

Contents

Preface	V
1 Introduction	1
2 Spermatogenesis	3
2.1 General considerations	3
2.2 First division	3
2.3 Fate of the nuclear membrane	7
2.4 Second division	7
2.5 Spermatogenesis in diploid males	8
2.6 Reported deviations from the usual type of hymenopteran spermatogenesis	9
2.7 Sperm polyphenism	10
3 Oogenesis	11
3.1 General considerations	11
3.2 Normal oogenesis	11
3.3 Oogenesis of polyploid <i>Nasonia vitripennis</i>	14
3.4 Thelytoky: general considerations	15
3.5 Thelytoky: discussion	16
4 DNA content in somatic cells	18
5 Sex-determination	20
5.1 General considerations	20
5.2 Multiple alleles at a single locus	20
5.3 Nucleocytoplasmic balance	20
5.4 Genic balance	21
5.5 Battaglia's scheme	21
5.6 Multiple locus	22
5.7 5.7.1 Bracon	23
5.7.2 Apis	24
5.7.3 Meliponine bees	24
5.7.4 Bombus	24
5.7.5 Pseudolasius	25
5.7.6 Neodiprion nigroscutum	25

5.7.7	Melittobia	25
5.7.8	Nasonia	26
5.7.9	Two thelytokous species	27
5.8	Distinguishing between the hypotheses.	28
5.9	Population genetic implications of the multiple-locus theory	29
5.10	Origins of sexual mosaics	30
5.11	Egg predetermination	32
6	Karyotype evolution	33
6.1	Notes on karyotype elucidation	33
6.2	General considerations	33
6.3	Chromosomal polymorphism	39
6.4	The genus-karyotype concept	40
6.4.1	Symphyta	41
6.4.2	Apocrita-Parasitica	41
6.4.3	Apocrita-Vespoidea	45
6.4.4	Apocrita-Formicoidea	45
6.4.5	Apocrita-Apoidea	55
6.5	Chromosome evolution in the order as a whole	60
7	The chromosomal basis of hymenopteran life cycles	61
7.1	The primitive cycle	61
7.2	Thelytokous species	61
7.3	Alternation of generations in Cynipidae	62
7.4	Modifications of sociality	67
8	Evolutionary considerations	70
8.1	The origin of hymenopteran haplodiploidy	70
8.2	Sex-ratios and the breeding system	72
8.3	Does dosage compensation occur in Hymenoptera?	73
8.4	Effects of haplodiploidy on stores of genetic variability	74
8.5	Sex-limited gene effects	75
8.6	Differences between sexes in phenotypic variability	75
8.7	Average fitness and the speed of evolution	76
8.8	Hymenoptera and sociality	76
	Literature	78
	Species Index	92