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A NUCLEAR BODY IN MEIOSIS OF BROMUS

By

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With 52 Figures in the Text

(Received March 14, 1963)

I. Introduction

A structure which is tentatively called a "nuclear body" has been observed in microsporocytes in a large number of species of Bromus. A single nuclear body is generally present at an early stage of meiosis, and it diminishes and disappears during later stages. It can sometimes be determined that the substance of the nuclear body is not distributed equally to the quartet of cells and gametes resulting from each microsporocyte.

The nuclear body has not been found in somatic divisions of root tips or shoot tips. It may therefore be a structure which arises just before meiosis or at the beginning of meiosis, and may be related to some fundamental process associated with meiosis.

The present investigation has had as one of its aims a description of the distribution of the nuclear body in species of the genus Bromus. Information has also been obtained concerning its morphology and behavior during meiosis, and its relation to specific chromosomes or chromosome regions. Some aspects of the nuclear body were compared in diploid species and those with various degrees of polyploidy. These observations have been reported in summary form (Walters, 1962).

II. Materials and Methods

The 20 species used in the present study are listed in the Table; collections from separate populations and the localities from which fixations or seed of these populations were obtained are noted. A total of 36 populations was sampled. Diploid chromosome numbers of these species were 14, 28, 42, 56, and 84. Detailed relationships of some of these species are described by Stebbins (1947, 1949), Stebbins and Toogood (1944), Stebbins, Toogood, and Harlan (1944), Stebbins and Walters (1949), Schultz-Schaeffer (1956), and Schultz-Schaeffer and Markarian (1957).

Florets were fixed in a mixture of 3 parts absolute ethyl alcohol: 1 part glacial acetic acid and stored in 70 % alcohol under refrigeration. Meiosis was generally studied in iron-acetocarmine squashes of microsporocytes. In some instances the depth of staining was increased by a combination of Feulgen and acetocarmine staining. Microsporocytes of mollis and japonicus, in which no nuclear body was visible by these means, were also lightly stained with acetocarmine and observed under the phase-contrast microscope.
Root tips and shoot tips were similarly fixed and stored. Studies of mitotic divisions were made in iron-acetocarmine squashes following maceration of root and shoot tips in stomach fluid of the snail Helix aspersa, according to the method described by Faberge (1945). The stomach fluid was diluted with an equal amount of distilled water. Shoot or root tips were run down from 70% alcohol to water and placed in this mixture in a depression slide; the depression was covered with a vaseline sealed cover slip. Refrigeration (ca. 5° C.) was frequently used to slow down the enzyme action. When shoot or root tips had a mushy consistency, a single layer of cells could easily be spread on the slide. Somatic cells were observed primarily under the phase-contrast microscope. After test anthers had been immersed for the same length of time in the same mixture of snail stomach fluid and water, and squashes were stained with iron-acetocarmine, the nuclear body was readily visible in microsporocytes under the phase-contrast microscope. Magnification of Figs. 1—3 is × 1370 and all other photographs are × 3300.

Acknowledgements. This investigation was supported by a research grant, G—10696, from the National Science Foundation. I am indebted to a number of people who assisted me in the collection of materials: Dr. A. A. BEETLE, Mr. E. R. BLAKLEY, Mrs. REGGIE RAUSCH, Dr. L. A. SNYDER, Dr. G. LEDYARD STEBBINS, Mrs. LORA WIEGMA~, and Dr. DANIEL ZOHARY. I also wish to thank Dr. STEBBINS for reading the taxonomic section of this manuscript. The strain of trinii from Argentina (PI 202,154) was obtained through the courtesy of the U.S.D.A., Plant Introduction Section, Beltsville, Md., and the trinii from Chile (PI 224,789) from the Plant Introduction Section, Pullman, Wash. I am very grateful to Dr. JAMES L. WALTERS and Dr. SPENCER W. BROWN for helpful suggestions during the course of these studies and for critical reading of the manuscript.

III. Observations

During this investigation the presence of the nuclear body was determined in a large number of plants, at various stages of meiosis. Generally the nuclear body was studied in detail in one or two plants of each species or of populations of species from different localities. No systematic attempt was made in these studies to determine the extent of variation in morphology or behavior of the nuclear body among anthers of individual plants or individuals of the same population or species. The following descriptions of the nuclear body during various stages of meiosis are not meant to imply that its appearance or behavior is constant within individuals or species. Indeed, differences were sometimes observed within an anther, within individuals, and among populations of these species, as well as between species. The following descriptions of the nuclear body apply only to specific samples in which they were made, and comparisons among individuals can be only broadly described.

Presence of the nuclear body in species of Bromus

The nuclear body has been observed in 204 plants of 18 species, representing all five sections of the genus Bromus (Table). It has not been found in two species belonging to one of these sections.