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CATIONIC PATTERN OF HEMOLYMPH IN ADULT  
HYMENOPTERA

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The cationic composition of insect hemolymph is extremely variable; some authors tentatively proposed different interpretations based on alimentary or phylogenetic considerations<sup>1, 2, 3</sup>. However, a reexamination of the numerous data already published on this matter leads to the conclusion that the different authors postulated at first that the cationic composition of the hemolymph does not markedly change during development and metamorphosis. Indeed this seems to be true in the case of some Exopterygotes such as Dragonflies (Aeschna cyanea<sup>4</sup> and Agrio virgo<sup>1, 4</sup>), Cockroaches (Periplaneta americana<sup>5, 6</sup>) and Grasshoppers (Locusta migratoria<sup>2, 7</sup>). However, the situation is far from being clear for the other Insect orders, especially in the case of Endopterygotes. Very few Insects have been studied so far at different stages of development: almost all the data concerning Heteroptera have been obtained from adults, while those concerning Lepidoptera, Diptera and Hymenoptera only deal with larvae or pupae. A comparison of the cationic composition of the larval, pupal and imaginal hemolymphs of the same species has only been carried out in the case of Bombyx mori<sup>2</sup>, and only for sodium and potassium in the case of Dytiscus sp.<sup>4</sup> In both cases, the differences between the stages are small.

This paper deals with the cationic composition of the hemolymph of two Hymenopteran adults, compared with that of their larvae and pupae.

Wasps (Vespula germanica F) have been used immediately after capture (lot 1) or after rearing for 15 days in a greenhouse, at 25° C, provided with water, sugar and honey

TABLE I  
Inorganic cations of the hemolymph of Hymenoptera, at different stages

Species	Stage	mEq/litre			Sum	% of the sum of the cations			Ref.	
		Na	K	Mg		Na	K	Mg		
<u>Apis mellifica</u> L.	larvae	10	45.0		80.1	13.6	38.1	22.7	1	
		10.9	30.5	18.2	20.5	25.6			2	
	adults	5.0	24.4	7.5	15.8	52.7	9.5	46.3	11	
<u>Vespula germanica</u> F.		47.1	27.1	17.8	1	93	50.6	29.1	19.1	this paper
	larvae	48.0	41			124.7	20.9	45.2	15.0	18.9
	pupae	26.0	56.4	18.7	23.6	113.8	20.0	53.4	9.9	16.7
	adults *	93	18.2	1.8	2.6	115.6	80.4	15.7	1.5	2.2
	**	153.5	21.9	2.2	<0.5	178.1	86.1	12.3	1.2	0.3
<u>Vespula pensylvanica</u> (Sauss.)	adult			7.1	1.0					10

\* lot n° 1 : studied immediately after capture

\*\* lot n° 2 : studied after rearing for 15 days in greenhouse

(lot 2). Bees (A) after capture. T with ether, one withdrawn, at the pipette, usually A volume of 0.05 wasps (lot 1) and 134 bees gave a the contents of natant has been potassium (flame of Van Slyke and

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<i>Vespula pensylvanica</i> (Sauss.)	adult	7.1	1.0		10
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\* lot n° 1 : studied immediately after capture  
 \*\* lot n° 2 : studied after rearing for 15 days in greenhouse

(lot 2). Bees (*Apis mellifica* L.) have been used immediately after capture. The animals have been lightly anesthetized with ether, one wing pulled off and the hemolymph carefully withdrawn, at the level of the wound, into a fine capillary pipette, usually helped by gentle pressure on the thorax. A volume of 0.05 ml of hemolymph has been collected from 166 wasps (lot 1) and a volume of 0.035 ml from 72 wasps (lot 2); 134 bees gave a volume of 0.095 ml of hemolymph. After pooling the contents of the pipettes and centrifuging, the clear supernatant has been used to determine the amount of sodium and potassium (flame-spectrophotometry : Eppendorf), calcium (method of Van Slyke and Sendroy<sup>8</sup>) and magnesium (method of Biggs<sup>9</sup>).

The results are given in Table I, together with the data of other authors concerning the larval and pupal hemolymph of the same species. The values are given in mEq/litre, and calculated in % of the sum of the four cations.

From these results, it is clear that the cationic composition of the adult hemolymph differs greatly from that of the corresponding larvae and pupae. In both species, the Na is 4 to 5 times higher in the adult than in the larval hemolymph, and represents 50% of the sum of the cations in the Bee, and 80 to 85% in the Wasp. In both species, the amounts of K and Mg are notably lower in the adult hemolymph than in that of the larvae. The low concentrations of Ca and Mg in *Vespula germanica* adult agree with the values obtained by Clark and Craig<sup>10</sup> for *V. pensylvanica*.

These findings show that the cationic composition of the blood of an Insect may vary considerably during its life course, and that the results obtained within a definite taxonomic group for only one stage can no longer be considered as representative for every stage of development of the insects belonging to this group.

In the case of Hymenoptera, the "specialized type" of cationic composition (low sodium, high potassium, high magnesium) appears as a biochemical adaptation to the conditions of life of the larval and pupal stages. These appear as being more specialized aspects than those obtaining in the adult which conforms to the general type of cationic blood patterns.

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