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THE DEVELOPMENT OF HOST DISCRIMINATION AND THE PREVENTION OF SUPERPARASITISM IN THE PARASITE PSEUDEUCOILA BOCHEI WELD (HYM.: CYNIPIDAE)

by

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SUMMARY

1. The solitary endoparasite *Pseudeucoila bochei* oviposits in larvae of *Drosophila* species. The wasp is able to discriminate between parasitized and unparasitized hosts and also between hosts with different numbers of parasite eggs. Although discrimination appeared to be very strong, in a number of cases considerable degrees of superparasitization were still found during earlier research (BAKKER *et al.*, 1967, 1972). Therefore, six possible causes of superparasitism in *P. bochei* were analysed:

a. a female lays more than one egg at an oviposition;
b. a female does not recognize hosts parasitized by other females;
c. a female lays a second egg after the first oviposition within the period needed for building up the factor which causes avoidance of superparasitization;
d. two or more females lay eggs simultaneously in one host;
e. a female's tendency to oviposit increases when she encounters only parasitized hosts for a long period; she will lay eggs in these hosts;
f. a female has not yet learnt to discriminate.

2. ad a: Per oviposition never more than one egg is laid (chapter III).

3. ad b: Hosts parasitized by a conspecific female were rejected by the wasps as properly as hosts parasitized by themselves (Table II, chapter IV).

4. ad c: The period needed for building up the factor which causes avoidance of superparasitization after the first oviposition appeared to be max. 70 seconds (Fig. 4). Acceptance or rejection of a once-parasitized host during this period depends on the interval between the oviposition and the second contact with that host, and on the distance between the places where the host was pierced at the first and second time (Fig. 5). The host is marked during or after the actual egg deposition, probably by substance(s) from the wasp's abdomen.

Due to the fast marking after an oviposition, only a very small proportion of superparasitization will take place by this cause (chapter V).

5. ad d. Simultaneous oviposition by several wasps in one host was seldom observed, and thus may bring about only very few superparasitizations (chapter VI).

6. ad e: A high tendency to oviposit will cause high degrees of superparasitization, only when the wasps do not have the opportunity to leave a site with parasitized hosts or when, in the field and under laboratory conditions, the number of parasites is large relative to the number of hosts. In general a wasp will migrate from a place where she parasitized a large percentage of the hosts, or found parasitized hosts only. This tendency to migrate is very high and only after the wasp is forced to stay with parasitized hosts for hours, superparasitization may occur, perhaps because the tendency to oviposit increases so high that the oviposition threshold for parasitized hosts is crossed temporarily (Fig. 8, 9 & 10, chapter VII).

7. ad f: Parasites appear to be unable to recognize parasitized hosts, before they have met unparasitized hosts. When they do only meet parasitized hosts, this leads to many superparasitizations (Tables XVI-XIX). The fact that females have not yet learnt to discriminate (*i.e.* inexperience) will have been the most important cause of superparasitization found in the earlier experiments (BAKKER *et al.*, 1967, 1972), because always inexperienced wasps were used then (chapter VIII).

8. A mathematical model developed by us (BAKKER *et al.*, 1972) to describe the possible effectuation of egg distributions found after certain parasitization periods appeared to be based on incorrect suppositions. Wasps do not have certain fixed values for the probabilities to accept hosts with different numbers of parasite eggs. The probability to oviposit unparasitized hosts is very high (*c.* 1), and as long as these hosts are present the probability to superparasitize is virtually 0. When the wasp finds only parasitized hosts for long periods, she will eventually oviposit in parasitized hosts, but takes the hosts with the lowest number of parasite eggs present. After each superparasitization a varying number of probes and attempts to escape from the site will occur between successive ovipositions (Fig. 7 & 10, chapter VII).

9. The ability to discriminate between parasitized and unparasitized hosts might have the following functions: (1) prevention of parasite egg wastage; (2) a means to save time because egg-laying takes considerably more time than probing a host; (3) initiation of migration when only parasitized hosts are met (chapter IX).

10. The ability to discriminate between hosts with different numbers of parasite eggs might have the following function: prevention of wastage of all the eggs of an inexperienced parasite. Inexperienced wasps (wasps which not oviposited before) meeting only parasitized hosts will lay one extra egg in each of the hosts with the lowest number of parasite eggs (these hosts are considered as "unparasitized"), and will then migrate. On successive visits to sites with hosts she will accept hosts with the same low (or lower) number of parasite eggs until she meets unparasitized larvae. From then onwards her eggs are no longer wasted (chapter VIII).

11. Inexperienced wasps do not parasitize hosts in a proper way during their first series of ovipositions. The oviposition behaviour has to mature and also experience is necessary for its development (Fig. 21). It appeared that the oviposition behaviour developed in the same way in wasps laying eggs in unparasitized and in parasitized hosts (chapter VIII).

12. The development of the oviposition behaviour and of the discrimination ability are apparently no connected processes, but evolve independently (chapter VIII).

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