

Cytological Proof of the Origin of Drones from Inseminated Eggs of the Honey Bee

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For the past century the view has been held that with bees drones develop exclusively from unfertilized eggs. (Dzierżoń [1]).

However, Woyke [2] has demonstrated that after sibling-mating some queens lay in worker cells eggs that give drones. The larvae were promptly eaten by the worker bees [3]. Since inseminated queens usually lay inseminated eggs in worker cells, it followed that the drones hatched from these inseminated eggs.

Heretofore cytological evidence of drones from inseminated eggs has been wanting. In the present investigations an effort was made to ascertain whether there are sperms in the eggs from which the described drones hatch.

Material and methods

The paper presents the results of a study of 238 eggs from four artificially sibling-mated and one naturally mated queen; 209 eggs came from worker cells, and 29 from drone cells. Queens were inseminated artificially according to the system brother \times sister. Next, by the method described earlier [2], a check was made for queens whose brood survived in the colony in 50 per cent only.

To be certain that the queens deposited in worker cells eggs that gave drones, the larvae were reared in an incubator with the aid of methods already described [2], [5]. Sexing of the larvae was done by the histological [2] and the anatomical [4] methods.

Next, four sibling-mated queens were chosen whose brood in worker cells was in 50 per cent male and devoured by the worker bees. For purposes of comparison use was made of the eggs of one queen mated naturally by unknown drones; she produced in worker cells a uniformly female brood.

The eggs were collected when one to three hours old. With this in view, the queens were caged under a queen excluder cover on a worker comb or a drone comb for two hours and the comb was then placed for one hour in an incubator. Thereafter the eggs were fixed with Petrunkevitch's fluid, and sections were stained with Heidenhain's iron hematoxylin and counterstained with eosin and examined for sperms.

Results

The spermatozoon is difficult to identify directly after it has penetrated into the egg. Soon, however, the cell plasma forms into a radial structure round the

head, thereby betraying the presence of the spermatozoon. As may be seen from Table I, all but one of the eggs from drone cells were found to contain no sperms. The explanation of the single exception may be that the queen was artificially forced to lay eggs in a drone comb by being caged under a cover.

TABLE I

Results of examination of 1-3-hour-old eggs deposited in drone cells by sibling-mated queens

Queen No.		Eggs examined	Eggs with no sperms found	Eggs with sperms
854		9	9	0
885		20	19	1
Total	absolute	29	28	1
	percents	100	97	3

TABLE II

Results of examination of 1-3-hour-old eggs collected from worker cells where sibling-mated queens produced 50 per cent of drone larvae

Sibling-mated queen No.	Eggs examined	Sperms not seen in:		Sperms found in:	
		eggs	percentage	eggs	percentage
751	79	11	14	68	86
854	58	5	9	53	91
882	9	2	22	7	78
885	33	3	9	30	91
Total	179	21	12	158	88
Naturally mated queen	30	6	20	24	80

The results of the examination of eggs from worker cells are compiled in Table II. As may be seen, sperms were found in 88 per cent of the 179 investigated eggs from the four sibling-mated queens. Their brood had previously been shown to be 50 per cent male and devoured by worker bees. This implies that at least a large proportion of these larvae came from inseminated eggs. Failure to find sperms in a part of the eggs may be explained by either non-insemination or examination

at a too early stage of development, when the presence of the sperm is difficult to establish. The first explanation is rather unlikely, because no drone brood — otherwise to be expected — appeared in the family. Table II shows that only 80 per cent of the eggs of the naturally inseminated queen were found to contain sperms. Yet such a queen normally deposits in worker cells eggs that are all inseminated. Therefore, failure to find the sperm in some of the eggs of a queen of either kind may be legitimately concluded to be due to examination at a too early stage of development or poor sections; and not absence of the sperm.

Since the percentage of eggs actually seen to contain sperm was in the case of sibling-mated queens even higher than of naturally inseminated ones, queens of either group may be taken to have deposited inseminated eggs in worker combs.

Whether we take the sibling-mated queens to have inseminated all eggs or only the actually established 88 per cent, the proportion is at any rate much higher than the 50 : 50 male-to-female ratio of their broods.

Hence it follows that sibling-mated queens deposit in worker cells inseminated eggs, from which drones emerge. Consequently, drones hatch not only from unfertilized but also inseminated eggs.

Details of the investigations will be described in the *Journal of Apicultural Research*.

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