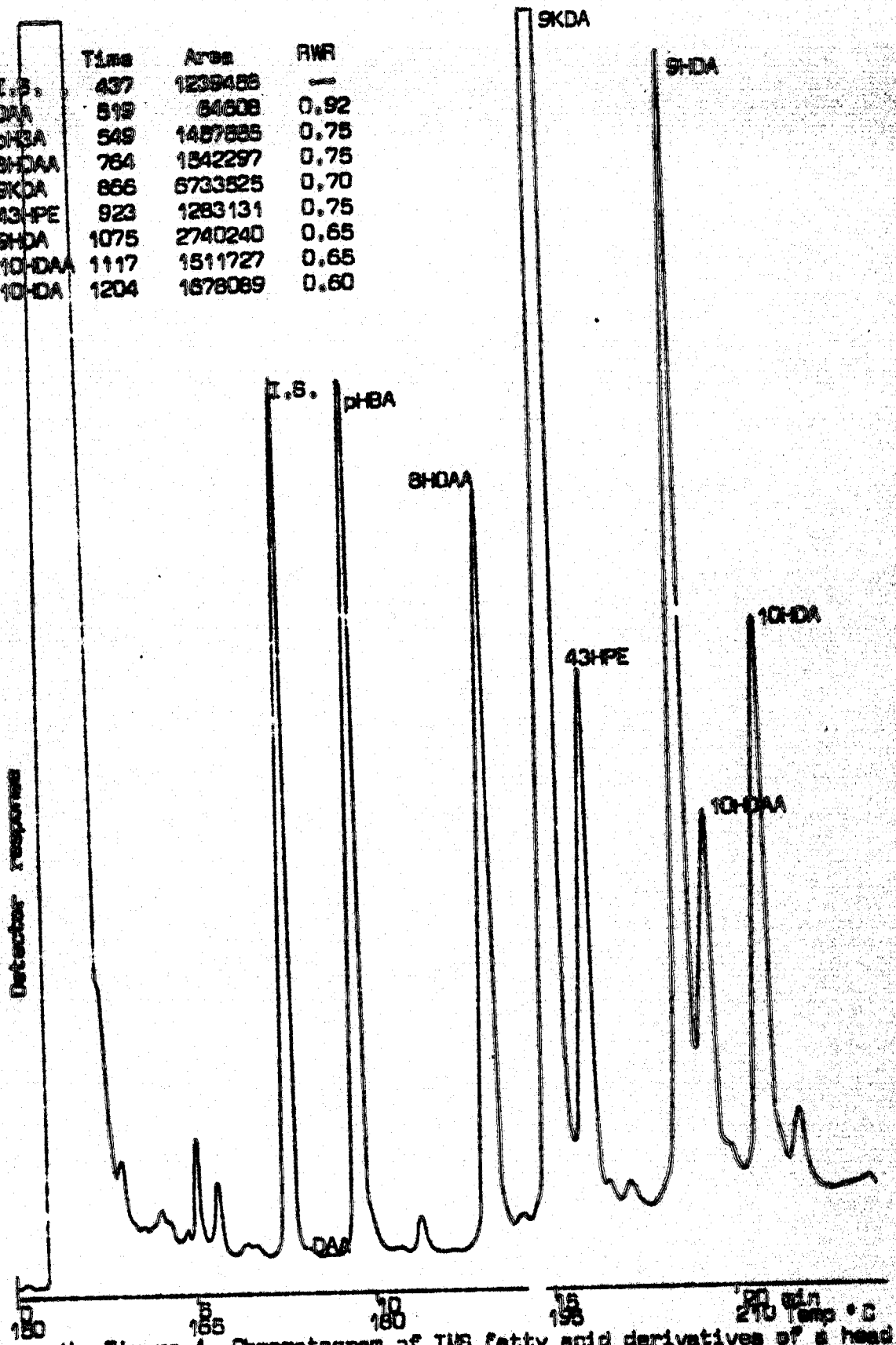
* Remains been that survived until study terminated on ninth day

Appendix Table A. Continued

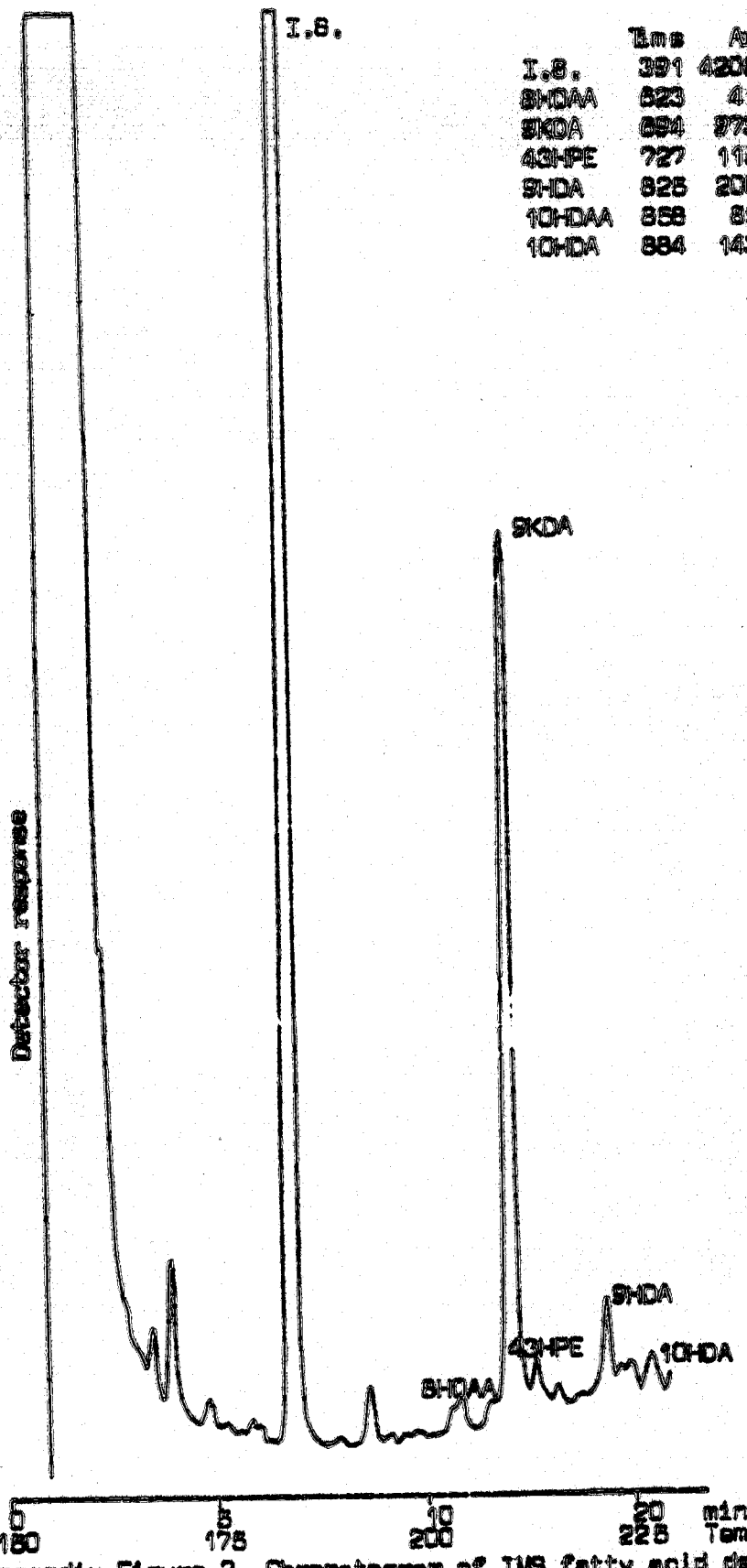
Group No	Mixture description: No. of social interactions	Social index	Age (days)	Ovariales per ovary	Percentage chemical: DAA	pHBA	BHDAA	5HDA	43HPE	5HDA	10HDAA	10HDA
6	23	5.88	9*	1/0	1.1	0.3	17.0		7.1	4.2	24.5	50.8
	15	0.98	9	5/6	3.8	0.7	7.2		2.5	7.3	21.3	58.1
	24	0.69	7	5/9	0.2		4.9		0.6	1.2	23.2	78.0
	24	0.58	9	2/5	0.2	0.2	5.3		0.6	2.6	28.7	62.7
	21	0.67	9*	5/3	3.4		20.5		8.8	6.3	29.3	31.7
7	38	-	9*	2/5	3.1		5.9		4.4	4.3	22.4	59.8
	29	0.59	9*	7/7	1.1		13.0	2.2	3.0	10.6	15.9	54.2
	29	-	9*	4/1	3.8		9.5		4.3	5.1	23.4	56.9
	45	3.30	9*	3/4	3.8		12.4		6.8	7.1	22.6	48.9
	32	0.36	8	-	0.8		4.8		1.2	1.6	25.4	66.2
8	35	0.80	7	3/4	1.6		5.5		1.5	1.1	26.5	63.8
	27	0.59	6	4/4	0.3		6.4		0.2	3.7	20.0	69.6
	52	0.67	9*	7/6	4.9		9.0		18.7	5.3	29.8	32.4
	106	1.09	9*	5/6	1.7		10.1		8.2	4.2	30.7	45.1
	87	3.25	6	-/3	0.3		4.1		1.3	1.3	24.8	69.2
9	69	16.00	9*	4/9	2.4		14.0		3.2	9.8	23.7	34.9
	46	1.37	9*	3/3	2.8		7.4		5.7	4.0	26.7	53.4
	62	0.31	9*	7/5	2.2		20.0		11.9	8.7	28.3	29.0
	45	0.16	9*	4/2	8.1		10.5		18.1	2.2	26.6	34.4
	69	0.35	8	4/5	1.3		6.4		5.9	3.3	27.6	55.5
10	57	0.85	8	4/5	1.7		12.0		0.3	3.6	22.4	60.8
	55	0.33	9*	4/2	5.8		8.0		9	4.5	28.9	39.7
	36	0.64	8	5/12	7.5		6.8		0.4	0.9	19.0	65.4
	39	1.06	9*	3/6	3.3		6.4		1.0	1.8	21.9	65.6
	33	5.05	4	3/4	-	-	-	-	-	-	-	-

* Denotes those that survived until study termination on ninth day

	Time	Area	RWR
I.S.	437	1239488	—
DAA	519	84808	0.92
pHBA	549	1457885	0.75
8HDAA	764	1542297	0.75
9KDA	866	5733525	0.70
43HPE	923	1283131	0.75
9HDA	1075	2740240	0.65
10HDAA	1117	1511727	0.65
10HDA	1204	1678089	0.60

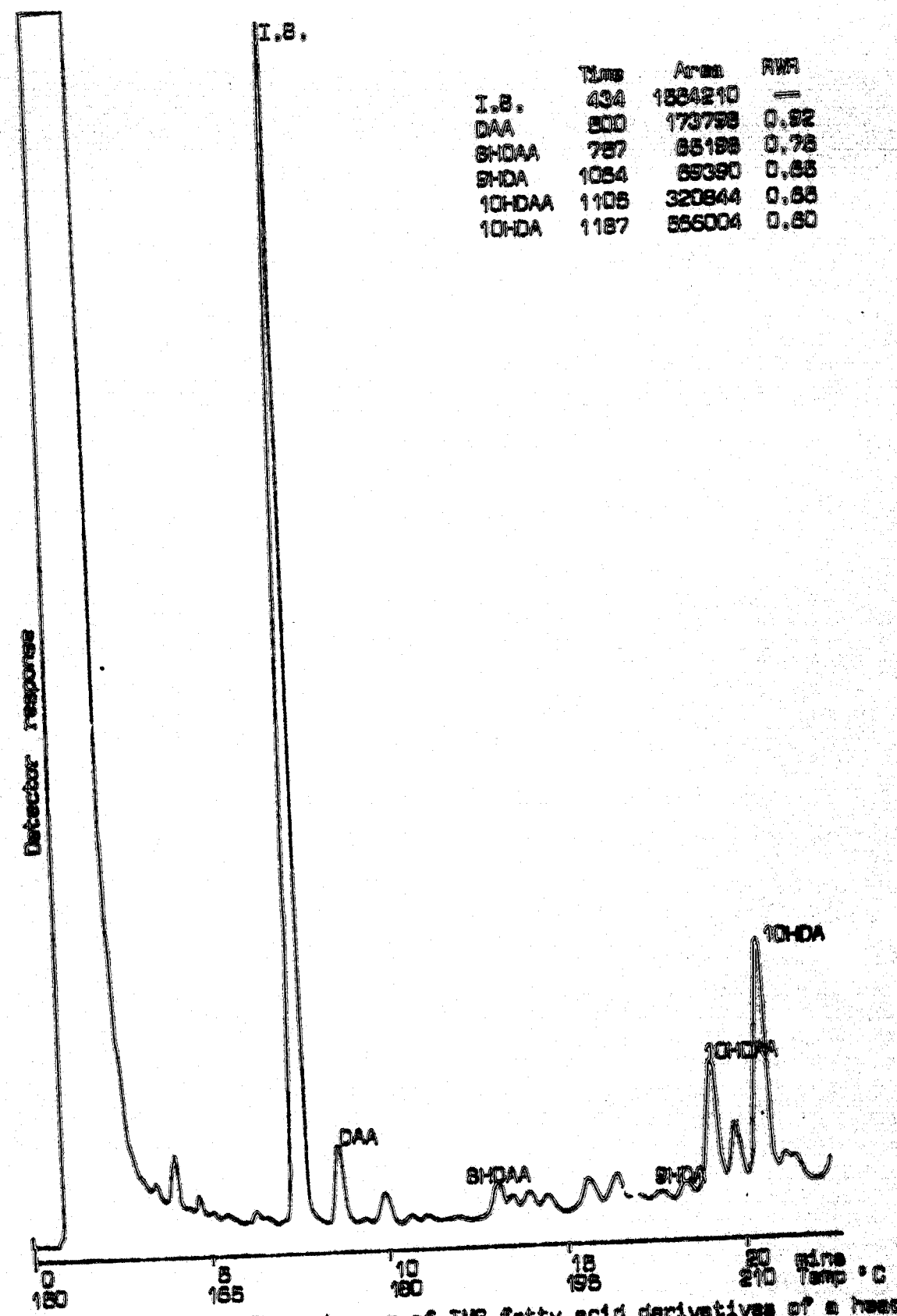


Appendix Figure 1. Chromatogram of TMS fatty acid derivatives of a head extract of an A.m.adansonii mated queen (Queen 14). Derivatization : 200µl BSTFA/CH_2Cl_2 1:1 | 150° C for 45 min. Column : 8% OV 101 on Supelcoport (80/100). Conditions : Temp. program 150-250° C at 3° / min, initial hold 0 min., carrier gas N_2, 20 ml/min. I.S. n-tetradecane 36µg/100µl CH_2Cl_2.



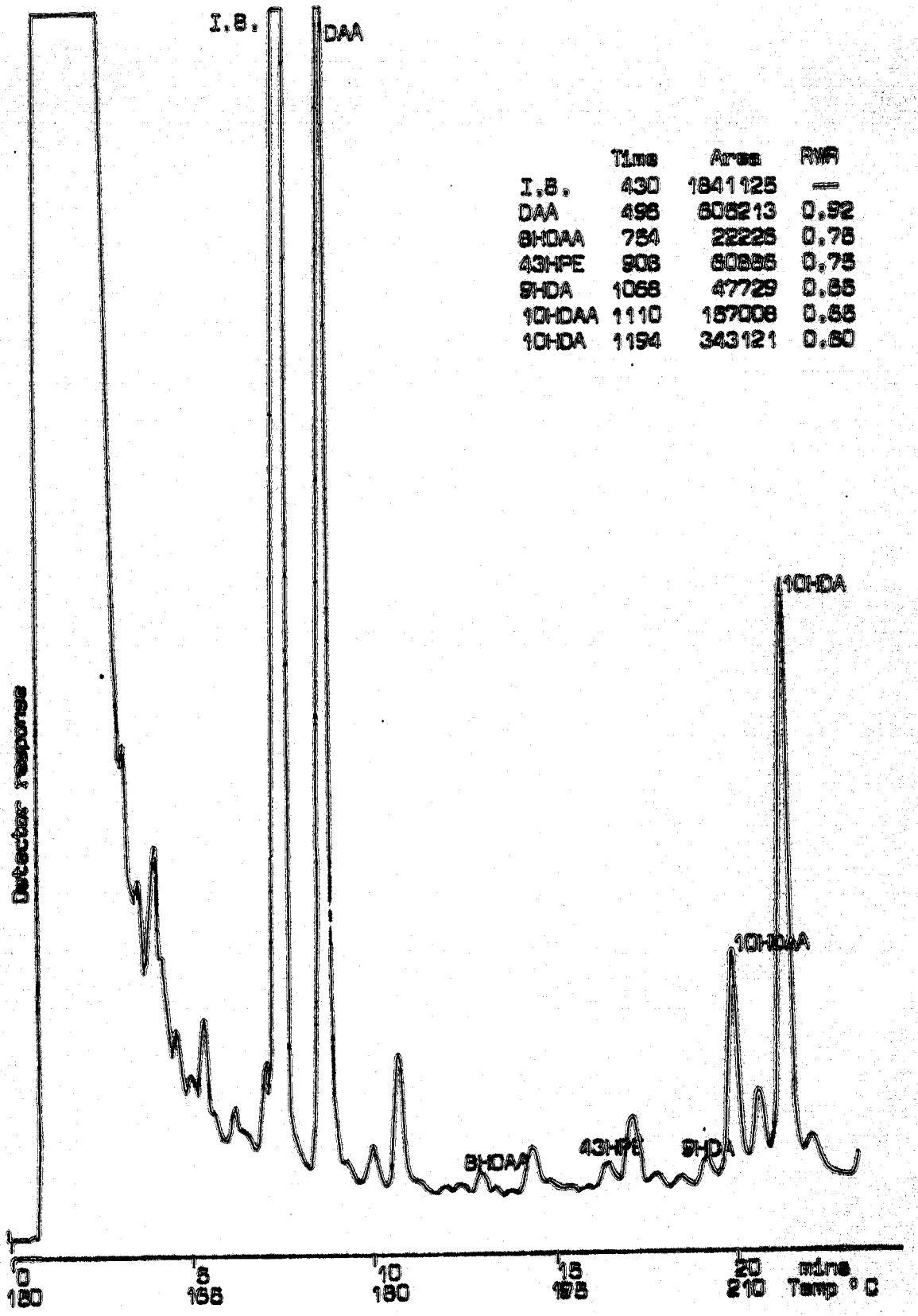
	Tms	Area	PWR
I.S.	391	4206401	—
8HDAA	823	41405	0.75
8KDA	894	973286	0.70
43HPE	727	116161	0.75
9HDA	825	200746	0.68
10HDAA	858	85079	0.88
10HDA	884	143858	0.80

Appendix Figure 2. Chromatogram of TMS fatty acid derivatives of a head extract of a queenless A.m.adansonii worker secreting 8KDA. Derivatisation : 200µl BSTFA/CH_2Cl_2 1:1 ; 150° C for 45 min. Column : 5% OV 101 on Supelcoport (80/100). Conditions : Temp. program 150-250° C at 5°/min., initial hold 0 min., carrier gas N_2 , 20ml/min. I.S. tetradecane 77µg/100µl CH_2Cl_2.



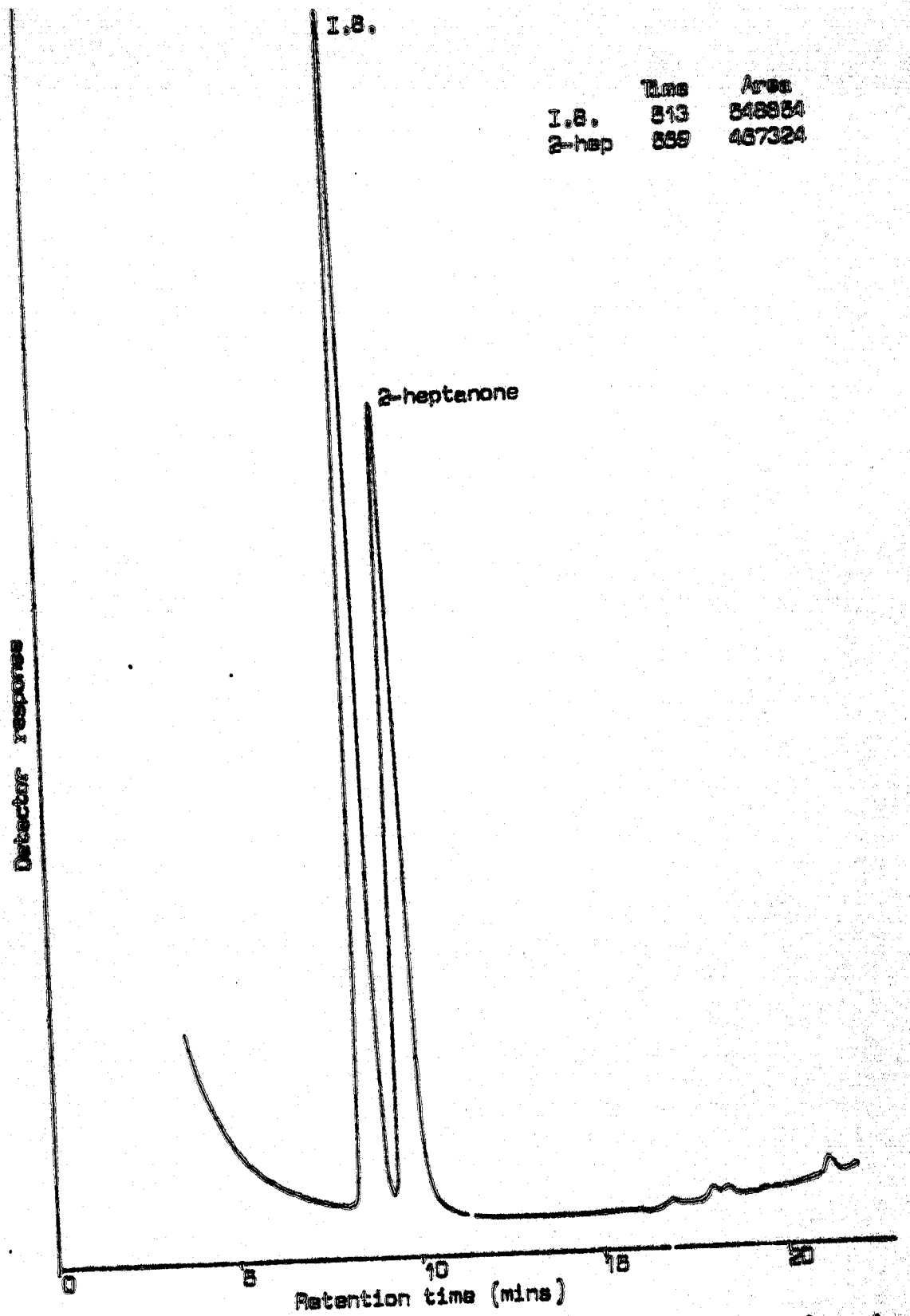
	Time	Area	RWR
I.S.	434	1564210	—
DAA	500	173758	0,92
8HDAA	757	65188	0,78
8HDA	1054	69390	0,65
10HDAA	1105	320844	0,65
10HDA	1187	556004	0,60

Appendix Figure 3. Chromatogram of TMS fatty acid derivatives of a head extract of a young queenright A.m.adansonii worker secreting very little DAA. Derivatization : 200µl BSTFA/CH_2Cl_2 1:1 ; 150° C for 45 min. Column : 5% OV 101 on Supelocoport (80/100). Conditions : Temp. program 150-250° C at 3° / min., initial hold 0 min., carrier gas N_2, 20ml/min. I.S. n-tetradecane 36µg/100µl CH_2Cl_2.



	Time	Area	RWR
I.S.	430	1841125	—
DAA	496	605213	0,92
8HDAA	754	22225	0,78
43HPE	908	60886	0,75
9HDA	1068	47729	0,65
10HDAA	1110	157008	0,65
10HDA	1194	343121	0,60

Appendix Figure 4. Chromatogram of TMS fatty acid derivatives of a head extract of an old queenright A.m.adansonii worker secreting large amounts of DAA. Derivatization : 200µl BSTFA/CH_2Cl_2 1:1 ; 150°C for 48 min. Column : 5% OV 101 on Supelcoport (80/100). Conditions : Temp program 150-250° C at 3° / min., initial hold 0 min., carrier gas N_2, 20ml/min. I.S. n-tetradecane 80.8µg/100µl CH_2Cl_2.



Appendix Figure 5. Chromatogram of a head extract of a queenless A.m. adansonii worker (D.D., D/D) in dichloromethane. Column : 10% SP-1000 on Supelcoport (80/100). Conditions : Temp. isothermal 80° C, carrier gas N_2, 20ml/min. I.S. 4-methyl-3-heptanone 28µg/80µl CH_2Cl_2.

Appendix Table 9a. A summary of the social activities of workers in Cage No. 1 (February 1980).

Social activity		Bee Number				
		1	2	3	4	5
Bee offers to others	(A)	32	19	18	22	15
Others accept offering	(B)	1	1	1	0	4
Others offer to bee	(C)	26	24	24	21	11
Bee accepts offering	(D)	0	3	2	2	0
Bee begs from others	(E)	3	9	8	11	4
Others give in response	(F)	1	5	5	6	2
Others beg from bee	(G)	10	8	8	4	5
Bee gives in response	(H)	4	5	4	2	4
Total times others feed bee	(D+F)	1	8	7	8	2
Opportunities bee had of feeding from others	(C+E)	29	33	32	32	15
Total times bee feeds others	(B+H)	5	6	3	2	8
Opportunities bee had of feeding others	(A+G)	42	27	26	26	20
Degree of Subordination		0.12	0.22	0.19	0.08	0.40
Degree of Dominance		0.03	0.24	0.22	0.23	0.13
Social Index		0.29	1.09	1.14	3.23	0.33
Age at death (days)		8	8	9*	9*	9

* Bees killed on ninth day

Appendix Table 9b. A summary of the social activities of workers in Cage No. 2 (February 1980).

Social activity		Bee Number 1	2	3	4	5
Bee offers to others	(A)	9	8	24	12	11
Others accept offering	(B)	1	1	0	2	0
Others offer to bee	(C)	11	13	8	19	13
Bee accepts offering	(D)	2	0	1	1	0
Bee begs from others	(E)	4	2	0	0	1
Others give in response	(F)	3	1	0	0	1
Others beg from bee	(G)	0	1	0	5	1
Bee gives in response	(H)	0	0	0	5	0
Total times others feed bee	(D+F)	5	1	1	1	1
Opportunities bee had of feeding from others	(C+E)	15	15	8	19	14
Total times bee feeds others	(B+H)	1	1	0	7	0
Opportunities bee had of feeding others	(A+G)	9	9	24	17	12
Degree of Subordination		0.11	0.11	0.00	0.41	0.00
Degree of Dominance		0.33	0.07	0.12	0.05	0.07
Social Index		3.00	0.60	-	0.13	-
Age at death (days)		6	7	4	7	6

Appendix Table 9c. A summary of the social activities of workers in Cage No. 3 (February 1980).

Social activity		Bee Number				
		1	2	3	4	5
Bee offers to others	(A)	40	30	70	42	29
Others accept offering	(B)	8	5	2	10	1
Others offer to bee	(C)	36	50	33	43	49
Bee accepts offering	(D)	1	7	2	4	12
Bee begs from others	(E)	14	49	46	14	25
Others give in response	(F)	9	21	15	3	18
Others beg from bee	(G)	29	23	27	39	30
Bee given in response	(H)	16	8	16	18	8
Total times others feed bee	(D+F)	10	28	17	7	30
Opportunities bee had of feeding from others	(C+E)	50	99	79	57	74
Total times bee feeds others	(B+H)	24	13	18	28	9
Opportunities bee had of feeding others	(A+G)	69	53	97	81	59
Degree of Subordination		0.35	0.25	0.19	0.35	0.15
Degree of Dominance		0.20	0.28	0.22	0.12	0.41
Social Index		0.38	1.15	1.16	0.36	2.86
Age at death (days)		9*	9*	9*	9*	9*

* Bees killed on ninth day

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