A KEY TO STANDARDIZE THE DESCRIPTION OF GROWTH STAGES IN TURNIP RAPE, BRASSICA CAMPESTRIS

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Abstract

The growth of plants of Span rape (Brassica campestris) in a greenhouse under supplemental light was recorded periodically by photography. Six growth stages were recognized: 0 = preemergence, 1 = seedling, 2 = rosette, 3 = stem elongation, 4 = flowering, and 5 = seed ripening. Brief descriptions of the stages are given.

Introduction

The division of the growth cycle of crop plants into readily recognizable stages that can be identified by a number or a standard term has been described for small grains, corn, cotton, and tobacco (1). These standardized descriptions of growth stages have proved useful to plant pathologists, entomologists, and agronomists who wished to relate their observations to the developmental morphology of the crop rather than to a time period.

No standard description of the development of turnip rape (Brassica campestris L.) or other closely related species is available. Turnip rape has become an important oilseed crop on the Canadian prairies. A considerable amount of research is being carried out on the crop and its diseases and pests. The present study was undertaken to identify and describe the easily recognized stages in the development of the rape plant as integral part in the development of methods for assessing disease losses.

Materials and methods

Turnip rape cv. Span was grown from November to January and again from April to June in a greenhouse maintained at 20°C in 15 cm clay pots filled with a 3:1:1 soil-sand-peat potting mixture. The plants were thinned to one per pot in the seedling stage, spaced on a greenhouse bench and supplied with supplemental illumination for 8 h per day. When flowering commenced, pollen was collected daily and all open flowers were manually pollinated by means of a camel-hair brush.

Growth was recorded on 35 mm film every 3 to 7 days during the growth cycle. A reference scale was included in each frame. Line drawings were prepared by tracings from the projected slides. Stems developing from axillary buds were not depicted.

Results and discussion

The several easily recognized morphological stages in the growth of B. campestris are depicted in Figure 1. Each stage is described in terms of the main stem.

Stage 0 (preemergence) comprises the period of development from the start of inhibition, through elongation of the seedling axis, to the emergence of the cotyledons from the soil.

Stage 1 (seedling) extends from emergence of the cotyledons from the soil to the unfolding of the first true leaf which is normal in appearance. Frequently the first-formed true leaf, and occasionally the second one, partially expands and quickly becomes senescent.

Stage 2 (rosette) begins when the first normal leaf is unfolded and terminates when the stem begins to elongate. Four to seven petiolate leaves unfold at this stage. Stem length remains essentially unchanged although stem girth increases. The cotyledons and frequently the first one or two true leaves are senescent by the end of Stage 2.

Stage 3 (stem elongation) commences with elongation of the internodes of the expanded leaves and ends when the first flower opens. The remaining (sessile) leaves of the main stem unfold and the internodes elongate to near-maximum. The inflorescence enlarges and the rachis elongates, separating the pedicels of the first few flowers. The main stem reaches 30 to 60 percent of its maximum length by the end of Stage 3.

Stage 4 (flowering) is signaled by the opening of the first flower on the terminal raceme of the main stem and ends with

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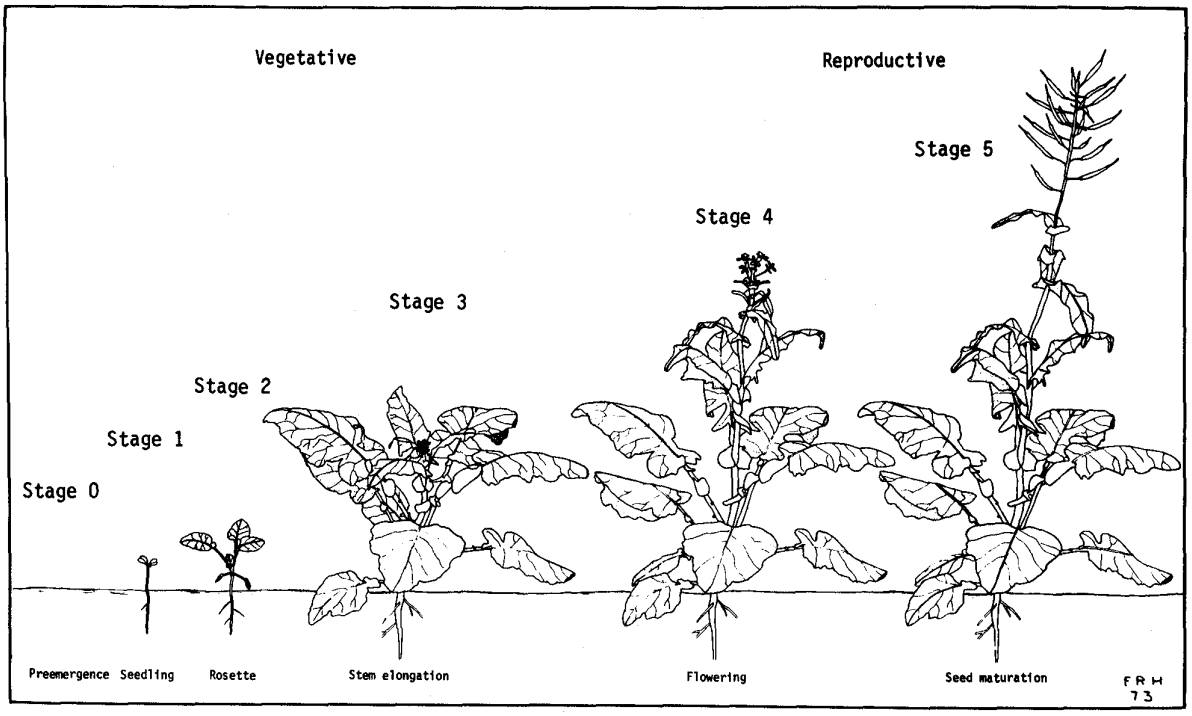

Figure 1. Stages in the growth of turnip rape (*Brassica campestris* L.)

incipient petal fall of the last flower on this raceme. Flowering progresses in the typical racemose pattern from base to apex. There is a moderate increase in plant height from elongation of the rachis of the inflorescence and from elongation of the internodes separating the uppermost leaves on the main stem. Axillary buds of the upper leaves, and occasionally some of the lower ones, become active and produce a stem, one to four sessile leaves and a terminal inflorescence. When environmental conditions are favorable, the racemes on the axillary stems will continue to flower for some time after flowering has finished on the main stem.

Stage 5 (seed ripening) begins with visible elongation of the ovary and incipient petal fall by the last-formed flower on the inflorescence of the main stem. It ends when all seeds of the plant have attained their maximum size and mature color. By the start of the seed-ripening stage, the siliques produced by the first-formed flowers have almost completed their elongation, their beaks are clearly discernable and their girth is approaching maximum. During this stage the siliques attain maximum size and change from green, through yellow to brown. The seeds achieve their final size and develop their mature reddish-brown color. Finally the siliques separate along the sutures and the seed is released. In western Canada the rape crop is generally swathed when 20 to 25 percent of the seeds have begun to turn from green to brown (2).

Duration of growth stages

The length of each growth stage in B. campestris is greatly influenced by temperature, moisture, and other factors in the environment of the plant. However, a rough approximation of the duration of the several stages, based on greenhouse and field observations is:

Stage	Description	Duration in days
0	Preemergence	4 to 6
1	Seedling	4 to 6
2	Rosette	18 to 25
3	Stem elongation	4 to 7
4	Flowering	7 to 14
5	Seed maturation	highly variable

Development of axillary stems

A secondary stem may emanate from any axillary bud on the main stem. The buds of the sessile upper leaves generally become active first with the development of a stem, one to four leaves, and a terminal inflorescence. However, in exceptional circumstances, for example, where stands are sparse or flea beetles have caused early, severe damage, the buds of the lower, petiolate leaves may also develop into flowering branches. Tertiary stems bearing

inflorescences occasionally develop from the axillary buds of the sessile leaves on the secondary stems.

Addendum

Since this manuscript was submitted for publication; another key to the growth stages of rape has been published (3).

Literature cited

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