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EFFICACY OF A NOVEL ESTER AZETIDINE 3-CARBOXYLATE AS A CHEMICAL HYBRIDIZING AGENT FOR *BRASSICA JUNCEA* (L.) CZERN & COSS.

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The chemicals which inhibit the development of gametes are known as gametocides or chemical hybridizing agents (Cross and Schulz 1997). Since these chemicals induce appreciable degree of male sterility without affecting female fertility thereby guaranteeing that seed-set in the treated plants is not due to self-pollination. Chemical hybridizing agents are of considerable importance in plant breeding where large scale cross-pollination of crops in required for the production of hybrid seed stock. There are large number of new generations of chemical hybridizing agents (CHAs) which are much useful with increasingly better selectivity and effectiveness (Cross and Schulz 1997, Chauhan *et al.* 2007). There are at least four classes of CHAs in current literature. One of such class of CHAs belong to the inhibitors of pollen fertility and a novel ester azetidine 3-carboxylate (A3C) belongs to this group. It has been effectively used to induce male sterility in wheat by Cross and Ladyman (1991) and Kofoid (1991). However, this CHA has not been tested so far in *Brassica juncea* for inducing male sterility. Present investigation has been under taken to test the efficacy of azetidine 3-carboxylate on *Brassica juncea* for inducing male sterility and possible use of male sterile plants in hybrid seed production.

Present experiment was conducted at the Botanical Garden, Department of Botany, School of Life Sciences, Khandari campus, Dr. B.R. Ambedkar University, Agra. The seeds of *Brassica juncea* (L.) Czern and Coss Var. Pusa bold were sown in a randomized row design, maintaining a distance of 35 cm between two rows. A group of sixty plants were sprayed once with 1, 2 and 3 ppm aqueous solutions just before floral bud initiation (T_1). Leaving thirty plants after first spray, the other thirty were spayed again (T_2) with these solutions at the time of floral bud initiation. A group of thirty plants were sprayed with distilled water to serve as control (T_0). A drop of wetting agent (Triton-X) was added to all the solutions.

Pollen viability of treated and untreated plants was checked at regular intervals throughout flowering with the help of 1% tetrazolium chloride (TTC) in 0.15 M Tris-HCl buffer at pH 7.5 after the procedure of Hauser and Morrison (1964). The average of the pollen fertility tested throughout flowering has been presented.

Data on plant height at maturity, number of branches/plant, number of leaves/plant, days taken to first flowering, number of fruits/plant, fruits size, number of seeds/siliqua, 100 seed weight and total yield/plant were collected in treated and untreated plants and analyzed using ANOVA test.

Plants treated with various concentrations at different stages of development exhibited changes in the morphological features, yield parameters and pollen viability.

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Table 1. Effect of azetidine 3-carboxylate on morphological and reproductive parameters in Brassica Juncea

Parameters	Treatments	Azetidine 3-Carboxilate			CD value at 5% level
		1.0ppm	2.0ppm	3.0ppm	
Plant height (cm)	T_1 T_2 T_0	108.5±1.3 100.2±2.1	90.7±3.2 88.3±1.8 118.0±2.0	87.5±2.1 85.6±1.0	12.1
Number of branches/plant	T_1 T_2 T_0	35.0±2.5 32.2±1.3	33.4±1.2 29.3±1.1 48.0±1.0	28.1±2.0 25.2±1.8	5.9
Number of leaves/plant	T_1 T_2 T_0	72.0±3.8 70.5±1.8	68.5±3.9 57.3±3.0 98.6±1.2	58.6±2.0 55.1±1.0	6.2
Days taken to first flowering	T_1 T_2 T_0	48.2±1.8 49.8±1.7	49.0±2.7 48.0±5.2 43.0±1.0	52.0±1.9 54.1±1.0	4.0
Pollen sterility (%)	T_1 T_2 T_0	97.2±1.5 100.0±0.0	100.0±0.0 100.0±0.0 10.3±2.2	100.0±0.0 100.0±0.0	1.7
Number of fruits /plant	T_1 T_2 T_0	158.0±1.3 140.2±1.0	155.1±2.1 140.0±0.9 258.3±3.0	152.7±1.1 135.2±0.8	12.0
Fruit /Size (cm)	T_1 T_2 T_0	5.9±1.7 4.4±2.9	5.6±1.5 5.0±3.8 6.0±0.36	4.5±2.5 4.4±4.6	0.2
Number of seeds/pod	T_1 T_2 T_0	14.2±1.8 12.8±1.7	13.0±2.7 12.5±5.2 14.8±2.1	11.7±1.9 10.8±1.6	0.5
Total yield (g)	T_1 T_2 T_0	16.0±2.3 14.7±3.2	15.4±1.3 14.1±4.3 25.2±1.26	12.5.214.2 10.9±3.6	5.8
100 seed weight (g)	T_1 T_2 T_0	0.68±0.05 0.63±0.02	0.60±0.09 0.58±0.01 0.70±0.06	0.53±0.04 0.48±0.03	0.3

The treated plants exhibited significant reduction in their height, number of branches/ plants, number of leaves/plants, number of siliqua/plant, fruit size, number of seeds/ siliqua, total yield/plant and hundred seed weight (Table 1). The reduction in all these morphological and yield parameters increased with the increase in the concentration and number of treatments. The plants sprayed twice with 3 ppm solution of A3C showed a significant reduction in all these parameters as compared to those of control plants (Table 1).

On the other hand, the treated plants took more days for first flowering as compared to untreated plants. Plants sprayed twice with 3 ppm A3C took maximum days (54.1) for first floral initiation as compared to only 48.2 days taken by plants sprayed only once with 1 ppm solution. The control plants showed flower initiation only after 43 days.

All the treatments with A3C were found to be effective in inducing pollen sterility ranging between 97.2100%. The plants sprayed only once with 1 ppm solution of A3C showed 97.2% sterility. On the other hand, treatments with 2 and 3 ppm A3C were effective in inducing complete (100%) pollen sterility. This sterility lasted throughout flowering. However, sterility induced by lower concentration declines with age (Table 1).

It is evident from the present findings that all the treatments with 2 and 3 ppm A3C

induced complete pollen sterility but caused significant reduction in plant growth as well as in yield parameters. However, it was encouraging to note that plants sprayed only once with 1 ppm azetidine-3-carboxylate induced appreciable degree of pollen sterility (97.2%) and these plants exhibited insignificant reduction in yield parameters. These plants can be exploited for hybrid seed production. However, A3C should be carefully used due to its toxicity to both human beings and animals. Cross and Ladyman (1991) and Kofoid (1991) have also effectively induced male sterility in wheat. Several other CHAs (benzotrizole, surf excel, ethrel, GA3, nirma, pendimethylin, maleic hydrazide, arsenic trioxide and sodium arsenate) have been used to induce complete pollen sterility in *Brassica juncea* (Chauhan and Singh 2002, Chauhan *et al.* 2003, Singh and Chauhan 2001, 2003, 2004, Lavania and Chauhan 2006, Chauhan *et al.* 2007 and Chauhan *et al.* 2010).

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