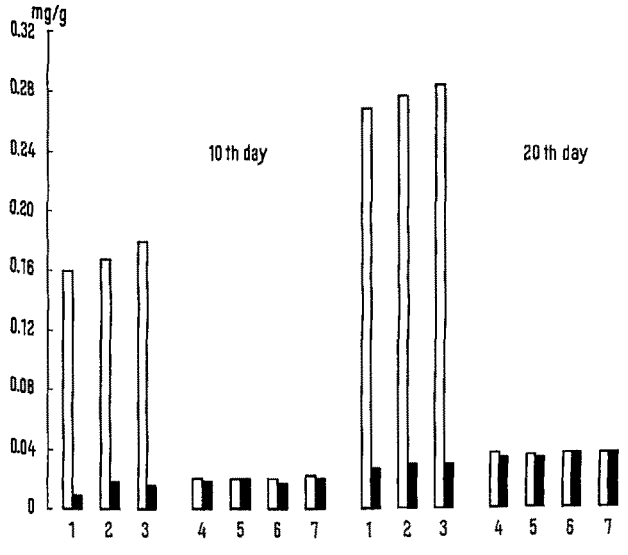
were subjected to a high nyctotemperature of 30°C nitrate accumulation resulted[3]. Although the possibility of stimulation of nitrate reductase activity in suscepts grown at low nyctotemperature was suggested[4], experimental proof for such a hypothesis is lacking. Hence a quantitative assay of nitrate reductase activity in susceptible and resistant rice seedlings grown at different nyctotemperatures was undertaken, the results of which are reported here.

Rice seedlings (*indica* varieties) susceptible (CO 13, GEB 24 and ADT 10) and resistant (CO 4, CO 25, CO 29 and CO 30) to 'blast' disease grown in Arnon and Hoagland nutrient solution were subjected to two nyctotemperatures (20° and 30°C) with a day temperature of 30°C in a thermostatically controlled miniature glasshouse with artificial light sources[5]. Leaf materials at desired age levels were collected and acetone dried powders prepared[6]. Nitrate reductase activity was measured colorimetrically (using a green filter – 540 mμ) by determining the amount of nitrite formed on incubation of the enzyme preparation with potassium nitrate (nitrite free) solution[7]. The results are presented in the Figure.

It can be seen that the variation in nyctotemperature did not affect the nitrate reductase activity in the resistant types. On the contrary, all the three susceptible types when grown at a low nyctotemperature registered a sizeable increase in nitrate reductase activity compared with those at a high nyctotemperature. This is in keeping with the postulated low reduction of nitrate at high nyctotemperature in tomato based on nitrate nitrogen accumulation recorded[8]. It has also been postulated[9] that the nitrate reducing ability of higher plants is possibly related to the genetic inheritance of nitrate reducing enzymes. The results reported here further indicate that this ability depends not only on the genotypic pattern but also on a particular genotype-nyctotemperature combination. Thus, it appears that the net effect of compatible genotype-nyctotemperature combination in susceptible rice types used by us at low nyctotemperature environment (20°C) seems to be one of stimulation of the nitrate reducing enzyme(s) leading on to incorporation of nitrogen in the amide. In the light of the recent work on the common co-factor for nitrate reductase and xanthine dehydrogenase which regulates the synthesis of nitrate reductase in *Aspergillus nidulans*[10], an extension of this idea to the problem of 'blast' would seem a worthwhile future line of investigation[11].




Nitrate reductase activity in *indica* rice varieties. 1–3: susceptible varieties; 4–7: resistant varieties. Ordinate: Nitrate reductase activity (mg nitrite nitrogen formed per g fresh weight). White columns: 20°C nyctotemperature; black columns: 30°C nyctotemperature.

*Zusammenfassung.* Der imperfekte Pilz *Piricularia oryzae* (Erreger von Blattflecken und anderen Schädigungen am Reis) befällt anfällige Sorten bei einer Nachttemperatur von 20°C, jedoch nicht bei einer solchen von 30°C. Die Nachttemperatur beeinflusst den Stickstoffhaushalt. Bei 20°C ist die Aktivität der Nitrat-Reduktase in den anfälligen Sorten (Figur, 1–3) wesentlich höher als bei 30°C; die resistenten Sorten (4–7) zeigen keine Unterschiede. Die Bedeutung der erhöhten Enzymaktivität für den Pilzbefall bleibt im einzelnen noch zu untersuchen.

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## Some Common Features of Three Types of Insect Sensilla

Electrophysiological studies have shown that the characteristics of mechanosensory sensilla are the same as those of chemosensory sensilla. If the recording electrode is located distal of the sense cell body (as in base-, side wall-, and tip-recording of bristles or papillae), the common features are: (1) a negative receptor potential (mechanoreceptor[1,2], olfactory receptor[3], taste receptor[4]); (2) impulses with a positive and then a negative phase

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(mechanoreceptor[1,2,5], olfactory receptor[3], taste receptor[4,5]); (3) an increase in amplitude of the impulses with an increase in their frequency (mechanoreceptor[1,5,6]; olfactory receptor[3], Figure 1; taste receptor[7], Figure 6).

THURM's remarks[6] regarding the activity of a mechanoreceptor cell of the honey bee apply to all 3 types of receptors. The opposite polarities of the two kinds of potentials – the receptor potential and the impulse, both of which are caused by depolarization of the cell membrane – indicate that these potentials are initiated in different parts of the membrane. As in the lobster stretch receptor[8] and in the pacinian corpuscle of mammals (summarized [9]), the receptor potential of insect sense cells probably originates in the dendrite, and the impulse in the distal part of the axon near the cell body. The recording electrode, placed extracellularly near the dendrite, shows a negative receptor potential as would be expected. However, the first phase of the impulse is positive. This phase inversion may be understood, if one assumes a high extracellular shunting resistance between the point of origin of the spike and the point of contact with the recording electrode. In this case the passive electrode would show a negative potential on the proximal side of the shunting resistance as a negative potential, which appears as a positive deflection of the active electrode. The second phase of the impulse is negative. Therefore, it could only be picked up by the active electrode from the distal side of the extracellular resistance. It probably represents the antidromic propagation of the spike along the cell body and dendrite (see also [6, 10], and [6]).

Values of DC-resistance measurements from the mechanoreceptor of the bee ranged between approximately 5 and 35 MΩ[2], from the chemoreceptor of a butterfly around 20 MΩ[11], and from the chemoreceptor of the blowfly *Phormia* between 20 and 80 MΩ[12]. AC-impedance measurements of the chemoreceptor of the blowfly *Calliphora* yielded values between 25 and 60 MΩ; this high impedance is mainly due to the structure of the hair[13]. Measurements made on hairs severed at their base gave values as high as those obtained from hairs *in situ*. According to THURM[6], the channel in the cuticle of the bee sensillum causes the high resistance. In taste hairs of blowflies there are two channels[14], and even in long hairs these could account for only a part of the measured resistance.

The resistance due to hair shape may be calculated as follows:

$$R = \frac{\varrho \cdot l}{c}$$

($\varrho$ = specific resistance of the Ringer solution. It is 70 to 76 Ωcm for the blowfly[13]. For the bee it is unknown, but it must be less than 70 Ωcm, since the Ringer solution for the bee has a higher concentration than that for the blowfly; l = length of the channel; c = cross section of the channel).

Both channels of a long chemosensory hair of the blowfly (400 μ in length and averaging together about 5 μ in width[13]) should produce a resistance of approximately:

$$R = \frac{75\,\Omega\text{cm} \cdot 4 \cdot 10^{-2}\,\text{cm}}{\pi \cdot 6 \cdot 10^{-8}\,\text{cm}^2} = 14\,M\Omega.$$

(measured: 25–60 MΩ or 20–80 MΩ). Similarly, the cuticular channel of the bee mechanoreceptor (30 μ in length and 5 μ in width[6]) should yield a resistance of less than this calculated value (cf. above mentioned remark for $\varrho$):

$$R = \frac{75\,\Omega\text{cm} \cdot 3 \cdot 10^{-3}\,\text{cm}}{\pi \cdot 6 \cdot 10^{-8}\,\text{cm}^2} = 1\,M\Omega$$

(measured: 5–35 MΩ).

In both cases the measured values are much higher than the calculated ones. In the taste receptor of the fly, the high resistance could be caused by the unidentified pore (or pores) at the tip of the hair, or by a limited permeability between the narrow and wide channel of the hair. This interpretation is not applicable to the mechanoreceptor of the bee. Here, the difference between the calculated and measured resistance could be due to a substance with very low conductivity, for example an embedding material surrounding the dendrite within a clinging sheath.

Except in the case of the scolopidia of insects it is only in recent years that attention has been directed to a sheath enveloping the distal part of the dendrite. Such a sheath has been mentioned by the following authors: RICHARD[15] in a sensillum of termite larvae with unknown function and one sense cell. SLIFER et al.[16] in a sensillum of grasshoppers with 4–6 sense cells and unknown function; all dendrites are surrounded by a single sheath. SLIFER et al.[17] in 3 sensilla of grasshoppers, the first with 40–50 sense cells, the second with 3–4 sense cells (both

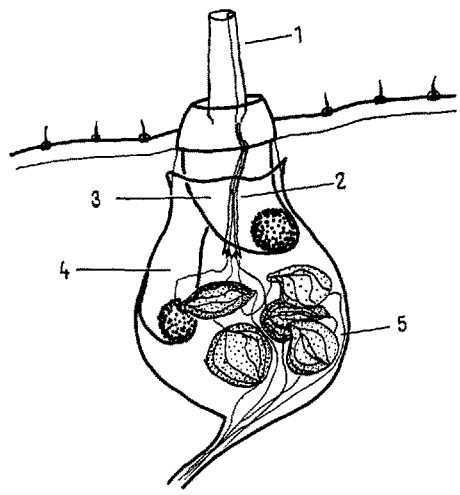


Fig. 1. Schematic drawing of the labellar taste sensillum of the blowfly. (1) Narrow channel of the hair; (2) sheath representing the continuation of the narrow channel through the lumen of the trichogen cell; (3) trichogen cell with the nucleus in the right corner; (4) tormogen (socket forming) cell; (5) sense cells, the dendrites of which are entering the sheath.

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are likely chemoreceptors; all dendrites are enclosed in a single sheath), and the third sensillum with one sense cell and mechanoreceptive function. PETERS[18] in a sensillum of blowfly larvae with unknown function and 3 sense cells; in this case each dendrite is enclosed in its own sheath. ADAMS[19] in taste hairs of a blood-sucking fly with 3–5 sense cells; the dendrites are enveloped in a single sheath with a compartment for each dendrite.

In the following cases the dendrites have been found to be enclosed by a sheath throughout their passage through the lumen of the trichogen cell: PETERS[20] in two types of mechanoreceptors in the blowfly, each with one sense cell. PETERS and RICHTER[21] and STÜRCKOW[22] in predominantly 5-celled hairs of the blowfly; all dendrites are enclosed in a single sheath with a compartment for each of them. PETERS and RICHTER[21] in chemoreceptive papillae of the blowfly with usually 4 sense cells.

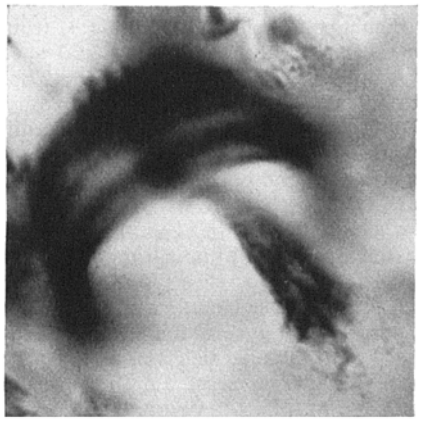

Fig. 2. Oblique view distal into the socket of a taste hair of *Calliphora* (stained with Methylene Blue in fixed form, teased preparation). Dendrites entering into the proximal part of the sheath, which ends here in 5 terminals, are visible only through the microscope. ×2000.

The position of the sheath in the taste sensillum of the blowfly is shown in Figure 1, while a photograph of the sheath is given in Figure 2.

SLIFER et al.[16,17] and RICHARD[15] observed that the sheath was cast off with the cuticle during molting. Therefore they called it a cuticular sheath. Although these sheaths are probably homologous with the scolops of the scolopidial organs, they should not be called a scolopoid sheath or scolops, as PETERS[20] has rightly pointed out, as long as the proof of homogeneity is lacking.

The function of the clinging sheath and an embedding material within the sheath around the dendrite could be mechanical protection, physiological protection, or a combination of these functions. In planning electrophysiological experiments and interpreting their results the possible existence of a high extracellular shunting resistance should be considered.

*Zusammenfassung.* In den letzten Jahren wurde gezeigt, dass um den distalen Teil der Dendriten von mechano- und chemorezeptorischen Sinneszellen eine Hülle vorkommt. Ihr möglicher Einfluss auf die gemeinsamen elektrophysiologischen Merkmale der Sinnesorgane wird diskutiert.

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## The Occurrence of $\Delta^3$-*trans*-Hexadecenoic Acid in Phosphatidyl Glycerol from Spinach Leaves

The preponderance of poly unsaturated fatty acid constituents in the lipids from photosynthetic tissues is well established. Galactosyl glycerides have been shown to contain over 90% of linolenic acid[1,2], but the phospholipids extracted from green leaves appear to contain, in addition to linolenic and linoleic acid, palmitic acid in quantity[1–4]. Apart from differences in biosynthetic mechanisms, the distinction in fatty acid constituents among these lipid classes is of interest with respect to their function in different biological interfaces. By contrast to most of the phospholipid species the galactolipids appear to be concentrated mainly in the chloroplast[5,6]. Therefore it is important to establish the fatty acid composition of phosphatidyl glycerol, since this compound has been demonstrated to be the major phospholipid of the photosynthetic apparatus[5–7].

Phosphatidyl glycerol was recently obtained in a pure form[8], and on isolating it from spinach leaves (*Spinacea oleracea*) a unique distribution of certain fatty acids became apparent. The fatty acid pattern of the total lipid fraction from spinach leaves appeared to be identical to that reported by others[9–11], and in good agreement with the studies of DEBUCH a *trans*-hexadecenoic acid (16:1

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