

## Influence of Intervarietal and Interspecific Crosses on Seed Set of *Gladiolus* under Mid- hill Environments of Dailekh Condition

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### Abstract

Twelve intervarietal crosses and ten interspecific crosses of *gladiolus* were tested separately in RCBD, each with 4 replications in the field of Agriculture Research Station, Dailekh from 2010 to 2011. The objective of the study was to find the potentiality of seed set in different crosses within and between the species. Under intervarietal crosses, high pooled capsule set per spike resulted in 'Ginger Red x G-4' (95.0%), 'G-4 x American Beauty' (92.5%), 'Intrepid x G-4' (92.5%), 'G-4 x Intrepid' (91.7%), 'American Beauty x G-4' (88.5%) and 'Intrepid x American Beauty' (83.15%), but 'Ginger Red x American Beauty' and 'Ginger Red x Intrepid' produced the lowest pooled capsule set per spike with 50.1% and 53.8% respectively. 'Intrepid x G-4' produced the highest pooled number of seed sets with 66.0 per capsule followed by 'G-4 x American Beauty' with 44.0 and 'G-4 x Intrepid' with 44.0 while both 'Ginger Red x American Beauty' and 'Ginger Red x Intrepid' produced the lowest pooled number of seeds with 2.0 per capsule. Under the interspecific crosses, Pooled number of seed set per capsule was inconsequentially high in '*Psittacinus* hybrid x G-4' with 56.0, 'Intrepid x *Psittacinus* hybrid' with 54.0 and 'White Prosperity x *Psittacinus* hybrid' with 52.0. The seed set due to the effects of present crosses of *gladiolus* are more satisfactorily successful than those in the previous studies. Incorporation of genotype 'G-4' and 'Intrepid' both as female and male parents have contributed to high number of seeds per capsule presumably due to inherent varietal trait coupled with favorable environment for triggering seed set.

**Key words:** capsule, genetic base, *Psittacinus* hybrid, spike

### Introduction

*Gladiolus grandiflora* Hort., generally called "Glad", a member of family Iridaceae, sub-family Ixioideae, tribe Ixieae, sub-tribe Gladiolines is a prominent bulbous cut flower plant (Ranjan *et al.* 2010). *Gladiolus* is known as Sword Lily or Corn Lily originated from South Africa. Being an important bulbous ornamental plant, it occupies a prime position among commercial flower crops which has high demand in both domestic and international markets (Ahmad *et al.* 2008, Wagle 2009). The current number of species in genus *Gladiolus* is 250-260. Presently cultivated *gladiolus* hybrids (*G. grandiflora*) have been developed genetically from

20-25 species out of 250-260 found in its native place (Goldblatt & Manning 1998, Misra *et al.* 2003).

Improvement of *gladiolus* depends on its natural variability and reproductive biology. Hybridization in *gladiolus* is carried out to develop new cultivars with improved plant growth, better spike quality, new color, desired size and form of florets. Symmetrical arrangements of the florets on spike, high rate of corm and cormel multiplication and resistance to pests and diseases are important traits in *gladiolus*. There are over 30,000 varieties evolved in *gladiolus* so far through conventional breeding (Singh 2006). Even though a large number of exotic and indigenous

gladiolus cultivars with desirable vegetative and floral traits are available, yet there is a scope to improve the traits of cultivars through further breeding. Major gains of productivity increase and incorporation of other traits so far have come from conventional breeding efforts (Raghava 1999). In *Gladiolus* spp. various colors of flowers are available, but there is non-existent of fragrant in most *Gladiolus* spp. Efforts need to be intensified to develop fragrant varieties combined with desirable traits. There are about 40 South African species having fragrant. The best known fragrant arose from a cross between *G. tristis* and *G. recurvus* (Adamovic 2000, Lewis, 1997).

*G. psittacinus* L. is a long duration seasonal flowering plant that furnishes a stable microclimate for an array of diseases. Corm rot and yellows (*Fusarium oxysporum* f. sp. gladioli) is the single most dreaded pathogen affecting gladiolus, which causes as much as 60-100% damage to gladiolus on varietal responses (Pathania and Misra 2002). That is the reason *Gladiolus psittacinus* needs including as one parent in interspecific cross with *G. grandiflora* Hort.

The development of desirable varieties with wide genetic base is possible only through sexual propagation in conventional breeding. The study on the potentiality of seed set in the intervarietal and interspecific crosses is one of the most important prerequisites for successful breeding program, for extremely low seed set in a few intervarietal crosses, and failures of seed set in some interspecific crosses are apparently realized major problems in bulbous flowers including gladiolus (Van Tuyl 1997).

## Methodology

The experiment was conducted under field condition in Agriculture Research Station, Dailekh from February 2010 to July 2012. A total of 12 intervarietal cross combinations: 'American Beauty x Intrepid', 'Intrepid x American Beauty', 'American Beauty x Ginger Red', 'Ginger Red x American Beauty', 'American Beauty x G-4', 'G-4 x American Beauty', 'Intrepid x Ginger Red', 'Ginger Red x Intrepid', 'Intrepid x G-4', 'G-4 x Intrepid', 'Ginger Red x G-4' and 'G-4 x Ginger Red' were carried out in Randomized Complete Block Design with four replications in the consecutive years 2010 and 2011. On the other hand, a total of 10 interspecific cross combinations: 'American Beauty x *Psittacinus* hybrid', '*Psittacinus* hybrid x American Beauty', 'Intrepid x

*Psittacinus* hybrid', '*Psittacinus* hybrid x Intrepid', 'Ginger Red x *Psittacinus* hybrid', '*Psittacinus* hybrid x Ginger Red', 'G-4 x *Psittacinus* hybrid', '*Psittacinus* hybrid x G-4', 'White Prosperity x *Psittacinus* hybrid', '*Psittacinus* hybrid x White Prosperity' were included to find the potentiality of seed set in Randomized Complete Block Design with four replications in the year 2011. Cross combinations were considered as treatments.

The first, second and third florets, which were showing color at bud stage, were used for emasculation on the first day, florets from the fourth to the sixth position and seventh to eight position were emasculated on the second day and the third day respectively in order to enhance effective fertilization after being pollinated. In morning, florets to be pollinated on the next day were emasculated by removing out all the anthers with forceps without injuring pistil. These emasculated florets were covered with muslin cloth bags (20 x 40 cm) to prevent contamination by pollens from unknown sources. Upon selection of male parent, the unopened flowers that were supposed to open and dehisce pollen in synchrony with stigma receptivity were tied at the tips of perianth with soft thread to prevent the entry of insects. Pollination was effected in about 48 hours after emasculation. Emasculated flowers were pollinated between 9.30 a.m. and 11.30 a.m. by gently rubbing dehisced anther against the sticky stigmatic surface. Intervarietal and interspecific crosses were made from the first fortnight of April to the first fortnight of May. After pollination, pollinated florets were covered with muslin cloth bags and tied with soft thread. Pollinated plants were labeled with identity tag. Four different spikes of the same parent were used per replication for crossing. Pollinated floret buds were covered carefully until the seeds have set. Capsules were harvested in about one month after pollination day. Observations were recorded on established parameters: number of days taken for capsule maturity, number of florets used per spike, number of capsules set per spike, per cent of capsules set per spike, total numbers of developed seeds per spike and number of developed seeds per capsule.

## Results and Discussion

The data on number of days for capsule maturity, per cent of capsule set per spike, total number of developed seeds per spike and number of developed seeds per capsule were highly significant due to the

effects of intervarietal cross combinations, but number of florets used per spike and number of capsules set per spike were insignificant in the year 2010 (Table 1). Even so, all six parameters were highly significant in the year 2011 (Table 2). Out of six pooled performances of parameters, five parameters viz., number of days for capsule maturity, number of

capsules set per spike, per cent of capsules set per spike, total number of seeds per spike and number of seeds per capsule were highly significant, but the number of florets used per spike was insignificant due to the effects of intervarietal cross combinations in the year 2010 and 2011 (Table 3).

**Table 1.** Performances of the crosses among different varieties on capsule and seed set of gladiolus at ARS, Dailekh, 2010

Intervarietal cross combinationa	No. of days taken for capsules maturity	No. of florets used per cross	No. of capsules set per spike	Percent of capsules set per spike	Total number of seeds set per spike	Number of seeds set capsule
American Beauty x Intrepid	25.67	5.67	4.00	70.6	92	23.0
Intrepid x American Beauty	26.67	6.00	5.00	83.3	147	29.4
American Beauty x Ginger Red	27.33	6.00	4.67	77.8	73	15.6
Ginger Red x American Beauty	26.33	6.33	3.00	47.4	5	1.7
American Beauty x G-4	29.67	5.67	4.67	82.4	174	37.3
G-4 x American Beauty	28.00	6.33	5.33	84.2	277	52.0
Intrepid x Ginger Red	25.67	5.67	3.33	58.7	30	9.0
Ginger Red x Intrepid	26.33	6.33	2.33	36.8	2	0.90
Intrepid x G-4	30.67	6.00	5.67	94.5	382	67.40
G-4 x Intrepid	30.67	6.00	5.00	83.3	184	36.80
Ginger Red x G-4	28.00	6.67	6.00	89.9	254	42.30
G-4 x Ginger Red	27.67	5.00	3.00	60.0	37	12.30
GM	27.72	5.97	4.33	72.41	138.08	27.31
P-value	0.001	0.950	0.121	<.001	0.002	<.001
LSD <sub>(0.05)</sub>	2.429	2.077	2.599	18.50	169.00	12.19
CV%	5.200	20.500	35.400	15.30	72.30	27.20

**Table 2.** Performances of the crosses among different varieties on capsule and seed set of gladiolus at ARS, Dailekh, 2011

Intervarietal cross combinationa	No. of days taken for capsules maturity	No. of florets used per cross	No. of capsules set per spike	Percent of capsules set per spike	Total number of seeds set per spike	Number of seeds set capsule
American Beauty x Intrepid	29.00	7.33	6.33	86.4	208.0	33.0
Intrepid x American Beauty	26.67	6.00	5.00	83.0	158.0	31.6
American Beauty x Ginger Red	27.33	6.00	4.33	72.2	73.0	16.9
Ginger Red x American Beauty	26.33	6.33	3.33	52.6	8.0	2.4
American Beauty x G-4	26.67	6.67	6.33	94.9	219.0	34.6
G-4 x American Beauty	29.33	7.00	7.00	100.0	246.0	35.3
Intrepid x Ginger Red	26.00	5.67	4.33	76.4	105.0	24.3
Ginger Red x Intrepid	29.33	5.67	4.00	70.55	9.0	2.3
Intrepid x G-4	28.67	7.00	6.33	90.4	411.0	64.9
G-4 x Intrepid	31.00	7.67	7.67	100.0	389.0	50.7
Ginger Red x G-4	28.00	8.00	8.00	100.0	127.0	15.9
G-4 x Ginger Red	30.00	7.33	7.00	95.5	201.0	28.7
GM	28.19	6.72	5.81	85.16	179.5	28.38
P-value	<.001	0.002	<.001	<.001	<.001	<.001
LSD <sub>(0.05)</sub>	1.626	1.119	1.265	10.43	98.16	11.21
CV%	3.400	9.8	12.9	7.2	32.3	23.1

**Table 3.** Pooled performances of the crosses among different varieties on capsule and seed set of gladiolus at ARS, Dailekh, 2010 and 2011

Intervarietal cross combinationa	No. of days taken for capsules maturity	No. of florets used per cross	No. of capsules set per spike	Percent of capsules set per spike	Total number of seeds set per spike	Number of seeds set capsule
American Beauty x Intrepid	27.33	6.50	5.17	78.5	150	28.0
Intrepid x American Beauty	26.67	6.00	5.00	83.15	153	31.0
American Beauty x Ginger Red	27.33	6.00	4.50	75.0	73	16.0
Ginger Red x American Beauty	26.33	6.33	3.17	50.1	7	2.0
American Beauty x G-4	28.17	6.17	5.50	88.5	197	36.0
G-4 x American Beauty	28.67	6.67	6.17	92.5	262	44.0
Intrepid x Ginger Red	25.83	5.67	3.83	67.5	67	17.0
Ginger Red x Intrepid	27.83	6.00	3.17	53.8	5	2.0
Intrepid x G-4	29.67	6.50	6.00	92.5	396	66.0
G-4 x Intrepid	30.83	6.83	6.33	91.7	287	44.0
Ginger Red x G-4	28.00	7.33	7.00	95.0	191	29.0
G-4 x Ginger Red	28.83	6.17	5.00	81.0	119	21.0
GM	27.96	6.35	5.07	79.104	159	28.0
P-value	<.001	0.368	<.001	<.001	<.001	<.001
LSD <sub>(0.05)</sub>	1.636	1.232	1.58	10.64	114.8	9.234
CV%	3.5	11.5	18.4	7.9	42.7	19.8

Table 4 highlights that number of days for capsule maturity was only significant, and the number of florets per spike, the number of capsules set per spike, per cent of capsules set per spike, total number of seeds set per spike and number of seeds set per capsule were highly significant due to the effects of crosses among commercial varieties and '*Psittacinus* hybrid' in the

year 2011.

#### Pooled performances of twelve intervarietal cross combinations

The pooled number of days for capsule maturity varied from 25.83 to 30.83 with the mean value of 27.96 under intervarietal cross combinations (Table 3).The

**Table 4.** Performances of the crosses between commercial varieties (*G. grandiflora*) and *Psittacinus* hybrid (*G. psittacinus*) on capsule and seeds set at ARS, Dailekh 2011

Intervarietal cross combinationa	No. of days taken for capsules maturity	No. of florets used per cross	No. of capsules set per spike	Percent of capsules set per spike	Total number of seeds set per spike	Number of seeds set capsule
American Beauty x <i>Psittacinus</i> hybrid	28.33	6.67	6.33	94.9	266	42.0
<i>Psittacinus</i> hybrid x American Beauty	27.67	6.33	4.67	73.8	88	19.0
Intrepid x <i>Psittacinus</i> hybrid	29.00	6.67	5.67	85.0	308	54.0
<i>Psittacinus</i> hybrid x Intrepid	29.67	7.67	7.33	95.6	335	46.0
Ginger Red x <i>Psittacinus</i> hybrid	27.33	8.33	4.67	56.1	68	15.0
<i>Psittacinus</i> hybrid x Ginger Red	28.33	6.33	4.00	63.2	24	6.0
G-4 x <i>Psittacinus</i> hybrid	28.67	5.67	5.33	94.0	232	44.0
<i>Psittacinus</i> hybrid x G-4	27.67	5.67	5.67	100.0	317	56.0
White Prosperity x <i>Psittacinus</i> hybrid	28.67	8.00	7.33	91.6	383	52.0
<i>Psittacinus</i> hybrid x White Prosperity	27.67	9.00	8.00	88.9	227	29.0
GM	28.30	7.03	5.90	84.3	225	36.3
P-value	0.035	0.005	0.007	0.002	<.001	<.001
LSD <sub>(0.05)</sub>	1.316	1.680	1.994	19.65	135.3	20.17
CV%	2.700	13.900	19.7	13.6	35.1	31.8

intervarietal crosses viz., 'Intrepid x Ginger Red' took the shortest duration (25.83 days) for capsule maturity, however; this parameter did not vary significantly from those of 'Ginger Red x American Beauty', 'Intrepid x American Beauty', 'American Beauty x Intrepid' and 'American Beauty x Ginger Red'. Contrastingly, the intervariatal cross 'G-4 x Intrepid' took the long duration (30.83 days) for capsule maturity followed consequentially by 'Intrepid x G-4' (29.67 days) and 'G-4 x Ginger Red' (28.83 days).

The pooled per cent of capsule set per spike was variable between 50.1 and 95.0 with the mean value of 79.104 per cent (Table 3). Although the intervariatal cross 'Ginger Red x G-4' produced highest pooled per cent of capsule set per spike (95.0 per cent) it was at par with those of 'G-4 x American Beauty' (92.5), 'Intrepid x G-4' (92.5), 'G-4 x Intrepid' (91.7), 'American Beauty x G-4' (88.5) and 'Intrepid x American Beauty' (83.15). In contrast, two of the intervariatal crosses viz., 'Ginger Red x American Beauty' and 'Ginger Red x Intrepid' produced remarkably the lowest pooled per cent of capsule set per spike with 50.1 and 53.8, respectively.

The total pooled number of seeds per spike was variable between 5 and 396 with the mean value of 159 (Table 3). Two intervariatal cross viz., 'Intrepid x G-4' and 'G-4 x Intrepid' produced considerably the highest total pooled number of seeds with 396.0 and 287.0 respectively. Although the intervariatal cross 'Ginger Red x Intrepid' recorded the lowest total pooled number of seeds per spike (5.0) it was at par with 'Ginger Red x American Beauty' (7), 'Intrepid x Ginger Red' (67.0) and 'American Beauty x Ginger Red' (73.0).

The pooled number of seeds set per capsule was variable from 2.0 to 66.0 with the mean value of 28.0 (Table 3). 'Intrepid x G-4' produced remarkably the highest number of seeds (66.0 per capsule), and it varied significantly from those of subsequent intervariatal crosses such as 'G-4 x American Beauty' (44.0 per capsule), 'G-4 x Intrepid' (44.0 per capsule) and 'American Beauty x G-4' (36.0). To the contrary, 'Ginger Red x American Beauty' and 'Ginger Red x Intrepid' produced remarkably the lowest number of seeds (2.0 per capsule).

#### **Performances of ten interspecific cross combinations**

The data on days to capsule maturity was variable from 27.33 to 29.67 with the mean value of 28.30 (Table 4). Interspecific crosses viz., 'Ginger Red x *Psittacinus*

hybrid' (27.33 days), '*Psittacinus* hybrid x American Beauty', '*Psittacinus* hybrid x G-4' and '*Psittacinus* hybrid x White Prosperity' (27.67 days), 'American Beauty x *Psittacinus* hybrid' and '*Psittacinus* hybrid x Ginger Red' (28.33 days) took comparatively short duration for capsule maturity. To the contrary, '*Psittacinus* hybrid x Intrepid' took comparatively long duration (29.67 days) and it was at par with 'Intrepid x *Psittacinus* hybrid' (29.0 days), 'G-4 x *Psittacinus* hybrid' (28.67 days) and 'White Prosperity x *Psittacinus* hybrid' (28.67 days).

Per cent of capsule set per spike was variable from 56.1 to 100 with the mean value of 84.3 (Table 4). The interspecific cross '*Psittacinus* hybrid x G-4' contributed to the highest per cent of capsule set (100), but the variation in this regard was at par with '*Psittacinus* hybrid x Intrepid' (95.6 per cent), 'American Beauty x *Psittacinus* hybrid' (94.9 per cent), 'G-4 x *Psittacinus* hybrid' (94.0 per cent) and 'White Prosperity x *Psittacinus* hybrid' (91.6 per cent). In contrast, 'Ginger Red x *Psittacinus* hybrid' contributed to the lowest per cent of capsule set (56.1), followed by '*Psittacinus* hybrid x Ginger Red' (63.2), '*Psittacinus* hybrid x American Beauty' (73.8).

The total number of seed per spike was variable from 24.0 to 383.0 with the mean value of 225.0 (Table 4). The interspecific cross 'White Prosperity x *Psittacinus* hybrid' contributed to the highest total number of seeds (383.0) followed insignificantly by '*Psittacinus* hybrid x Intrepid' (335.0), 'Intrepid x *Psittacinus* hybrid' (308.0), 'American Beauty x *Psittacinus* hybrid' (266.0), 'G-4 x *Psittacinus* hybrid' (232.0) and '*Psittacinus* hybrid x White Prosperity' (227.0). The interspecific crosses viz., '*Psittacinus* hybrid x Ginger Red', 'Ginger red x *Psittacinus* hybrid' and '*Psittacinus* hybrid x American Beauty' contributed to considerably the lowest total number of seeds (24.0, 68.0, and 88.0 per spike respectively).

The number of seeds per capsule was variable from 6.0 to 56.0 with the mean value of 36.3 (Table 4). The interspecific cross '*Psittacinus* hybrid x G-4' produced the highest number of seeds (56.0 per capsule), however; followed insignificantly by 'Intrepid x *Psittacinus* hybrid' (54.0 per capsule), 'White Prosperity x *Psittacinus* hybrid' (52.0 per capsule), '*Psittacinus* hybrid x Intrepid' (46.0 per capsule), 'G-4 x *Psittacinus* hybrid' (44.0 per capsule) and 'American Beauty x *Psittacinus* hybrid' (42.0 per capsule). To the contrary, three interspecific crosses viz., '*Psittacinus*

hybrid x Ginger Red', 'Ginger Red x *Psittacinus* hybrid' and '*Psittacinus* hybrid x American Beauty' produced significantly the low seeds per capsule with 6.0, 15.0 and 19.0 respectively.

The intervarietal cross combinations *viz.*, 'Intrepid x G-4' and 'Intrepid x American Beauty' showed relatively consistent results for high pooled capsule set with 94.5 % and 83.3% respectively in 2010, and with 90.4% and 83.0% respectively in 2011. Even so, low pooled performances of capsule set resulted in 'Ginger Red x American Beauty' with 47.4 % and 'Ginger Red x Intrepid' with 36.8% in 2010, and with 52.6 % and 70.4% respectively in 2011 (Table 1, 2 and 3). Dhaduk *et al.* (1987) noted the highest capsule sets in 'Patrica x Jowagenaar' with 96.6% and 'Melody x Sam Smith' with 90% under 45 crosses tested. Under the same study, very low capsule set resulted in 'Sylvia x Sam Smith' with only 6.67% and 'Hunting Song x Jowagenaar' with 13.33%. The present finding of the study is, therefore, in some conformity with that of Dhaduk *et al.* (1987) despite the inclusion of different varieties in recent and former studies. Under the present study, remarkably low number of seed set was noted only in two intervarietal crosses *viz.*, 'Ginger Red x American Beauty' and 'Ginger Red x Intrepid' most possibly due to occurrence of cross-incompatibilities.

Additionally 'Intrepid x G-4' was found as the best cross-compatible and the most stable intervarietal cross combination to produce not only the high number of total seeds per spike but also the high number of seeds per capsule in the consecutive years 2010 and 2011 (Table 3). Furthermore, its reciprocal cross *viz.*, 'G-4 x Intrepid' also revealed the second best cross-compatible intervarietal cross combination in order to obtain the high number of seeds set per capsule in both the years 2010 and 2011 (Table 3). Misra *et al.* (2001) also reported wide variations with respect to seeds per capsule in different crosses, and it was mainly due to the genetic potentiality of the parent.

The interspecific crosses *viz.*, '*Psittacinus* hybrid x G-4', '*Psittacinus* hybrid x Intrepid', 'American Beauty x *Psittacinus* hybrid', 'G-4 x *Psittacinus* hybrid' and 'White Prosperity x *Psittacinus* hybrid' are more promising crosses than the remaining ones to obtain maximally the high per cent of capsule set in the year 2011 (Table 4). In respect of total number of seed set per spike, 'White Prosperity x *Psittacinus* hybrid', '*Psittacinus* hybrid x Intrepid', '*Psittacinus* hybrid x G-4' and 'Intrepid x *Psittacinus* hybrid' are relatively

good crosses as comparing against the rest of the crosses tested. As for high number of seed set per capsule, the crosses *viz.*, '*Psittacinus* hybrid x G-4', 'Intrepid x *Psittacinus* hybrid' and 'White Prosperity x *Psittacinus* hybrid' are superior over the remaining ones. Apart from the two crosses *viz.*, 'Red Ginger x *Psittacinus* hybrid' and 'Red Ginger x *Psittacinus* hybrid', most of the remaining crosses among commercial varieties and *Psittacinus* hybrid are cross-compatible ones for three important parameters such as per cent of capsule set per spike, total number of seed set per spike and number of seed set per capsule. The variety 'Ginger Red' either as male or as female parent with '*Psittacinus* hybrid' produced low total number of seeds per spike and number of seeds per capsule (Table 4). Dhaduk *et al.* (1987) reported that varieties *viz.*, 'Sylvia', '*Psittacinus* hybrid', 'Jogenaar' did not set capsule at all under natural self pollination, and '*Psittacinus* hybrid x Sancerre' produced the low number of seed per capsule (0.38) under artificial cross pollination. Poon (2009) recorded the high number of developed seeds (15.22 per capsule) from the crosses between '*Psittacinus* hybrid and Kum Kum' under Bengaluru condition, India when crosses were made from early January to mid February. Moreover, relatively high number of developed seeds (55.9 per capsule) was recorded from the crosses between '*Psittacinus* hybrid and G-4' in the similar study under Dailekh condition, Nepal when crosses were made from the first fortnight of April to the first fortnight of May. The findings of the two studies formerly made by Dhaduk *et al.* (1987) and Poon (2009) are quite different from that of the recent study most presumably due to the inclusion of different genotypes as male parents in crosses, some of flower abortions at low temperature and low light intensity during early January and mid February (12.0<sup>o</sup>-29.0<sup>o</sup>C) under Bengaluru environments, India. Moderate high temperature (15<sup>o</sup>-32<sup>o</sup>C) during April and May possibly could produce a positive effect in overcoming incongruity in interspecific crosses of gladiolus under mid-hill environments of Dailekh, Nepal. As low temperature and low light intensity leading to the activation of inhibitors in pollen tube, occurrence of flower abortion, and inclusion of pentaploid variety are responsible factors to cause impediments in getting success of capsule and seed set in intervarietal and interspecific crosses of flower bulbs (Anonym, 2009, Okazaki & Murami, 1992).

Inclusion of two genotypes *viz.*, 'Intrepid' and 'G-4' both in direct intervarietal cross ('Intrepid x G-4') and

reciprocal cross ('G-4 x Intrepid') appeared to have contributed to high number of seeds per capsule under recent intervarietal crosses (Plate 1 and 2).

In addition, only 'G-4' which was used either as male or female parent with other genotypes in direct or reciprocal crosses were quite promising ones under intervarietal as well as interspecific crosses.



Plate I- Intrepid × G-4



Plate II- G-4 × Intrepid

On the other hand' the same two genotypes *viz.*, 'Intrepid' and 'G-4' were also quite encouraging parents to obtain maximally high number of seeds per capsule as comparing to those of the other crosses

among modern commercial varieties and '*Psittacinus* hybrid' (Plate III, IV and V).

Both genotypes 'G-4' and 'Intrepid' presumably had good genetic trait to trigger high seed setting behavior on its respective cross. Contrastingly, 'Ginger Red' used as female parent reflected poor seed set per capsule under interspecific crosses. Most commercial varieties (*G. grandiflora* Hort.) are found crossable and compatible with '*Psittacinus* hybrid' (*G. psittacinus*) for seed set most possibly due to taxonomic similarities between the species of parents.

The major conclusive recommendations elucidated from the present study are:

- Most of the commercial varieties of gladiolus being cultivated in Nepal are compatibly crossable for seed setting behavior.
- Matured capsule must be harvested in approximately a month after the day of cross-pollination depending upon the inclusion of varieties or species in crosses.
- Getting success in viable seed set is almost always difficult when interspecific crosses are made from *G. grandiflorus* x *G. calianthus*; however, even under the open field condition, viable seed sets resulted in the interspecific crosses made from *G. grandiflorus* x *G. psittacinus* (Poon 2009, Personal experience 2011). Hence, inclusion of *G. psittacinus* as one of the parent will render the interspecific hybridization program deserving in future.



Plate III- Intrepid × *Psittacinus* hybrid



Plate IV- G-4 × *Psittacinus* hybrid



Plate V- *Psittacinus* hybrid × G-4

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