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The majority of the invited contributions are review papers, summarizing and putting into perspective the latest results of research in a particular area; the other contributions comprise research papers giving details on specific aspects. "Advances in Photosynthesis Research", therefore, is an important document, containing the latest high-level information about photosynthesis in its broadest sense. The four volumes are of considerable value as a reference source for scientists active in the field and others wishing to be informed about recent developments. Furthermore, these volumes will prove to be important as a means of background study for those entering this exciting and promising field of investigation.

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^{1}H NMR SPECTROSCOPY OF PROTOCHLOROPHYLLIDE Mg. PHOTOREDUCTION OF PROTOCHLOROPHYLLIDE Mg AND PROTOCHLOROPHYLLIDE Zn IN ETIOPLAST LAMELLAE.

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1. INTRODUCTION

The accurate chemical structure of the precursor of chlorophyll, protochlorophyllide which has been accumulated in etiolated primary bean leaves has not yet been completely assessed*,especially with respect to the occurence of an ester group (phytol, methyl ...) at the propionic chain, or of a second vinyl at carbon C_4. As absorption and fluorescence spectroscopy is unable to solve this question we have recorded the high resolution (360 MHz) ^{1}HMR spectra of the purified pigment extracted from etiolated bean leaves. For valuable comparison, the esterified pigment (protochlorophyll = PChl) from the pumpkin cuticle has been extracted and purified. This pigment is esterified by a long-chain alcohol.

Mg^{2+} has been substituted by Zn^{2+} in purified protochlorophyllide in view to compare in a first approach the physico-chemical properties of PChlide Mg and PChlide Zn, and to understand the role of the central ion. These pigments were further linked to the apoprotein (protochlorophyllide photoreductase) present in the etioplast lamellae.

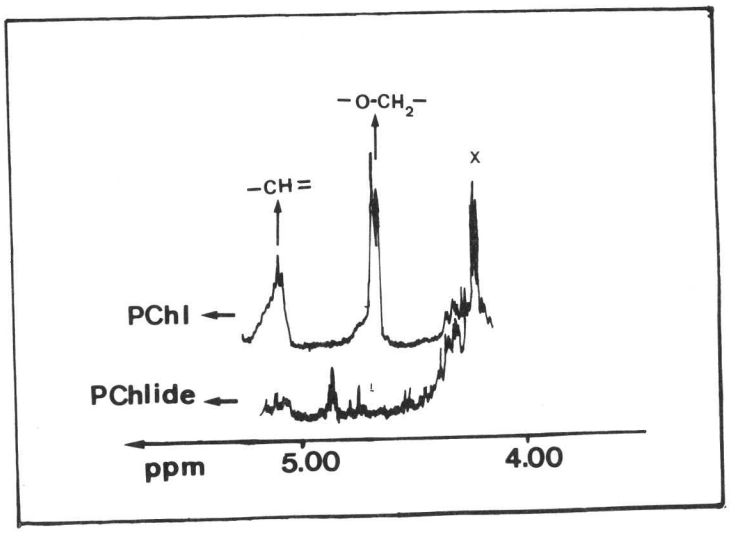

Figure 1. ^{1}H NMR spectra of PChlide and PChl showing that in PChl the $-O-CH_2$ and the $-CH=$ of a long-chain alcohol is present.

* Protochlorophyllide (abbrev.: PChlide) has currently been considered as the free acid of 2-vinylpheoporphyrin a_5-Mg.

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2. MATERIAL AND METHODS

This will be published elsewhere (Bombart,Dujardin, 1984).

3. RESULTS

3.1. Characteristical regions of the ^1H NMR spectra.

The high resolution ^1H NMR spectra of protochlorophyllide are presented in figs.1 and 2. Fig.1 shows the lack of the $-O-CH_2-$ doublet resonance of a long-chain alcohol, when compared to the same region in the ^1H NMR spectrum of protochlorophyll (Rasquain et al., 1977; Katz et al., 1963).
Fig.2 shows the resonance of a $-CH_2$ (4), $-CH_3$ (4') at the level of carbon C_4 which is characteristic of an ethyl substituent and not a vinyl (which is present in divinylprotochlorophyll(ide).

3.2. The PChlide Zn in etioplast lamellae:.

Protochlorophyllide Mg and Zn have very similar absorption and fluorescence spectra. The red absorption and fluorescence maxima of protochlorophyllide Zn are shifted towards shorter wavelengths by only a few nanometers from those of PChlide Mg.
Is was therefore expected that PChlide Zn should behave in a similar way as PChlide Mg, when introduced in the presence of NADPH,into a suspension of etioplast lamellae, which have been previously depleted from photoreducible PChlide Mg by illumination. Griffiths (1980) has shown that the exogenous PChlide Mg is able to form a complex with the apoprotein and the cofactor; when illuminated,this complex is photoreduced to Chlide Mg. We have established that when exogenous PChlide Mg and PChlide Zn are introduced with NADPH in PChlide depleted etioplast lamellae, both form two distinct photoreducible complexes with the aporeductase. Figure 3 A and figure 3 B present the corresponding absorption and fluorescence spectra for the newly formed PChlide Mg and Zn. The zinc photoreducible complexes absorb at 637 and 645 nm and they emit a fluorescence at 640 and 652 nm.The Mg photoactive complexes absorb at longer wavelengths than the zinc comple-

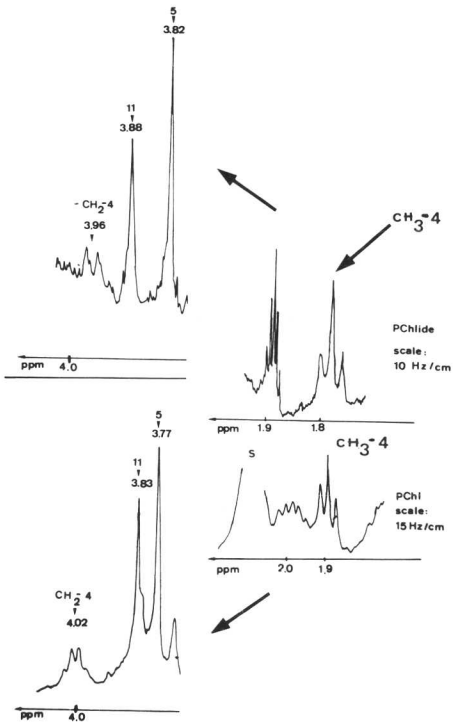

Figure 2. ^1H NMR spectra of PChlide and PChl showing that these pigments have a $-CH_2-CH_3$ in C_4 position.

xes, namely at 640 and 650 nm, they emit their fluorescence at 655 nm. We have demonstrated that all the photoreducible PChlide Mg and protochlorophyllide Zn complexes are converted into chlorophyllide Mg or chlorophyllide Zn after flash illumination. Further experiments have also proved that the pigment obtained by photoconversion of the protochlorophyllide Zn-protein complexes is surely chlorophyllide Zn. Complete data will be published elsewhere (Bombart, Dujardin, 1984).

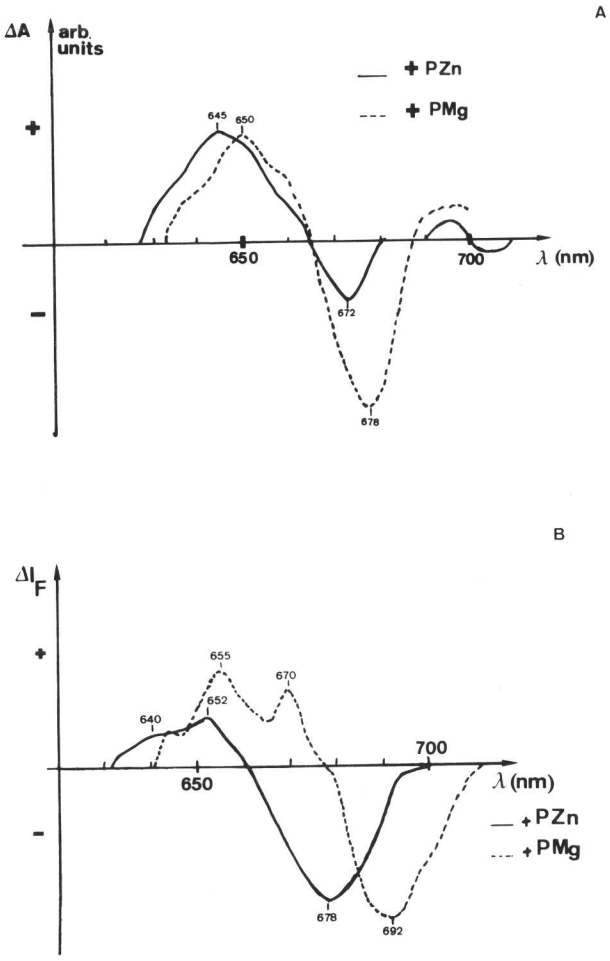

Figure 3. Difference absorption (A) or fluorescence (B) spectra (77 K) between an etioplast suspension incubated with PChlide Zn and the same suspension after flash illumination (full line); dashed line : same spectra but with PChlide Mg (+ PMg).

4. REFERENCES

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5. ACKNOWLEDGEMENTS

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