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Inheritance study of flower color in genotypes of yellow sarson

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Abstract
The inheritance study of yellow sarson genotypes revealed that the yellow color was dominant and was under monogenic control the white flower is due to defective chloroplast it was stated by the scientist in literature the f1, f2, bc1, bc2 study gave the clear picture about the flower color inheritance and dominance of yellow color flowers in f1 and acceptable ratios for plants which are yellow and white in color according to mendelian inheritance.

Keywords: Inheritance study, flower color, genotypes, yellow sarson

Introduction
The yellow sarson crop *Brassica rapa* var yellow sarson has yellow flower and white flowers Color cues are used by species in nature to attract or repel others (Faegri and van der Pijl 1979) [2]. Flower colour is one of the most well-known of these cues.an enticing signal for pollinators. The primary cause of flower colour variation is Carotenoids, flavonoids, betalains, and chlorophylls are examples of chemically different colours. Being in charge of yellows, oranges, and reds. The most common biocolor isoprenoid (Grotewold 2006) [3]. Carotenoids, despite being well preserved, are aa well-represented group with over 750 chemicals found in plants, algae, fungus, and cyanobacteria Britton and colleagues (2004) [4]; Takaichi (2011) [1] The most typical Xanthophylls are carotenoids found in yellow floral organs. Which are very species- or variety-specific in terms of quantity and composition (Ohmiya 2011) [5].

Material and Methods
The present investigation was conducted at N. E. Borlaug Crop Research Center, G.B. Pant University of Agriculture and Technology, Pantnagar. Geographically, Pantnagar is situated at 29º N latitude, 79.3º E longitude and at an altitude of 243.84 meters above the mean sea level. The university falls under the subtropical zone and is situated in the *Tarai* region at the foot hills of Shivalik range of the Himalayas. Climate of Pantnagar is sub- humid, sub-tropical with hot and dry summers and cool winters. The average annual rainfall of the area is 1433.3 mm and 80-90% of it is received during rainy season. Few showers are commonly received during winter season (November to March). Frost generally occurs at the end of December and sometimes also in January. Maximum temperature of the area is recorded during the month of May and June and the minimum temperature in the month of January. Mean relative humidity remains almost 80-90 per cent from mid-June to February. Soils of this region are developed from medium to moderately coarse textured calcareous alluvium brought down from mountains by numerous streams flowing through the Bhabar and Tarai region. These soils are mainly silty and loamy in texture with fine to medium fine granular structure, having good moisture retention and are highly productive.

The Cross YSH0401 x PANT SWETA was attempted to study inheritance of flower colour. The crosses of F_1's were generated during *rabi* season of year 2019-20. These F_1's were backcrossed with both the parents to generate BC_1 and BC_2 generation during the *rabi* season of year 2020-2021 and the F_1's was also selfed to produce seeds for F_2 generation. Fresh F_1's was also developed during the year 2020-21. The six generation (P_1, P_2, F_1, F_2, BC_1 and BC_2) of 4 different crosses *viz.*, was grown during the *rabi* season of year 2021-2022 to generate data for inheritance study.

Result and Discussion

Inheritance studies for flower colour in Brassica

The cross YSH-0401 (yellow colour flower) x Pant Sweta (white colour flower) were generated to study the inheritance of flower colour in Brassica. For this purpose, the F_1, F_2 and backcross generations were generated and data were recorded on flower colour (Table 1). The parent YSH-0401 had yellow colour flower while the parent Pant Sweta had white colour flower. In case of F_1 generation all 20 plants were yellow indicating that yellow colour is dominant over white colour. Zhang *et al*. (2002) [9] studied the inheritance of flower colour in *Brassica* spp. by crossing *B. rapa* inbred line having yellow flower with a *B. napus* inbred line with white flower. The results showed that the in rapeseed yellow flower colour presented dominant and epistatic effect over the white colour. An investigation conducted by The F_2 generation showed segregation for flower colour. The F_2 plants were divided into two group i.e. yellow flower and white flower group. Out of total 250 F_2 plants, 190 plants had yellow flower and 60 plants had white flower. These numbers fit to the ratio of 3 (yellow): 1 (white) with chi - square value 0.18 which is less than 3.8 i.e. chi square tabulated value at 5% level of significance [χ^2_{cal}<3.84($\chi^2_{0.05,\ 1\ df}$)]. The segregation pattern of 3:1 in F_2 generation showed that inheritance of flower colour in Brassica is controlled by single dominant gene. The backcross generations were also evaluated for flower colour. In the backcross of F_1 with dominant parent *i.e.*, BC_1P_1 (F_1 x YSH-0401), all 350 plants had yellow colour flower. In case of backcross between F_1 and recessive parent *i.e.* BC_1P_2 (F_1 x Pant sweta), out of 340 plants, 175 plants had yellow flower and 165 plants had white flower. The segregation pattern in BC_1P_2 showed a good fit in ratio 1:1 with chi square value of 0.28. The results obtained from these backcrosses again showed that flower colour in this cross is controlled by single dominant gene and this also confirms the result obtained from F_2 generation. Overall the results obtained from F_1, F_2 and backcross generation indicated that yellow flower colour is dominant over white colour and flower colour is under control of a single dominant gene. Rahman 2001 worked on a Canadian cultivars and one yellow-flowered, brown-seeded rapid cycling accession, and their F1, F2, F3 and backcross populations. The resukts of study revealed that petal colour was under monogenic control and yellow petal colour gene is dominant over the creamy-white petal colour gene. In *B. napus*, although some researchers reported that the white flower character was controlled by one pair of incompletely dominant genes (Zhang *et al*. 2000; Peng 2008; Wen *et al*. 2010). Tian *et al*. (2009) [6, 8, 10] found that the white flower trait of *B. napus* was controlled by two pairs of major gene. In case of *Brassica juncea* Zhang (2018) [7] found that two independent genes governed the white flower trait they were recessive and indepen-dent genes (*Bjpc1* and *Bjpc2*).

Table 1: Inheritance pattern of flower colour in different generation of cross YSH-0401 (yellow colour flower) x Pant Sweta (white colour flower)

Generation	Total no. of plants	Expected frequency		Observed frequency		Expected ratio	X^2 cal	X^2 tab (0.05, 1 df)
		Yellow	White	Yellow	White			
F_1	20	20	0	20	0	1:0		
F_2	250	187	63	190	60	3:1	0.18	3.84
BC_1P_1 (F_1 x YSH-0401)	350	350	0	350	0	1:0	0.00	3.84
BC_2P_2 (F_1 x Pant sweta)	340	170	170	175	165	1:1	0.28	3.84

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