

Contents

1	The Hover Wasps	1
1.1	The Stenogastrinae: Genera and Species	1
1.2	A Brief History of the Studies on Hover Wasps	4
1.3	The Other Social Wasps	14
1.3.1	Polistinae	14
1.3.2	Vespiniae	20
	References	22
2	Morphology and Anatomy	27
2.1	Morphology and Anatomy of the Adults	27
2.1.1	The Head	29
2.1.2	The Thorax	32
2.1.3	The Gaster	34
2.2	Internal Anatomy	40
2.2.1	Alimentary System	40
2.2.2	Reproductive System	42
2.2.3	Other Exocrine Glands	47
2.3	Morphology and Anatomy of the Immature Stages	48
2.3.1	The Egg	48
2.3.2	The Larva	50
2.3.3	The Pupa	54
2.3.4	Duration of Immature Development	54
	References	58
3	Behaviour	61
3.1	Female and Male Behavioural Patterns	61
3.2	Ethological Characters of Hover Wasps	62
3.3	Presence On and Absence Off the Nest	63
3.4	Elementary Behaviours	64
3.4.1	Resting	64
3.4.2	Self-grooming	66
3.4.3	Self-feeding	67

3.4.4	Flight	67
3.4.5	Defecation	67
3.4.6	Mating and Related Behaviours	68
3.5	Colony Maintenance Behaviours	72
3.5.1	Defence from Predators and Parasites	72
3.5.2	Collection of Abdominal Secretion and Oviposition	74
3.5.3	Larval Care	78
3.5.4	Foraging	79
3.5.5	Collection of Nest Material and Nest Construction	81
3.5.6	Ant Guard Construction	81
3.6	Social Behaviour	81
3.6.1	Food Exchange	81
3.6.2	Dominance–Subordinance	83
3.6.3	Fighting	83
3.6.4	Male Clustering	84
	References	85
4	Colonial Dynamics	89
4.1	Factors Influencing Colony Dynamics	89
4.1.1	The Environment	90
4.2	Colony Development	97
4.2.1	Colony Size	97
4.2.2	Nest Foundation	99
4.2.3	Colony Cycle	101
4.3	Individual Life Histories	106
4.3.1	Alternative Behavioural Strategies and Group Social Structure	108
4.3.2	To Leave or Stay?	108
4.4	Colonial Genetic Structure	112
4.4.1	Adult Female Relatedness	112
4.4.2	Brood Relatedness	113
4.5	To Co-breed or Not to Co-breed?	114
4.5.1	Factors Influencing Reproductive Partitioning	115
4.6	Helping and Alloparental Care: To Collaborate or Not to Collaborate?	116
4.6.1	Dominance Hierarchies	117
4.7	The “Decision Tree” and “Social Trajectories” in Hover Wasps	122
	References	123
5	Social Communication	129
5.1	Communication in Social Insects	129
5.2	Channels for Information Transfer	129

5.3	Social Communication in Hover Wasps	130
5.3.1	Adults–Immature Brood Interactions	130
5.3.2	Adult–Adult Interactions	131
	References	145
6	The Nest of Hover Wasps	149
6.1	General Characteristics of Social Wasp Nests	149
6.2	The Nests of Stenogastrinae	152
6.2.1	Nest Architecture	152
6.2.2	Intra and Interspecific Variability	153
6.2.3	Stenogaster	154
6.2.4	Anischnogaster	156
6.2.5	Liostenogaster	157
6.2.6	Parischnogaster	179
6.2.7	Eustenogaster	190
6.2.8	Metischnogaster	202
6.3	The Nest as a Defence for the Immature Brood	204
6.3.1	Nidification Sites	204
6.3.2	Nest Camouflage	204
6.3.3	Ant Guards	205
6.3.4	Limiting Access to the Cells	213
6.3.5	Nest Clustering	214
6.4	Materials and Instruments	217
6.5	The Nest as a Tool	222
6.6	The Evolution of Nest Architecture	224
6.6.1	Nests and Speciation	226
	References	227
7	The Evolution of Social Behaviour in Insects and the Hover Wasps	233
7.1	Eusociality	233
7.2	Social Insects	235
7.3	Evolution of Social Behaviour	236
7.3.1	The Biological Altruism Problem	236
7.3.2	Importance of Kinship	236
7.3.3	Hamilton and Inclusive Fitness	237
7.3.4	Hypotheses on Social Evolution in Insects	238
7.3.5	The Evolution of Caste Polymorphism	239
7.3.6	Towards a Social Concept of the Organism	240
7.4	Social Wasps and Their Importance in the Study of the Evolution of Sociality	241
7.5	The Evolution of Social Behaviour in Hover Wasps	244
7.5.1	Foreword	244
7.5.2	Hover Wasp Sociality	245
7.5.3	Predisposition to Sociality	247

7.5.4 Social Decisions: Whether or Not to Disperse 247

7.5.5 To Breed or Not to Breed 252

7.5.6 To Help or Not to Help 253

7.5.7 Limiting Factors of the Social Evolution
of Hover Wasps 254

7.5.8 Caste Differentiation 255

7.5.9 Some Considerations on the Evolution of Eusociality
in Wasps 256

7.6 Future Studies of Hover Wasps 258

References 258

Index 265