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THE ORIGIN OF BLOOD MEALS OF BITING MIDGES (DIPTERA:
CERATOPOGONIDAE) AND MOSQUITOES (DIPTERA: CULICIDAE)
TRAPPED IN TURKEY RUNS IN ISRAEL

The study reported here was undertaken as part of a research programme connected with turkey meningo encephalitis (T.M.E.), a neuroparalytic disease of turkeys first described by Komarov and Kalmar (1960) and so far reported only in Israel (Samberg, 1974), and was aimed at checking the blood meal sources of biting midges and mosquitoes trapped in turkey and goose runs. The importance, in epidemiological studies, of such blood meal identification has been discussed by Boreham (1975). Light traps were used for catching the insects as it was proved by Acuff (1976), working on mosquitoes, that the New Jersey light trap collected the widest spectrum of species in comparison with three other methods. Nevertheless one cannot exclude the possibility of obtaining biased results with light traps in regard to species composition and numbers.

MATERIALS AND METHODS

Suction light traps with white incandescent bulbs (Du Toit, 1944) were used in 1972 and 1973. The traps were routinely placed in turkey runs except at Bet Shiqma where a goose run was utilized. The living insects captured in this way were brought to the laboratory and placed in a refrigerator at -20°C for about an hour to kill them and to prevent further blood digestion.

The source of blood meals was determined by precipitin tests following the methods given in Braverman, Boreham and Galun (1971). Blood meals negative to birds were then tested with general mammal antisera. For these tests, specimens believed to be engorged with blood were selected from the catches and sent to Imperial College Field Station, each in a gelatin capsule supported on a layer of non-absorbent cotton wool placed above a layer of hygroscopic silica gel. However, it was not possible to ascertain, in all species, whether the selected *Culicoides* contained blood, so the test material included some unfed and gravid insects. For this reason it was expected that a high percentage of negative results would be obtained.

RESULTS AND DISCUSSION

No reactions for mammalian blood were obtained in any of the precipitin tests conducted on either biting midges or mosquitoes.

Table 1 gives the proportions of avian blood meals to total *Culicoides* tested. Blood engorged females generally constituted a small proportion of the total *Culicoides* catch. This proportion would also be expected to be influenced by the proximity of the trap to *Culicoides* hosts and the species composition of the sample. Previous work (Braverman *et al.*, 1971) showed that in *C. imicola* Kieffer, 1913 (= *C. pallidipennis* Carter, Ingram and MacFie, 1920) this proportion was 12 per cent.

TABLE 1.—PRECIPITIN TESTS ON *Culicoides* CAUGHT BY LIGHT TRAPPING IN POULTRY RUNS DURING 1972-1973

Trapping place	Month/year	Number tested	Ratio of avian blood meals to total <i>Culicoides</i> tested									
			<i>Praetere-</i> <i>missus</i>	<i>Imicola</i>	<i>Circum-</i> <i>scriptus</i> *	<i>Obsoletus</i> *	<i>New-</i> <i>stead</i> *	<i>Schultzei</i>	<i>Punciti-</i> <i>collis</i> *	<i>Agathen-</i> <i>sis</i> *	<i>Punctatus</i>	
Givat Hayyim	3,4/72	246			8/118		1/32				2/96	
Givat Hayyim	5/72	84			0/24		0/46			0/9	0/2	
Givat Hayyim	6/72	59	5/8	0/15		0/1	0/21		0/1	0/13		0/3
Geshar Ha-Ziv	10/72	5				2/3						
Bet Herut	10/72	86	78/82	2/2	1/1							
Bet Herut	11/72	24	23/24									
Bet Herut	12/72	14	13/14									
Bet Herut	7/73	34	32/34									
Bet Herut	8/73	35	31/34	1/1								
Ganne Yehuda	8/73	1	1/1									
Bet Shiqmat†	8/73	1	1/1									
Bet Shiqmat†	9/73	1	1/1									
Total		590	185/199	3/18	9/143	2/4	1/99	0/4	0/22	2/98	0/3	

* In these species, detection of engorged females is difficult. The proportion of negative results is very probably inflated owing to inclusion of non-engorged females in the tested samples.

† Collections from goose run; all others were from turkey runs.

The ratio of positive avian blood meals to the total number of individuals submitted was very high for *Culicoides praetermissus* Carter Ingram and MacFie, 1920, and this was in striking contrast to suction light trap captures of *Culicoides* made near other hosts (e.g. sheep, cattle and horses) in which no engorged females of this species were found (Braverman, 1973).

The remaining species are included to add further information on specific host ranges.

Table 2 shows the results obtained with the engorged mosquitoes taken in the suction light trap and makes it clear that both *Culex pipiens molestus* Forskal, 1775, and *Aedes caspius* Pallas, 1771, feed on birds.

TABLE 2.—PRECIPITIN TESTS OF MOSQUITOES CAUGHT BY LIGHT TRAPPING IN POULTRY RUNS DURING 1972-1973

Trapping place	Month/Year	Number tested	Ratio of avian blood meals to total mosquitoes tested	
			<i>Aedes caspius</i>	<i>Culex pipiens molestus</i>
Bet Herut	11/72	1		
Bet Herut	8/73	58	1/1	
Ganne Yehuda	8/73	1	49/49	9/9
Bet Shiqma*	9/73	2		1/1
TOTAL		62	1/1	1/1
			51/51	11/11

* Collections made in goose runs; all others from turkey runs

The larger number of *Aedes caspius* captured probably reflects the closer proximity of its breeding sites (which occurred within the range of attraction of the traps). Feeding of *Culex pipiens molestus* on birds has already been reported (Taylor, Work, Hurlbut and Rizk, 1956; Saliternik and Barkai, 1963).

In Israel *Aedes caspius* has been considered as feeding on humans (Theodor, *pers. comm.*). Our results show for the first time that it also feeds on birds. However, it must be remembered that a very selective sampling technique has been used and the results obtained do not necessarily reflect the over-all host selection pattern of these insects under all conditions.

CONCLUSION

In view of the fact that *Culicoides praetermissus* particularly and also *Culex pipiens molestus* and *Aedes caspius* trapped in turkey and goose runs have been found by precipitin tests to feed relatively frequently on avian

hosts, these species might be considered as potential vectors of poultry pathogens. It has already been shown (Nir, 1972) that *Culex pipiens molestus* can transmit T.M.E.

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