THE COURSE OF THE POLLEN TUBE IN CULTIVATED BARLEY

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The writer has not found in the literature a complete and authoritative account of the course followed by the pollen tube in the ovary tissue of the small grains. Lemer and Holzner (2) in 1888 logically implied a path through the most likely tissues but evidently did not observe the tube in the barley ovary because of the difficulty of following it in stained preparations. In 1933, the findings of Krauss (1) were in disagreement and these stimulated the present work.

MATERIALS AND METHODS

Ten varieties of barley differing widely in botanical and physiological characters were used in studying the course of the pollen tube. Stained portions of pollen tubes were found of all the varieties and in no case did they occur outside the path as described. In most cases, hand-pollinated pistils sampled within 1 hour were used. For the earlier samples, Wilson’s modification of Bouin fluid was used as a killing and fixing agent. Later, the pistils were first wet with formal-acetic-alcohol and then placed in Craf fluid to complete the fixation. The latter method gave equally good fixation without prolonged washing. Formal-acetic-alcohol was used in a few cases, but resulted in distortion of the egg apparatus and a separation of the outer integument from the inner wall of the ovary. Whole mounts of single styles showed pollen tubes throughout their entire length, but it was necessary to section the ovary because of its increased thickness. Pistils embedded in paraffin were cut 10 μ to 30 μ thick. The thicker sections showed longer portions of the pollen tubes, but those in adjacent sections were often lost because of insecure adherence to the slide.

During the past 5 years, various stains have been tried, but identification of the tube has been difficult and uncertain. Following the suggestion of Maheshwari and Wulff (4), however, potassium iodide-iodine solution (KI, 5 grams; H₂O, 600 cc; and I, 1 gram) was used and this stained the ovary tissue brown and pollen grains and pollen tubes black. After storage for a few hours in a very weak potassium iodide-iodine solution (the above formula diluted 1:75), the brown tissue faded to light brown while the pollen starch remained black. The effect of this staining was accentuated by leaving the slide overnight to dry out and re-applying iodine solution. This was, of course, at the expense of the ground tissue which did not return completely to its former turgor. The only other evidence of starch in the preparations was the presence of small numbers of very small grains in the cells of the parenchymatous tissue of the ovary wall. The success of this method depends, of course, upon the presence of starch grains in the pollen tube. Where ordinary black-staining starch is not present in the pollen, as in those varieties bearing waxy starch, or where the starch has already disappeared from the tube, identification of the pollen tube by means of iodine is not possible. For reasons not yet understood, many pollen tubes containing starch might be found in the pistils of a variety at one sampling; whereas, at other times, only a trace of starch or none at all was apparent. Samples showing the most starch in the pollen tube were taken from field-grown plants toward the middle of the day.