Kuliah 1

Nodal points in insect evolution (Hinton, 1976)

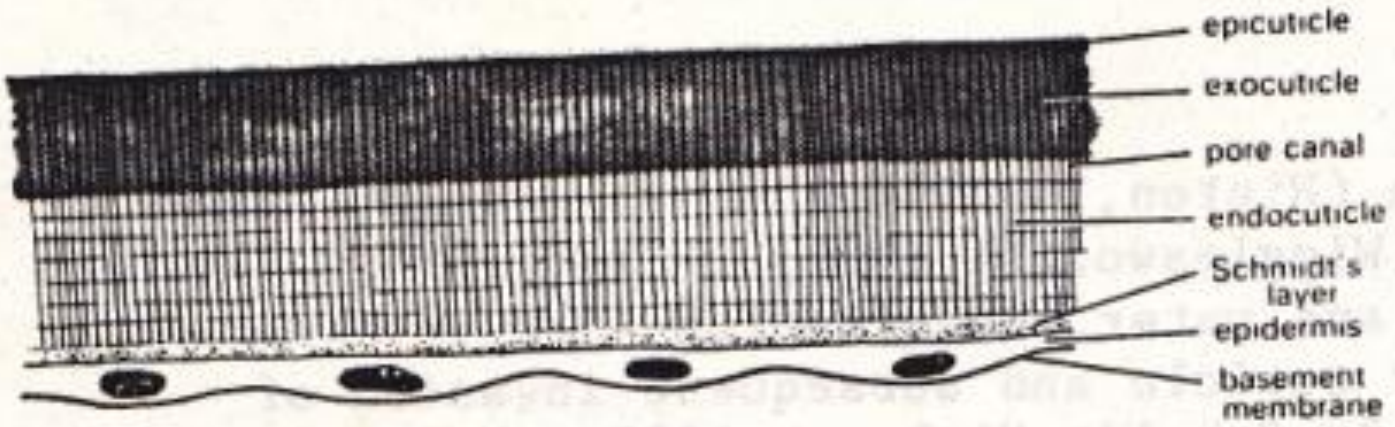
1. Development of tracheal system (Wigglesworth, 1981)
- conflict between respiration and water conservation
2. Acquisition of impermeable outer cuticle and subsequent invasion of dry land (Hadley, 1980; Beament, 1958; Schmidt-Nielsen, 1975; Chapman, 1971)

3. Evolution of flapping wings (Wotton, 1981)

- advantages of flight
- complications caused by wings

4. Development of pupal stage and subsequent separation of feeding and reproductive stages

- problems with wings—holometabolous and hemimetabolous solutions (Maiorana, 1979)
- relative success of holo- and hemimetabolous insects (Cole, 1980; Bernays, 1986)



Diagrammatic representation of a section of mature cuticle and epidermis.

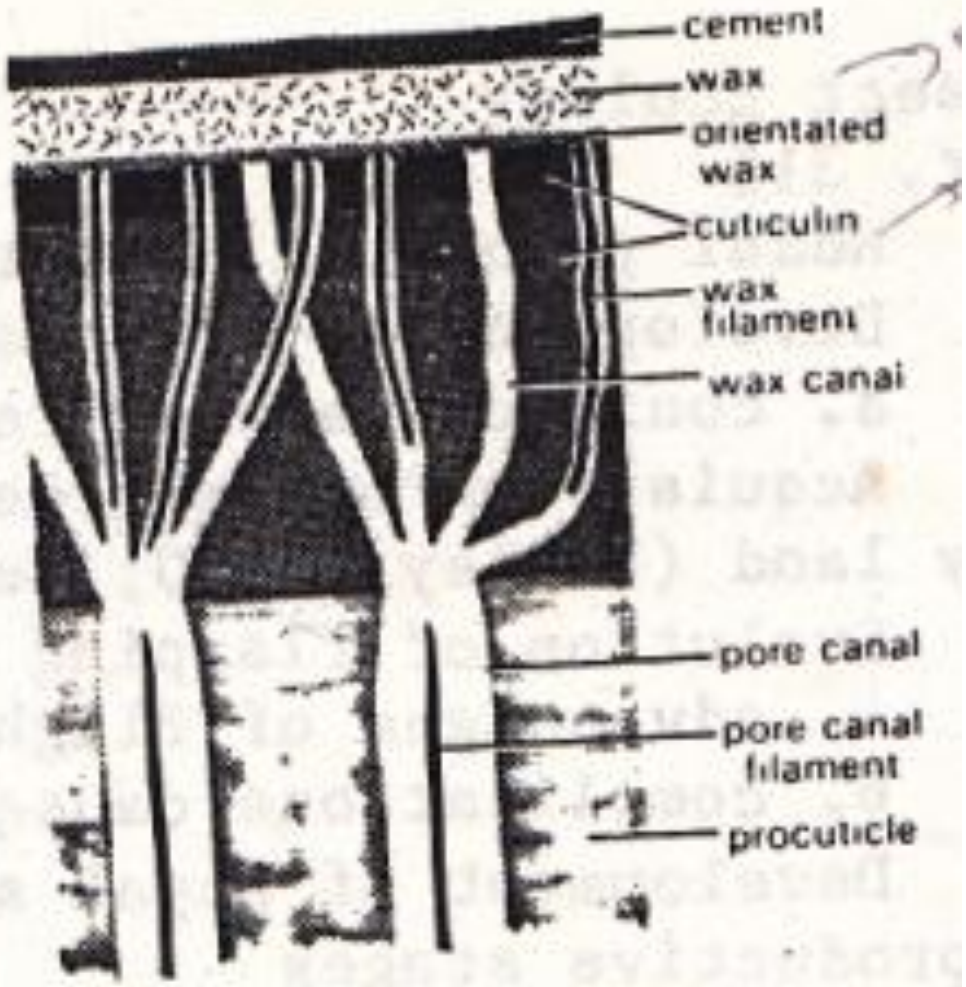


Fig. 287. Diagrammatic representation of a section through the epicuticle.

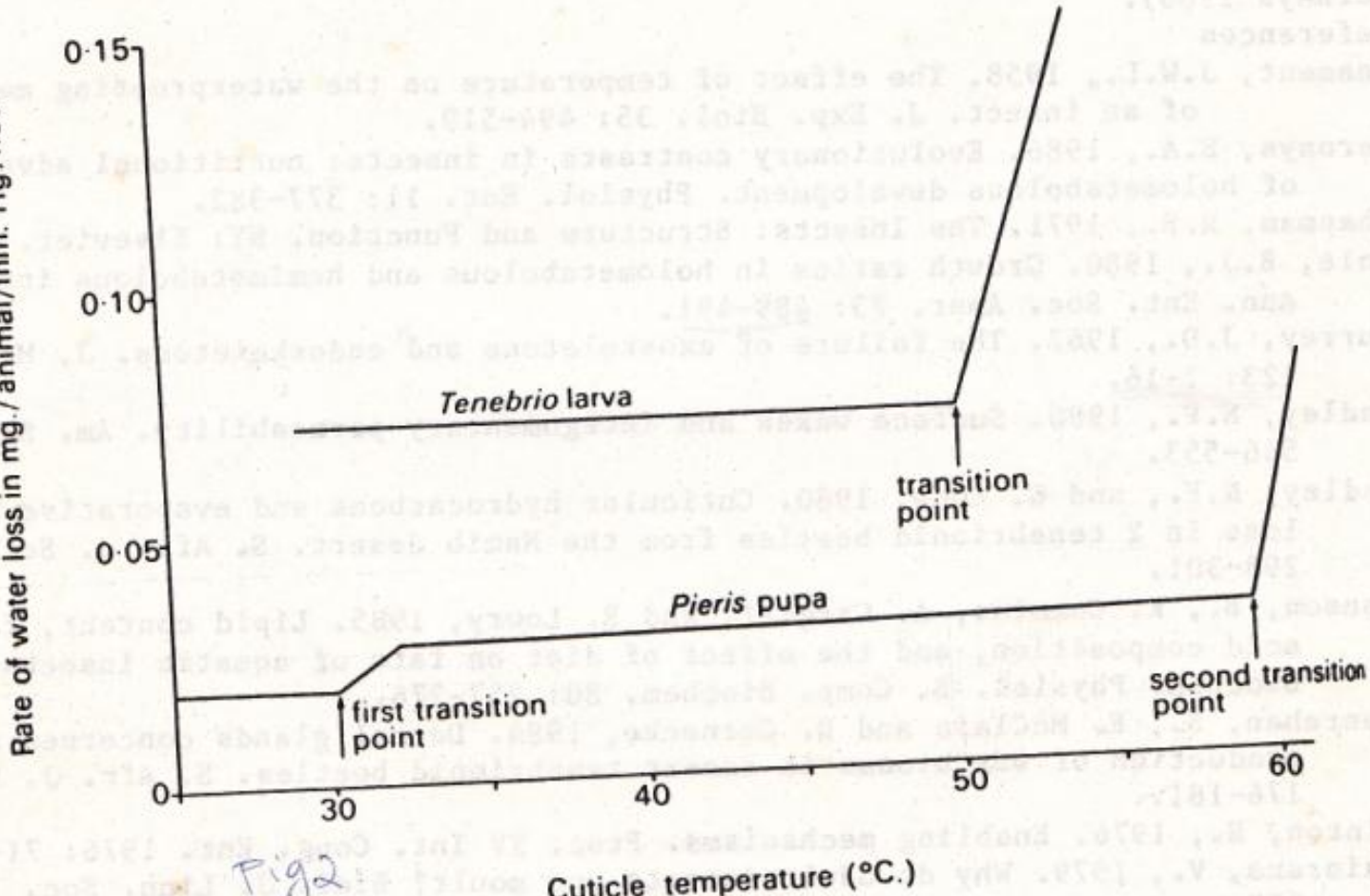


Fig 2

The relationship between the rate of water loss through the cuticle and temperature in *Tenebrio* larvae and *Pieris* pupae (after Beament, 1959).

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TABLE 2. Comparative summary of lipid-hydrocarbon/body mass ratios and hydrocarbon (HC) composition of some Namib tenebrionid beetles. All extractions with chloroform : methanol (2:1, volume for volume).

	Onymacris plana		*Cardiosis fairmairei*	*Zophosis mniszechi*	*Zophosis testudinaria*	*Onymacris r. albotessellata*	*Cauricara phalangium*	*Onymacris laeviceps*	*Physadesmia globosa*	
	(C)*	(I)*							♂	♀
No. of elytra analyzed	17	17	6	10	11	5	17	9	5	5
Elytra mass (mg)	907.3	820.2	15.1	58.7	147.3	164.1	52.9	188.9	147.5	250.6
Total lipid (mg)	5.85	4.07	0.93	1.03	1.26	1.44	1.43	1.24	4.27	3.23
Total hydrocarbon (mg)	0.83	1.16	0.53	0.40	0.90	0.61	0.53	0.90	0.95	0.94
% hydrocarbon	14.2	28.5	57.0	38.8	71.4	42.4	37.1	72.6	22.2	29.1
HC mass/elytra mass (μg/mg)	0.91	1.41	35.1	6.81	6.11	3.72	10.0	4.76	6.44	3.75
HC size range (no. carbons) (quantities >0.5%)	20–34B†	21–33	19–35	19–33	19–37B	19–40B	19–35B	19–35B	19–35B	19–40B
% *n*-alkanes	86.2	79.6	91.2	81.7	77.2	65.4	67.3	92.4	91.9	69.1
% branched	13.8	20.4	9.8	18.4	22.8	34.7	32.7	7.6	8.1	30.9

* Coastal (C) and inland (I) populations.
† B = branched.

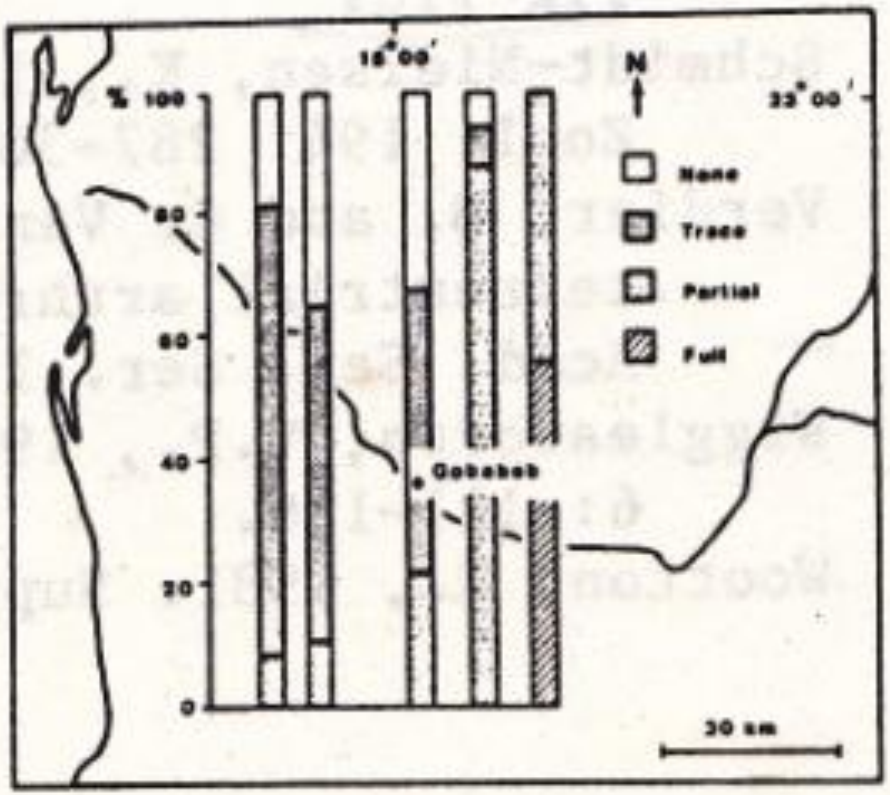

FIG. 3. Variation in percentage of cuticular surface of *Onymacris plana* covered by wax bloom, along the climatic gradient that exists between the coastal fog desert and inland hot dry desert. Horizontal position of vertical bars denotes the latitude of the collecting sites across the gradient.