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SEM STUDY OF COROLLA TUBE AND POLLEN GRAINS OF *NYCTANTHES ARBOR-TRISTIS* L.

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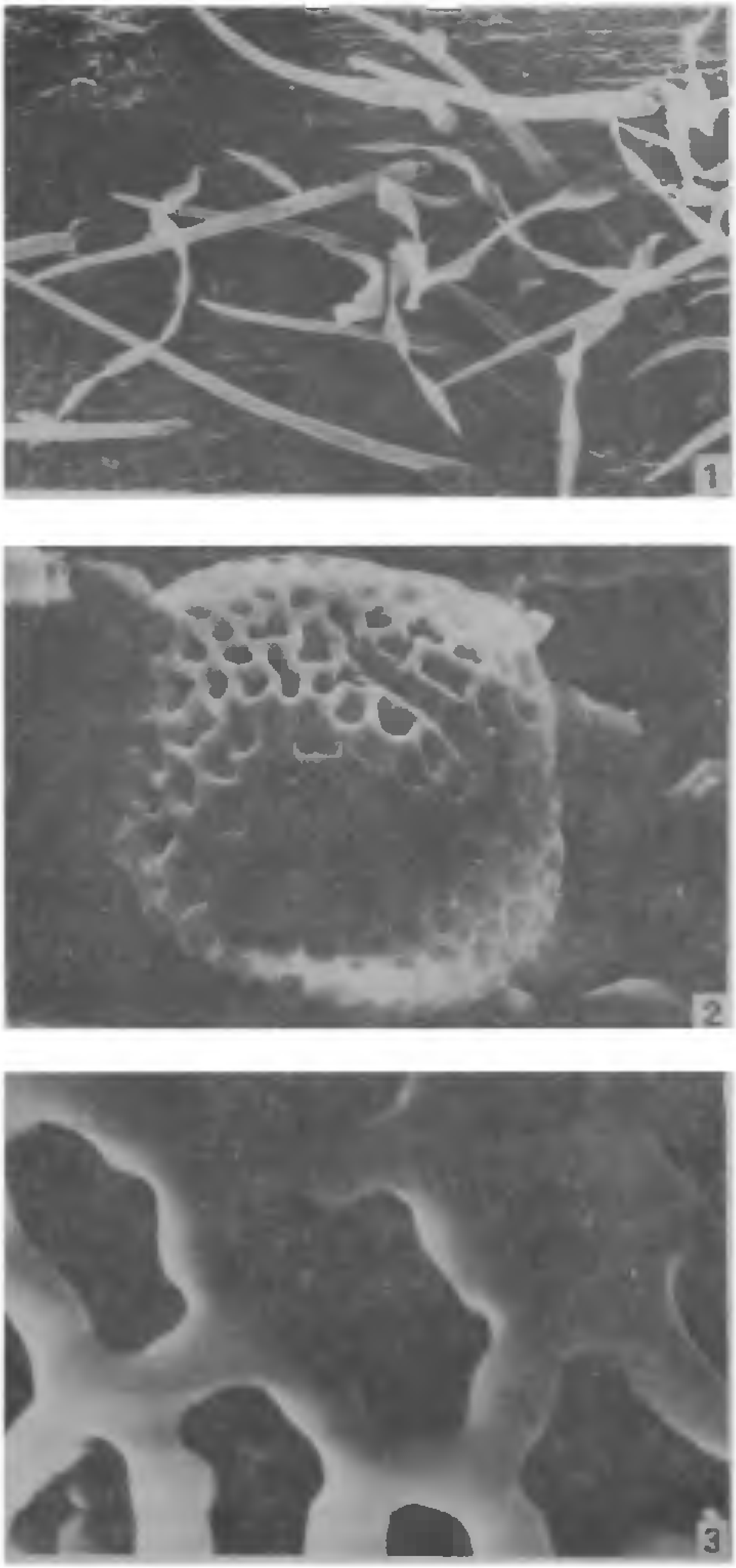
SCANNING electron microscopy allows a better look at the corolla tube and pollen grains of plants. The present study is aimed at assessing the often-emphasized importance of corolla tube and pollen grain studies *vis-a-vis* their systematic significance[1-3]. For this purpose *Nyctanthes arbor-tristis* L. was selected in the first instance as the orange-coloured corolla tubes of *N. arbor-tristis* are often employed for adulterating commercial saffron (styles and trifid stigmas of *Crocus sativus* L.).

The corolla is salver-shaped and comprises 5–7 white, contorted lobes crowning an orange-coloured tube. The length of the coloured corolla tubes of *N. arbor-tristis* varies from 1 to 1.5 cm. Stamens are epipetalous. On the inner border of the corolla tube are present unicellular hairs, restricted to the lower end of the corolla tube (figure 1). Anthers are bilobed, each lobe having two pollen sacs in which characteristic pollen grains are found (figure 2). The tricolpate pollen grains are spherical (figure 2), with smooth intine. The exine surface shows a unique architectural pattern (figure 3), with muri winding and simple swollen ends. The lumina, varying in shape and size, are generally polygonal[4] and provided with bacules (figure 3).



Figures 1–3. Scanning electron micrographs of *N. arbor-tristis.* **1,** Inner surface of corolla tube showing unicellular hairs (× 150). **2,** Pollen grains (× 2000). **3,** Exine of pollen grain (× 12000).

Notably, genuine saffron consists of the 'trifid stigma plus portion of the style' of *C. sativus*, the flowers of which have the typical morphology of those of the family Iridaceae. The three stigmatic lobes possess unique-looking long and short papillae, in which are lodged the distinctly spherical and smooth-surfaced pollen grains. The pollen grains lack the architectural pattern observed on the surface of *N. arbor-tristis* pollen.

These findings have revealed distinct micromorphological differences between the corolla tube and pollen grain surface of *N. arbor-tristis* and the morphological features of the trifid stigma and style of *C. sativus*. They may be of significant help in tackling the adulteration problem of commercial samples of saffron (especially with respect to corolla tubes of *N. arbor-tristis*).

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SUGAR PHOSPHATES AND URIDINE NUCLEOTIDES IN DEVELOPING GRAINS OF LOW AND HIGH STARCH BARLEY GENOTYPES

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A high lysine and protein barley mutant Notch-2 has lower starch accumulation during grain development compared to its parent NP 113. The decreased starch synthesis in the mutant grain is not due to limitation of soluble sugar precursors[1]. Since sucrose is the primary precursor of starch biosynthesis in developing grain, the constraint in starch accumulation could be somewhere in the pathway of sucrose–starch conversion. Sugar phosphates and nucleotides are important metabolites in conversion of sucrose to starch[2]. This communication reports changes in the levels of some of these metabolites, viz. glucose 1-phosphate (G1-P), glucose 6-phosphate (G6-P), fructose 6-phosphate (F6-P), uridine triphosphate (UTP), uridine diphosphate (UDP) and uridine diphosphate glucose (UDP-glucose), in developing grains of NP 113 and Notch-2.

Barley plants of the two genotypes (NP 113 and Notch-2) were raised in pots under identical fertility and environmental conditions. The ears were harvested at weekly intervals beginning 10 days after anthesis, until maturity. The grains were dehusked and stored in liquid nitrogen until analysis.

The metabolites were extracted with ice-cold perchloric acid (0.8 N) by a slight modification of the method described by Rasi-Caldogno and DeMichelis[3]. The extracts were neutralized with potassium carbonate and diluted to suitable volume with Tris-HCl buffer (50 mM, pH 7.6).

G1-P, G6-P and F6-P[4]; UTP and UDP[5]; and UDP-glucose[6] were estimated by standard enzymatic methods, by coupling the corresponding enzyme reactions with reduction of nicotinamide adenine dinucleotide (phosphate) and monitoring the increase in absorbance at 340 nm.

Extracts were prepared in duplicate for each metabolite and duplicate estimations were carried out with each extract.

Developmental patterns and relative levels of sugar phosphates and uridine nucleotides in developing grains of NP 113 barley and the low starch mutant Notch-2 are presented in figure 1. Sugar phosphates estimated followed more or less similar developmental patterns in that the levels were higher during the early stages of development and declined during the later stages. These patterns resemble those reported earlier for developing wheat grains[7].

Sucrose is the primary precursor of starch biosynthesis in developing grains. There is evidence to suggest that sucrose-carbon enters the amyloplast (site of starch biosynthesis) in the form of triose phosphate[3], which is converted into starch via fructose 1,6-bisphosphate, F6-P, G6-P, and UDP-glucose and/or ADP-glucose (adenosine diphosphate glucose). Since developing grain is predominantly a biosynthetic tissue, all these metabolites and the accessory metabolites UDP and UTP are expected to be concentrated in the amyloplasts.

With the exception of G1-P average level per grain of all the metabolites reported here were higher in the mutant Notch-2 grain compared to those in normal NP 113 grain (figure 1); hence these metabolites are not expected to limit starch accumulation in the mutant grain. G1-P content was relatively lower in Notch-2 grain. In the amyloplast G1-P is formed from G6-P by the action of phosphoglucomutase and is utilized to produce ADP-