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Studies on Emergence, Growth and Development of Horseweed (*Erigeron canadensis*) under Mid-hill conditions of Himachal Pradesh

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Biology of weeds needs to be studied in order to understand the influence of environmental factors on the various phases of their life cycle, the mechanism of perenntation and re-appearance in certain habitats in a particular season; the weakest phase in life cycle when they could be vulnerable to control measures as also of their role in the eco-system functioning, etc. *Erigeron canadensis,* commonly known as horseweed and belonging to family Composite, is a new introduction in the State and is invading orchards, grasslands, pastures, wasteland and abandoned fields at an alarming rate. The present study was, therefore, undertaken to study the time of emergence, growth and development of this newly emerged horseweed under mid-hill conditions of north-western Himalayas.

The experiments were carried out at the Research Farm of Department of Agronomy (1999-2000) and Department of Tea Husbandry and Technology (2000-01), CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur. Before the start of experiment, it was ascertained that plots were heavily infested with *Erigeron canadensis.* Four plots of size 2 m x 2 m were demarcated and maintained with the help of sticks in natural grassland heavily infested with *E. canadensis* in fall and spring season. These four plots were considered as four replications at each location and season. From these demarcated plots, observations on emergence, growth and development were recorded at monthly interval.

E. canadensis emerged in two different flushes in a year i. e. during spring season and fall season (Fig. 1). The fall emergence of the weed starts during the month of July and continues upto September. However, the count ranged (average of two years) from 392 to 435 plants m^{-2} during the two seasons of observation. These densities are higher than those reported by Buhler and Owen (1997), but are much lower than those observed in a no-tillage corn field in Massachusetts (Bhowmik and Bekech, 1993). Emergence of its next flush started in February. Emergence count as recorded on March 15 was 228 plants m^{-2} which further increased upto 310 plants m^{-2} during May. Thus, it was observed

Table 1. Biology of *Erigeron canadensis* (Average of two years)

Observations	Fall emergence	Spring emergence
Number of leaves $plant^{-1}$ (Flowering)	68	76
Number of branches $plant^{-1}$ (Flowering)	16	12
Final plant population m^{-2}	128	88
Number of capitula $branch^{-1}$	8	10
Number of seeds $capitulum^{-1}$	328	346
Number of seeds $plant^{-1}$	41,984	41,520
Dry matter accumulation $plant^{-1}$	6.8	6.2
Time of flowering	May-June	July
Time of seed formation	July 15-July 25	August
Time of maturity	July 25-August 10	September
Root length $plant^{-1}$	18.5 cm	11.7 cm

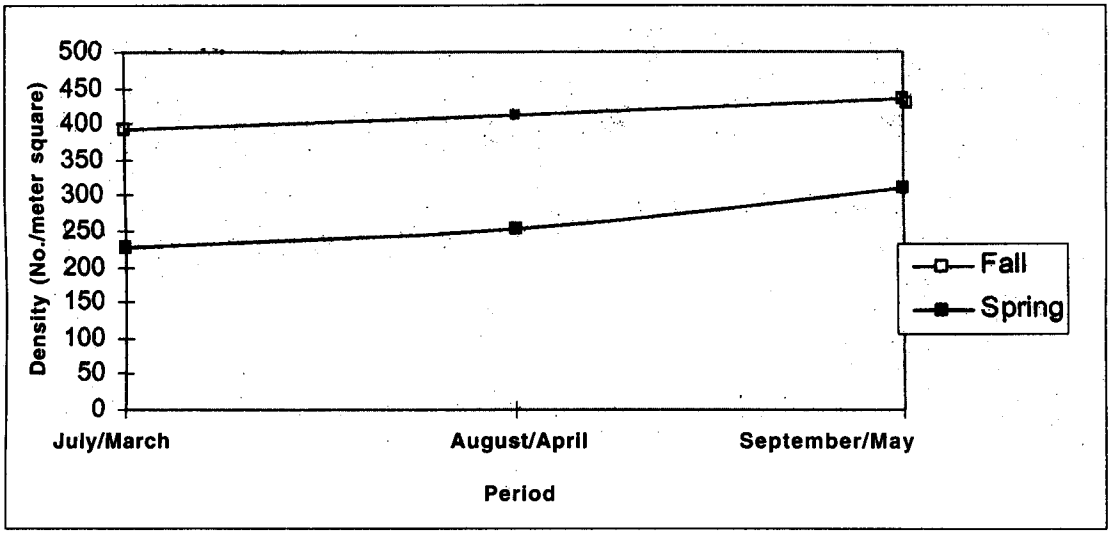

Fig. 1. *E. canadensis* density in relation to time of emergence.

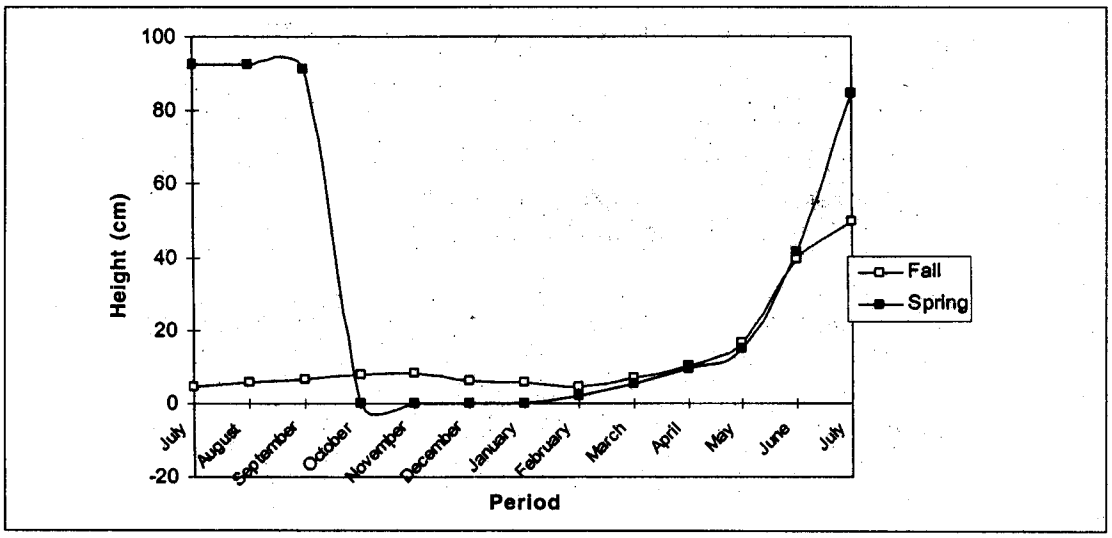

Fig. 2. Plant height of *E. canadensis* as influenced by the time period.

that population of spring emerged *E. canadensis* was less than that of fall emerged *E. canadensis*. These results are in confirmation with the findings of Buhler and Owen (1997), who also reported that spring emergence accounted for 25% of total emergence of *E. canadensis* over a year.

The fall emerged *E. canadensis* continued to grow actively till November and the plant height increased to 8.4 cm (Fig. 2), but later on the plants suffered chilling injuries due to low temperature conditions. Hence, it resulted in lesser height of plants. The horseweed that had emerged during fall seasons formed vegetative rosettes in the winters, to overcome the cold stress during these months. Bhowmik and Bekech (1993) and Buhler and Owen (1997) have also reported similar

mechanism to survive winters by the fall emerged *E. canadensis*. March onwards, the plants which survived winters, resumed active growth upto July and obtained height of 49.8 cm (Fig. 2), afterwards the plants matured and died. Whereas spring emerged plants continued to grow and attained maturity during September when the plants had achieved height of 91.4 cm (Fig. 2).

Fall emerged *E. canadensis* had lesser number of leaves, more number of branches per plant, less number of seeds per capitulum, more dry matter per plant, flowered, formed seeds and matured earlier as compared to spring emerged horseweed (Table 1). Fall emerged *E. canadensis* had stronger root system and more root length as compared to spring emerged *E. canadensis*. Therefore, it can be concluded that the horseweed emerged in two flushes in a year i. e. fall emerged (July-September) and spring emerged (March-May) season. The fall emerged weed was found to have more rebust growth and development of shoot as well as roots as compared to spring emerged.

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