———, Barbier, M., Roger, R. 'Dosages individuels des acides cето-9 decene-2 oique et hydroxy-10 decene-2 oique dans les tetes des reines et des ouvrieres d'abeilles'. Annls. Abeille, 10(1) : 45-52, 1967.

———, Roger, B., Theurkauff, J. 'Sur l'existence d'un cycle annuel de la production de pheromone (acide ceto-9 decene-2 oique) chez les reines d'abeilles (Apis mellifera ligustica, Spinola)'. C. R. Acad. Sci. Paris (D), 275 : 2399-2402, 1972.

———, Roger, B., Theurkauff, J. 'Mise en evidence d'un cycle saisonnier de la teneur en acides ceto-9 et hydroxy-9 decene-2 oique des tetes de reines vierges d'abeille'. Apidologie, 5(4) : 319-355, 1974.

Perepelova, L.I. 'Laying workers, the egg-laying activity of the queen, and swarming'. Bee World, 10 : 69-71, 1929.

Perez, J. 'Les Abeilles'. In Traite de biologie de l'abeille, ed. R. Chauvin. Vol I, p 47, 1968.

Plowright, R.C., Jay, S.C. 'On the size determination of bumble bee castes (Hymenoptera:Apidae)'. Can. J. Zool., 55(7):1133-1138, 1977.

Rembold, H. 'Biologically active substances in royal jelly'. Vitam. Horm., 23 : 359-382, 1965.

———, Leckner, B., Geistbeck, I. 'The chemical basis of honeybee, Apis mellifera, caste formation. Partial purification of queen bee determinator from royal jelly'. J. Insect Physiol., 20(2) : 307-314, 1974.

Renner, M., Vierling,G. 'Die rolle des taschendrüsenpheromons beim hochzeitsflug der bienenkönigin'. Behav.Ecol.Sociobiol., 2 : 329-338, 1977.

Ruttner, F. 'The present Knowledge on the Taxonomy of African Races of Bees'. In African Bees: Taxonomy, Biology and Economic Use, ed. D.J.C. Fletcher. Apimondia International Symposium, Pretoria, pp 50-54, 1977.

———, Koeniger, N., Veith, H.J. 'Queen substance bei eierlegenden Arbeiterinnen der honigbiene (Apis mellifica L.)'. Naturwissenschaften, 63(9) : 434-435, 1976.

Sakagami, S.F. 'The false queen : fourth adjustive response in dequeened honeybee colonies'. Behaviour, 13 : 280-295, 1958.

———, Hayashida, K. 'Biology of the primitive social bee, Melictus duplex Dalla Torre II. Nest structure and immature stages'. Insectes Soc., 7(1) : 57-98, 1960.

Seeley, T.D. 'Queen substance dispersal by messenger workers in honeybee colonies'. Behav. Ecol. Sociobiol., 5 : 391-415, 1979.

Shearer, D.A. Loch, R. '2-heptanone in the mandibular gland secretion of the honey-bee'. Nature, Lond., 206 : 530, 1965.

———, Boch, R., Morse, R.A., Laigo, F.M. 'Occurence of 9-oxodec-trans-2-enoic acid in queens of Apis dorsata, Apis cerana and Apis mellifera'. J. Insect Physiol., 16(7) : 1437-1441, 1970.

Simpson, J. 'The function of the salivary glands of Apis mellifera'. J. Insect Physiol., 4 : 107-121, 1960.

———. 'Repellency of the mandibular gland scent of worker honey bees'. Nature, Lond., 209 : 531-532, 1966.

———. 'The existence and physical properties of pheromones by which worker honeybees recognize queens'. J. apicult. Res., 18(4) : 233-249, 1979.

Shuel, R.W., Dixon, S.E. 'Studies on the mode of action of royal jelly in honeybee development. II. Respiration of newly emerged larvae on various substrates'. Can. J. Zool., 37(5) : 803-813, 1959.

———, Dixon, S.E. 'The early establishment of dimorphism in the female honeybee, Apis mellifera L.'. Insectes Soc., 7(3) : 265-282, 1960.

Showers, R.E. 'Preliminary evaluation of honey bee (Apis mellifera L.) behaviour induced by the pheromone 9-oxodec-trans-2-enoic acid'. Am. Bee J., 107(8) : 294-296, 1967.

Smith, F.G. 'Beekeeping observations in Tanganyika'. Bee World, 39(2) : 29-36, 1958.

Spradbery, J.P. 'Wasps. An account of the Biology and Natural History of Social and Solitary Wasps'. Sidgwick and Jackson, London, 1973.

Szabo, T.I. 'Behavioural studies on queen introduction in the honeybee. 2. Effect of age and storage conditions of virgin queens on their attractiveness to workers'. J. apicult. Res., 13(2) : 127-135, 1974a.

———, 'Behavioural studies on queen introduction in honey bees. 4. Introduction of queen models into honey bee colonies'. Am. Bee J., 114(5) : 174-176, 1974b.

Taber, S.III, Poole, H. 'Caste determination in honeybees : The production of Queen-Worker intermediates'. J. apicult. Res., 12(2) : 111-116, 1973.

Thompson, P.R. 'Histological development of cuticle in the worker honeybee, Apis mellifera adansonii'. J. apicult. Res., 17(1) : 32-40, 1978.

Tribe, G.D., Fletcher, D.J.C. 'Rate of development of the workers of Apis mellifera adansonii L.'. In African Bees : Taxonomy, Biology and Economic Use, ed. D.J.C. Fletcher. Apimondia International Symposium, Pretoria, pp115-119, 1977.

Velthuis, H.H.W. 'Queen substances from the abdomen of the honey bee queen'. Z. vergl. Physiol., 70 : 210-222, 1970a.

———. 'Ovarian development in Apis mellifera worker bees'. Entomologia exp. appl., 13 : 377-394, 1970b.

———. 'Observations on the transmission of queen substances in the honey bee colony by the attendants of the queen'. Behaviour, 41 : 105-129, 1972.

———. 'Egg laying, Aggression and Dominance in bees'. Proc. XVth Int. Congr. Entomol., Washington D.C., pp 436-449, 1976.

———, Es, J. van. 'Some functional aspects of the mandibular glands of the queen honeybee'. J. apicult. Res., 3(1) : 11-16, 1964.

———, Verheijen, F.J., Gattenbos, A.J. 'Laying worker honey bee : similarities to the queen'. Nature, Lond., 207 : 1314, 1965.

———, Clement, J., Morse, R.A., Laigo, F.M. 'The ovaries of Apis dorsata workers and queens from the Philippines'. J. apicult. Res., 10(2) : 63-66, 1971.

Verheijen-Voogd, C. 'How worker bees perceive the presence of their queen'. Z. vergl. Physiol., 41 : 527-582, 1959.

Vierling, C., Renner, M. 'Die bedeutung des [illegible] der tergitteschen- [illegible]sen für die attraktivität der bienenkönigin gegenüber jungen [illegible]beiterinnen'. Behav. Ecol. Sociobiol., 2 : 185-200, 1977.

Voogd, S. 'Inhibition of ovary development in worker bees by extraction fluid of the queen'. Experientia, 11(5) : 181-182, 1955.

Wang, Der-I. 'Growth rates of young queen and worker honeybee larvae'. J. apicult. Res., 4(1) : 3-5, 1965.

Weaver, N. 'Rearing of Honeybee larvae on Royal Jelly in the laboratory'. Science, N.Y., 121 : 509 - 510 , 1955.

———. 'Ovarian development of worker honey bees'. J. econ. Ent., 49(6) : 854-857, 1956.

———. 'Effects of larval age on dimorphic differentiation of the female honeybee'. Ann. ent. Soc. Am., 50(3) : 283-294, 1957.

———. 'Control of dimorphism in the female honeybee'. Science, N.Y., 138 : 995, 1962.

———. 'The threat of Africanized bees to North America'. In African Bees : Taxonomy, Biology and Economic Use, ed. D.J.C. Fletcher. Apimondia International Symposium, Pretoria, pp 63-66, 1977.

Weiss, K. 'Mechanism of the caste formation in the honey bee, Apis mellifica L.'. Apidologie, 9(3) : 223-258, 1978.

West Eberhard, M.J. 'The evolution of social behaviour by kin selection'. Q. Rev. Biol., 50(1) : 1-33, 1975.

Wiese, H. 'Apiculture with Africanized bees in Brazil'. In African Bees : Taxonomy, Biology and Economic Use, ed. D.J.C. Fletcher. Apimondia International Symposium, pp 67-76, 1977.

Wilde, J. de. 'Juvenile hormone and caste differentiation in the honey bee (Apis mellifera L.)'. In Phase and Caste Determination in Insects, Endocrine Aspects, ed. M. Luecher. XVth Inter. Cong. Entomol., Washington D.C., pp 5-20, 1976.

Williams, I.H., Free, J.B. 'Effect of environmental conditions during the larval period on the tendency of worker honeybees to develop their ovaries'. J. Ent. (A), 49(2) : 179-182, 1975.

Wilson, E.O. 'The Insect Societies'. Harvard Univ. Press, Camb., Mass., 1971.

———. 'Sociobiology : The New Synthesis'. Harvard Univ. Press, Camb., Mass., 1975.

Winston M.L., Otis, G.W. 'Ages of bees in swarms and afterswarms of the Africanized honeybees'. J. apicult Res., 17 : 123-129, 1978.

Wirtz, P. 'Differentiation in the honeybee larva', Meded. Landb. Hoogsch. Wageningen, Netherlands, 73(5) : 155 pp Thesis, 1973.

———, Beetsma, J. 'Induction of caste differentiation in the honeybee (Apis mellifera L.) by juvenile hormone'. Entomologia exp. appl., 15 : 517-520, 1972.

Woyke, J. 'Correlations between the age at which honeybee brood was grafted, characteristics of the resultant queens, and results of insemination'. J. apicult. Res., 10(1) : 45-55, 1971.

Yadava, R.P.S., Smith, M.V. 'Aggressive behaviour of Apis mellifera L. workers towards introduced queens. I. Behavioural mechanisms involved in the release of worker aggression'. Behaviour, 39 : 212-236, 1971a.

———, Smith, M.V. 'Aggressive behaviour of Apis mellifera L. workers towards introduced queens. II. Role of the mandibular gland contents of the queen in releasing aggressive behaviour'. Can. J. Zool., 49 : 1179-1183, 1971b.

———, Smith, M.V. 'Aggressive behaviour of Apis mellifera L. workers towards introduced queens. III. Relationship between the attractiveness of the queen and worker aggression'. Can. J. Zool., 49 : 1359-1362, 1971c.

Zander, E., Becker, F. 'Die Ausbildung des Geschlechtes bei der Honigbiene'. Erlenger J. Bienenk., 3 : 161-246, 1925.

Zmarlicki, C., Morse, R.A. 'The effect of mandibular gland extirpation on the longevity and attractiveness to workers of queen honey bees, Apis mellifera L.'. Ann. Ento. Soc. Am., 57(1) : 73-74, 1964.

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 mead extracts of groups of queenright *A.m. adansonii* workers (November 1978)

Maybee description		Percentage chemical (average of 5 heads)							
Age	Sample no.	DAA	pHBA	4HBAA	5HDA	4,5HPE	5HOA	10HDAM	10HDA
0–48 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		10.8	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	15.8	1.6	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	12.8		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	OAA	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	0.6	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	11.5	4.2	17.4	49.4
8	1	7	2/3*	2.2	1.5	2.6		4.2	12.8	5.1	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

* Same worker showing laying behaviour

Appendix Table 3. Continued

Marker description				Total chemical (µg/head)								
Age (days)	Heads/ sample	Queenless period (days)	Ovarial development	DAA	pHBA	8HDAA	9KDA	4,5HPE	9HDA	10HDAA	10NDA	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
13	2	13	1/1	1.8		3.4		4.4	6.1	8.2	4.6	28.4
13	1	13	3/2*	4.0		5.5		6.4	8.4	8.9	6.9	37.9
28	1	13	3/2	1.6		6.5		6.4	8.4	12.1	6.6	43.9
28	1	13	4/4*	4.5	1.4	1.7		2.8	4.0	11.4	4.3	25.5
28	1	13	4/4	1 4		10.4		8.3	9.6	18.7	8.5	61.4
5	5	*	0/0	1.8	0.9	4.0		4.3	6.1	2.6	17.0	35.3
5	5	*	0/0	1.4	0.9	5.3		6.1	8.4	3.8	20.7	47.1
10	7	*	1/1			3.6		4.5	8.4	3.7	6.1	28.7
10	2	*	3/2	2.6		1.2		2.0	4.3	4.2	3.6	15.2
20	3	*	0/0	18.7		5.2		5.6	8.8	9.1	6.7	38.0
20	2	*	2/2	3.1	0.4	4.3		4.3	5.7	3.5	4.5	33.6
28	1	*	1/1	6.9		5.8		6.5	9.2	5.1	6.6	36.3
28	2	*	0/0	13.6	2.1	11.8		11.2	16.2	23.9	11.8	83.0
56	5	*	0/0	20.8	0.8	2.0		7.6	10.8	15.2	10.9	60.8
56	2	*	1/1	18.1	1.8	5.1		4.1	10.3	6.3	10.2	59.7
56	1	*	2/2	12.5		8.6		7.7	11.0	19.5	20.2	85.2
						10.7		8.7	10.4	20.5	11.7	74.6

* Some ovum showing laying behaviour

Appendix Table 3. Continued

Marker description				Total chemical (µg/head)								
Age (days)	Heads/ sample	Gynaneae period (days)	Ovarial development	DAA	pHBA	BHDAA	9KDA	4,5EPE	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	10.8	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	18.9	1.7	10.2		5.6	10.3	27.5	35.5	101.6

Appendix Table 3. Continued

Age (days)	Worker description: Hands/sample	Worker description: Queenless period (days)	Worker description: Ovarial development	Total chemical (µg/hr): DAA	pHBA	BHBAA	9HDA	4-3HPE	9HDA	10HDAA	10:HDA	Total secretion
54	1	18	0/0	14.0		4.5		7.7	11.5	26.7	9.9	74.4
14	5	18	0/0	2.6	1.1	5.8		6.4	9.2	4.1	7.7	36.0
15	2	18	0/0	1.5	0.9	2.4		5.8	6.5	8.9	13.9	39.2
15	1	18	1/1	3.2		4.8		8.8	11.5	10.9	46.8	85.3
25	2	18	0/0	8.1		3.3		7.5	5.5	8.2	7.4	36.1
25	3	18	1/1	11.1	1.5	4.6		4.3	9.3	7.6	44.2	82.5
28	10	28	-	4.3	0.4	4.3	2.8	3.8	7.7	9.7	7.8	41.5
28	10	28	-	3.7	1.0	4.5	3.0	3.6	22.5	15.3	10.8	63.6
28	10	28	-	3.4	0.2	2.3	1.8	1.8	5.1	2.5	4.1	21.0
28	10	28	-	6.1		4.2	3.2	3.7	9.0	8.3	8.3	42.8
28	10	28	-	2.7	0.2	1.9	1.7	1.9	4.5	3.7	3.8	19.6
36	11	28	-	8.0	1.3	4.1	3.1	3.4	8.3	13.9	12.9	54.9
36	11	28	-	4.4	1.2	4.8	3.8	4.3	10.0	8.5	9.1	46.1
36	11	28	-	6.1	1.1	3.6	2.7	4.0	8.1	7.3	6.9	39.9
43	1	28	4/4	3.1		8.4		5.3	8.7	12.0	14.0	51.1
43	4	28	1/2/3	15.2	1.2	5.1		3.2	7.4	11.1	9.8	52.4
43	4	28	1/2/3	15.9	1.4	6.7		3.3	9.5	12.4	9.7	58.8
43	4	28	1/2/3	19.1	1.6	7.4		3.4	10.6	13.9	8.8	64.0
43	8	28	0/1/2	21.7	1.9	6.5		4.0	12.8	12.0	13.3	72.1
43	9	28	-	5.3	1.2	5.8		4.2	10.9	10.1	19.8	57.4
50	4	28	1/2/3	7.2	0.4	6.0		3.8	10.8	12.2	6.4	40.8
50	8	28	0/1/2	25.7	2.0	11.7	4.7	13.3	27.1	23.9	32.5	140.9
50	9	28	-	13.0		5.7	4.6	10.9	15.1	23.8	18.6	91.6
50	4	28	-	9.9	0.5	8.3		4.7	15.6	17.3	14.8	71.0
57	5	28	1/2/3	8.5		8.4		2.7	10.4	15.4	4.5	49.9
57	7	28	0/1/2	16.0	1.7	8.0		4.5	13.3	10.9	1'	65.8
57	1	28	4/4	4.5		3.9		2.5	2.9	14.8	18.3	47.2
57	1	28	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

Age (days)	Moults/ sample	Ecdysteroid period (days)	Ovarial development	Percentage chemical							
				DAA	pHBA	4HBAA	5HDA	4,5HPE	5HOA	10HDAA	10HDA
14	5	12	0/0	7.1	3.1	13.8		17.8	25.5	11.3	21.3
15	2	12	0/0	3.9	2.4	6.2		12.6	16.7	22.8	35.4
15	1	12	1/1	3.8		5.7		18.3	13.5	12.8	53.9
15	2	12	0/0	22.4		9.1		9.8	15.2	22.9	20.6
15	3	12	1/1	13.4	1.8	5.6		5.2	11.3	9.2	53.6
15	1	12	0/0	18.9		6.1		10.4	15.5	35.9	13.3
21	2	18	-	10.5	1.1	11.7	6.9	9.1	18.6	23.4	18.8
21	2	18	-	5.8	1.6	7.1	4.8	5.7	35.3	24.8	15.6
21	2	18	-	15.9	1.2	18.9	8.3	8.4	24.2	11.7	19.3
21	2	18	-	14.3		9.9	7.6	8.5	21.1	19.3	19.3
21	2	18	-	13.4	1.0	9.8	8.5	9.7	23.3	18.7	15.5
21	2	18	-	14.5	2.3	7.6	5.6	6.2	15.1	25.3	23.5
21	2	18	-	9.5	2.5	10.4	8.3	9.3	21.7	18.5	19.8
21	1	18	-	15.3	2.8	9.8	6.9	10.8	20.4	18.2	17.3
43	4	6	4/4	6.8		16.3		18.3	16.9	23.3	27.2
43	5	6	1/2/3	23.9	2.5	11.6		5.3	16.6	21.7	12.5
43	4	6	1/2/3	29.0	2.4	9.8		6.1	14.2	21.2	17.3
43	4	6	1/2/3	27.1	2.3	11.3		5.7	16.1	21.8	16.5
43	3	6	0/1/2	30.1	2.5	9.0		5.5	17.8	16.7	18.4
43	5	6	-	9.5	2.1	10.1		7.3	18.9	17.5	34.5
43	4	6	1/2/3	15.5	0.8	12.9		8.2	23.1	26.0	13.6
43	3	6	0/1/2	18.2	1.4	8.3	3.3	9.4	19.2	17.0	23.1
43	4	6	-	14.1		6.2	5.0	11.9	16.5	25.9	20.5
57	5	12	-	13.9	8.7	11.7		6.5	21.9	24.4	20.9
57	7	12	1/2/3	17.0		16.9		5.4	28.8	31.8	9.8
57	1	12	0/1/2	24.3	2.6	12.1		6.8	28.1	16.6	17.6
57	1	12	4/4	5.4		8.3		5.3	6.2	31.3	39.5
			4/4	18.7	1.6	18.8		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

Number description			Percentage chemical							
Heads/ sample	Ovarial development	Ovarioles per ovary	DAA	pHBA	BHPBA	5HDA	4,5HPE	5HDA	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	16.3	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
2	3/3	5/5	11.8	2.8	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	-	-	18.6	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	67.8
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)

Cage No.	Worker description: No. of social interactions	Social index	Age (days)	Ovarioles per ovary	Percentage chemical: 9HA	9HDA	9HDAA	9HDA	4,3MPE	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	4.8	0.4	5.3		2.2	5.8	14.1	68.3
	37	1.25	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	70.8
	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	3.3	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
	45	0.86	9*	6/6	2.2	1.2	17.7	3.3	8.7	10.2	21.5	35.1
	30	0.52	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	1.8	1.2	11.3		3.7	4.1	23.8	54.3
	62	1.46	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	1.85	9*	3/3	4.5		12.9		7.2	7.0	38.6	28.8
	18	1.62	6	6/8	1.7		1.8		0.3	0.9	21.4	73.8

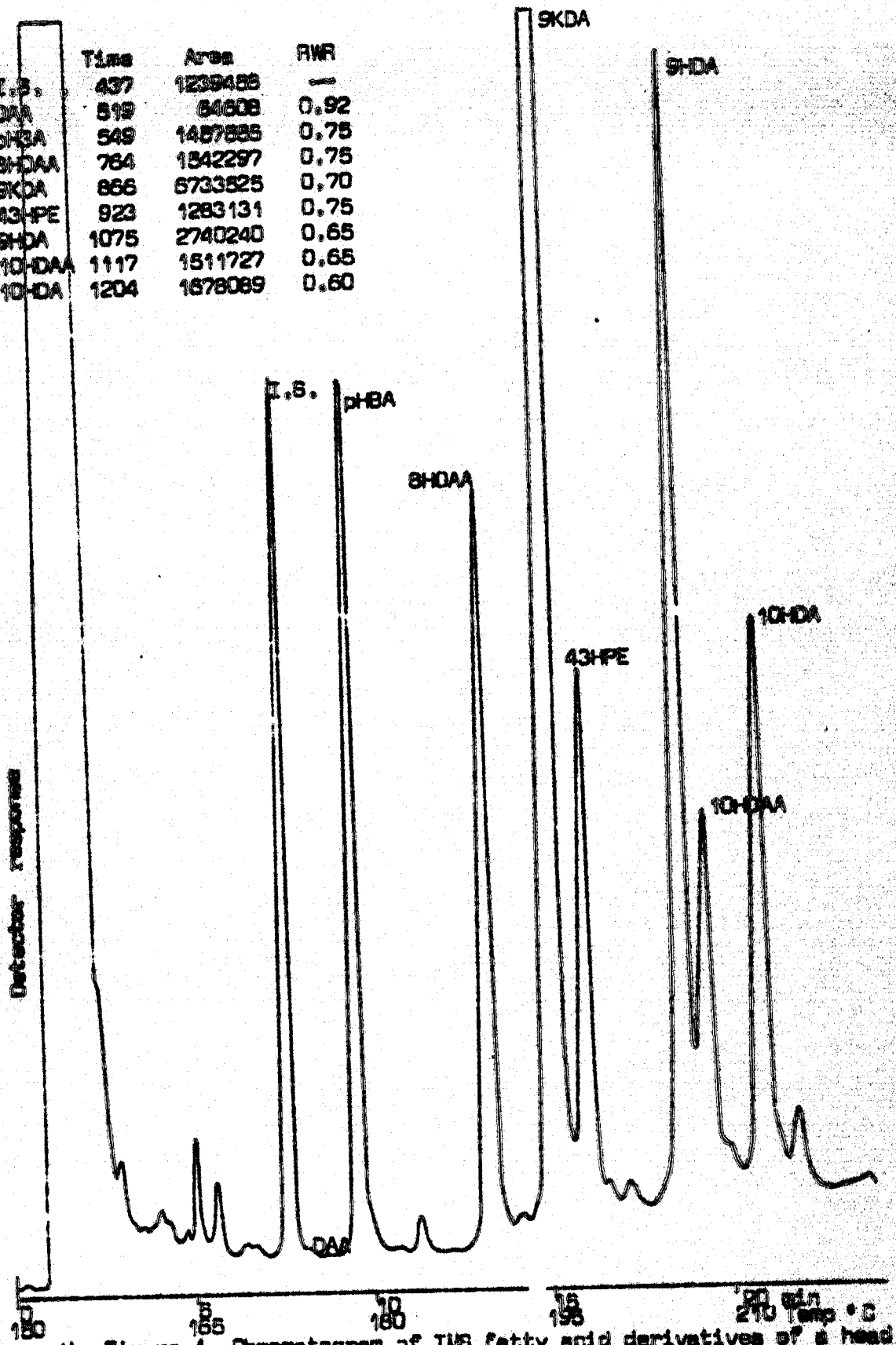
* Females knew that survivors until shortly terminated on ninth day

Appendix Table A. Continued

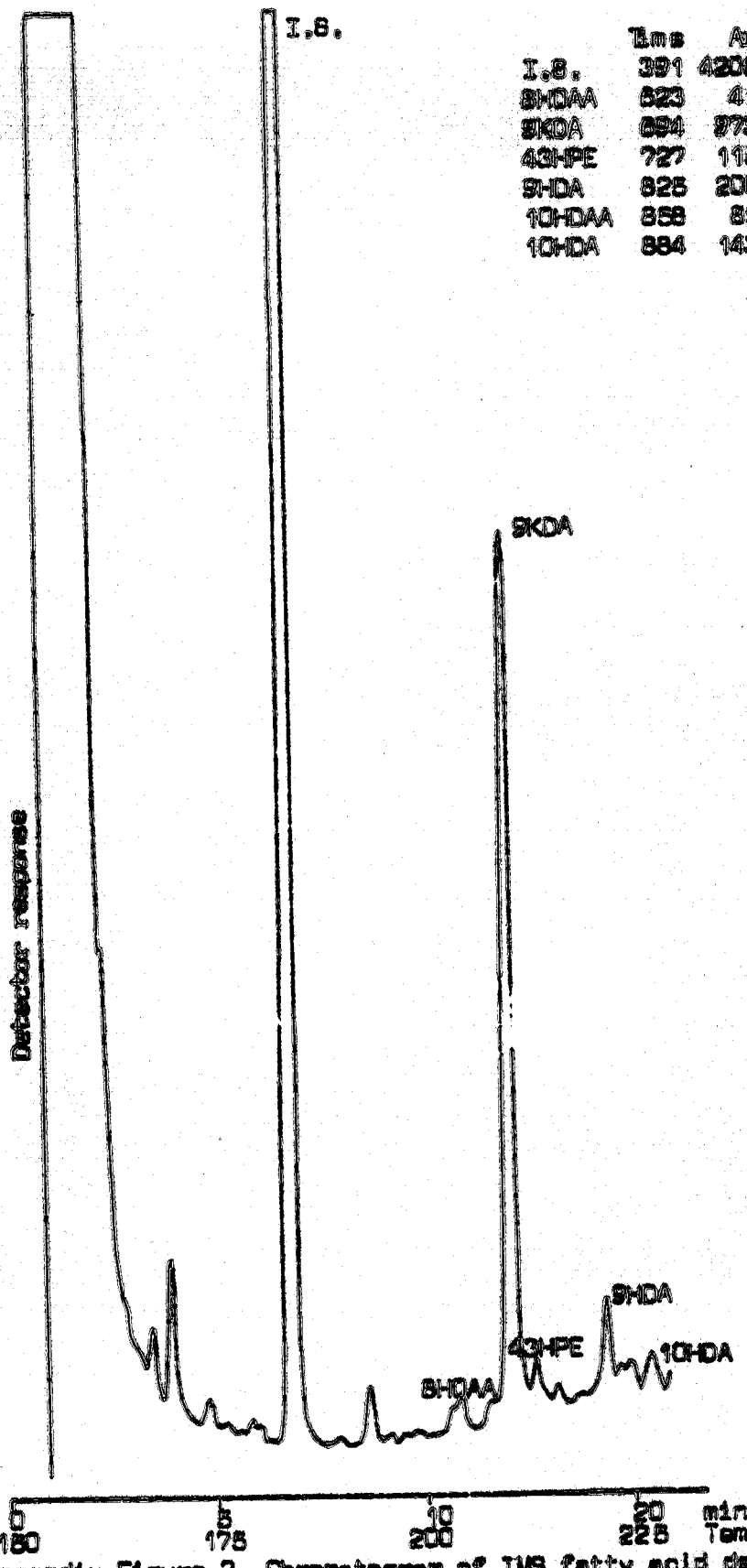
Group No	Mixture description: No. of social interactions	Social index	Age (days)	Ovariales per ovary	Percentage chemical: DAA	pHBA	BHDAA	5HDA	43HPE	5HDA	10HDAA	10HDA
6	23	5.88	9*	1/0	1.1	0.3	17.0		7.1	4.2	24.5	50.8
	15	0.98	9	5/6	3.8	0.7	7.2		2.5	7.3	21.3	58.1
	24	0.69	7	5/9	0.2		4.9		0.6	1.2	23.2	78.0
	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

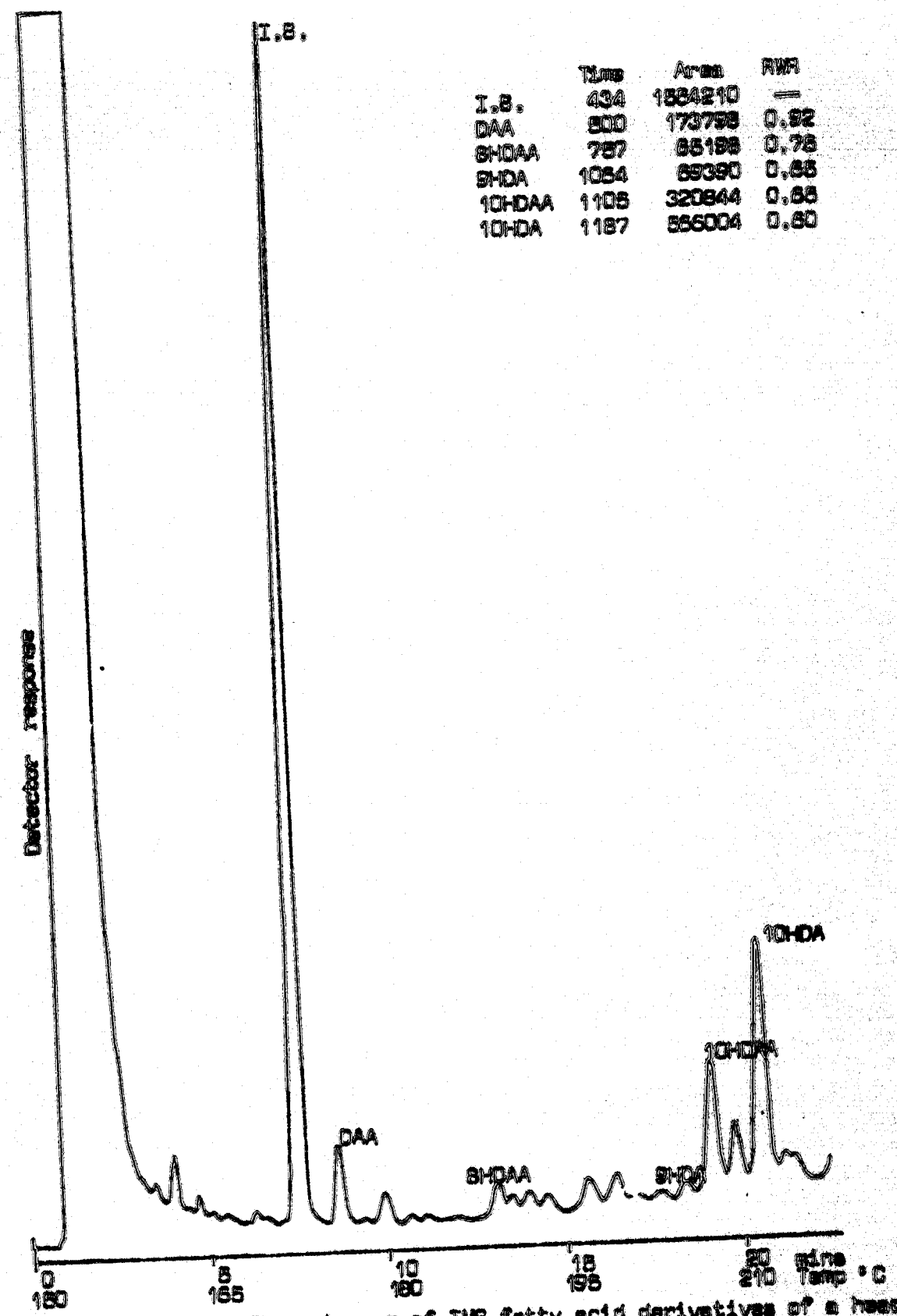


Appendix Figure 1. Chromatogram of TMS fatty acid derivatives of a head extract of an A.m.adansonii mated queen (Queen 14). Derivatization : 200µl BSTFA/CH_2Cl_2 1:1 | 150° C for 45 min. Column : 8% OV 101 on Supelcoport (80/100). Conditions : Temp. program 150-250° C at 3° / min, initial hold 0 min.,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



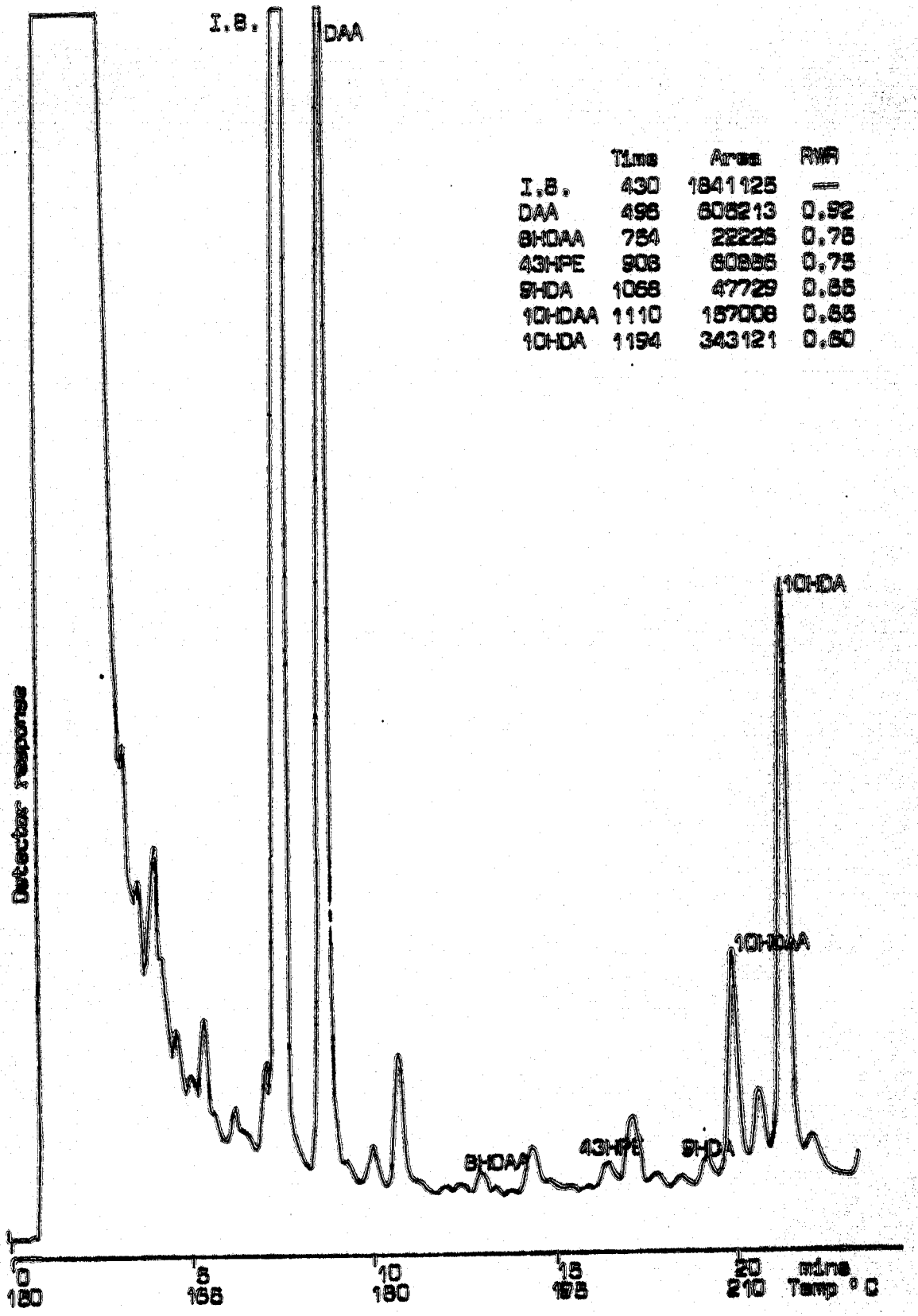
	Tms	Area	PWR
I.S.	391	4206401	—
8HDAA	823	41405	0.75
8KDA	894	973286	0.70
43HPE	727	116161	0.75
9HDA	825	200746	0.68
10HDAA	858	85079	0.88
10HDA	884	143858	0.80

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.



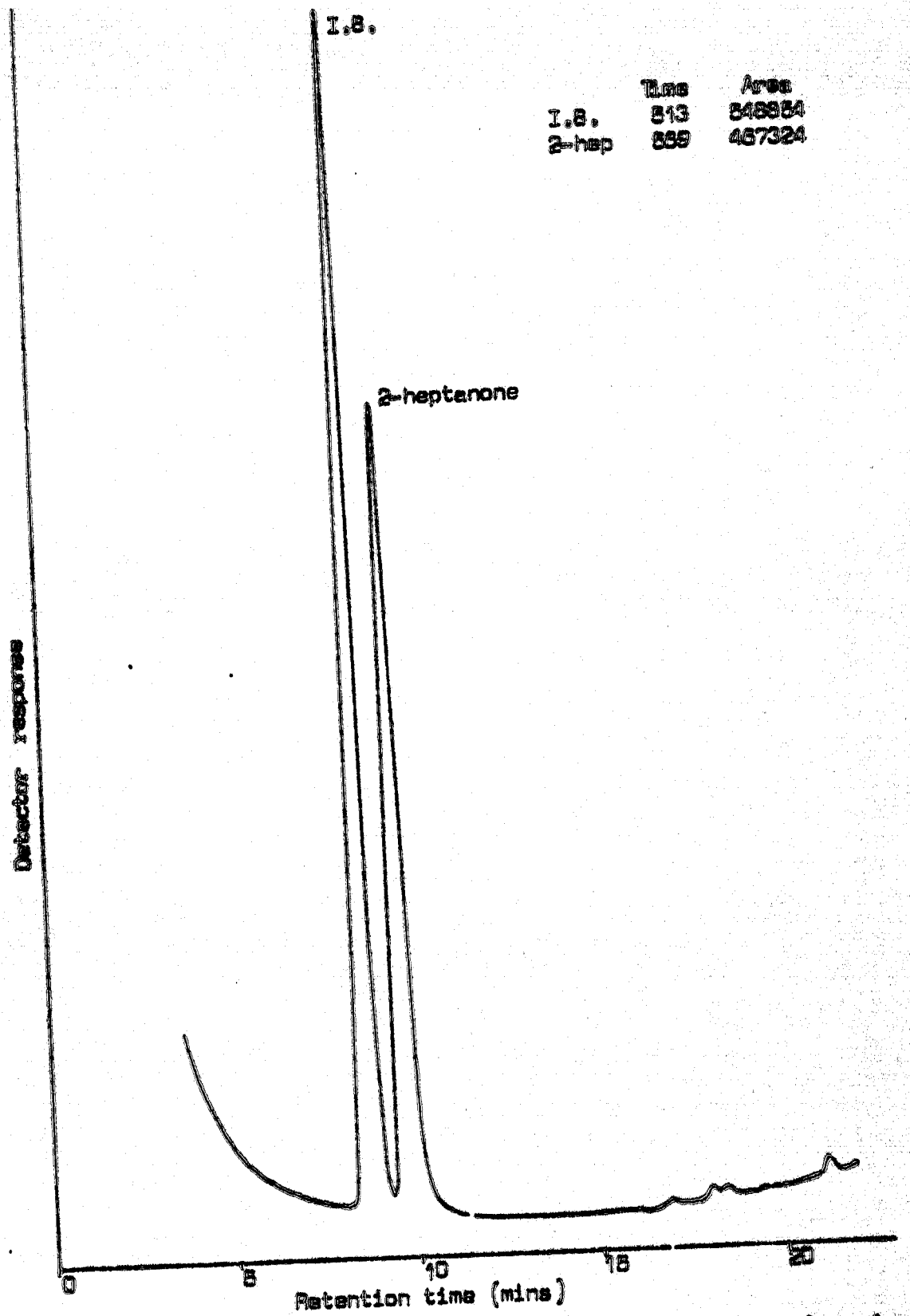
	Time	Area	RWR
I.S.	434	1564210	—
DAA	500	173758	0,92
8HDAA	757	65188	0,78
8HDA	1054	69390	0,65
10HDAA	1105	320844	0,65
10HDA	1187	556004	0,60

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