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Field evaluation of botanical extracts against lily caterpillar (*Polytela gloriosae* Fabricius) infesting spider lily

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Abstract
Lily caterpillar, *Polytela gloriosae* is a major and regular occurring pest of all lily growing areas and it cause severe losses to yield. Field evaluation of botanical extracts and loss assessment of lily caterpillar were carried out at Navsari, Gujarat. The results revealed that lowest population of lily caterpillar (1.44 larvae per plant) with lowest per cent bud damage (24.95 per cent flower bud damage per plant) was recorded in the treatment of *Azadirachta indica* leaves extract 10 per cent. Mean loss in flower bud yield by lily caterpillar in spider lily could be avoided by using neem to the tune of 48.90 per cent and highest flower bud yield (29.63 lakhs flower buds/ha/year) was obtained from the plots treated with Neem leaves extract 10 per cent.

Keywords: *Polytela gloriosae*, spider lily, botanical extracts, yield loss

Introduction
Flowers symbolize beauty, purity, peace and love. Flower cultivation has been practiced in India since long time, but it is only in the recent years that floriculture industry has become much popular (Shreeram and Leelavathi, 2017) [1]. The important flowers of commercial value are rose, gladiolous, tuberose, china aster, jasmine, orchids, chrysenthemum and spider lily (Koladiya, 1995) [2]. Spider lily (*Hymenocallis littoralis* L.) is a perennial bulbous flowering plant, belongs to family Amaryllidaceae. The farmers use popularly growing spider lily due to its remunerative price, pleasant fragrance and attractive white flowers. It is used as a loose flower in the preparation of garlands, veni, gajara, car decoration, bouquets and stage decoration. Generally, unopened flower buds are harvested from the stalk during morning or evening every day to keep the flower buds fresh as they have short vase life. Each flower bud is 10-12 cm long. Spider lily gives economic production up to 7 to 10 years (Kejkar and Polara, 2017)[3].South Gujarat with its moderate temperature in summer and high atmospheric humidity prevalent throughout the year proved most suitable for floriculture in open field condition and green house floriculture (Dattatraya, 2007) [4]. Spider lily is the most cultivated loose flower crop in south Gujarat in an area of approximately 900 ha with productivity of 30 lakh buds per ha/year (Elangaivendhan *et al*., 2016) [5]. Out of all districts of south Gujarat, Navsari is the leading producer of spider lily (Dedun, 2016) [6].

Pest and diseases are major problems in spider lily. The insect pests attacking lilies are lily caterpillar (*Polytela gloriosae* Fabricius), green peach aphid (*Myzus persicae* Sulzer), aphid (*Rhopalosiphum nymphaease* L.), lily weevil (*Agasphaerops nigra* Horn), lily bulb mite (*Rhizoglyphus echinopus* Fum and Rob) and lily beetle (*Lilioceris lilii* Scopoli) (Pulluri, 1994) [7].

Lily caterpillar, *P. gloriosae* (Lepidoptera: Noctuidae) is a major and regular occurring pest of all lily growing areas. It is also called as Indian lily moth. The species was first described by Johan Christian Fabricius in 1781. It is mainly found in India and Sri Lanka (Kocak *et al*., 2012) [8]. Hampson (1894) [9] first time recorded this pest throughout India and Ceylon. Lily caterpillar is a host of different lilies like *Crinum asiaticum* L., *Gloriosa superba* L., *Lilium longiflorum* Thunb, *Amaryllis belladonna* L. *etc*. Lily caterpillar is a major problem under spider lily (Anon., 2015) [10].

Lily caterpillars are black larvae with red orange and white spots on the dorsal side attacks almost all parts of the plant. Adults are small sized grey coloured moths.

They lay eggs in mass on leaves. It feeds on leaves and defoliates the plants up to the ground level during monsoon (Patel *et al*., 1989) [11]. It is generally active during monsoon. Yield loss occur in lilies is mainly due to *P. gloriosae*. In case of heavy infestation, the plants are more or less completely defoliated.

Materials and Methods

Evaluation of botanical extracts and loss assessment of lily caterpillar were carried out at the Floriculture Farm, NAU, Navsari, Gujarat during 2018. There were eight treatments including an untreated control and each treatment was replicated three times in the randomized block design. Two sprays were given to each treatment at 15 days interval.

For preparation of leaf extracts, 100 gms. leaves of each plant were taken and grinded in electrical grinder with 100 ml of water for 5 minutes. It was filtered with fine muslin cloth. Remnants from the cloth were again grinded with 100 ml of water and finally one litre volume was made by adding water to make 10 per cent solution. As per requirement the same method was used for preparing all botanical extracts individually.

The observations of lily caterpillar were recorded by thoroughly observing the randomly selected 5 plants and number of larvae of lily caterpillar per plant. Observations were recorded before spraying and 1, 7 and 15 days after each spray. Observations of 15th day interval of the first spray were considered as pre treatment observation for the subsequent spray. Total flower buds and damaged flower buds were counted on randomly selected five plants before spraying and 1, 7 and 15 days after each spray and expressed as per cent damage. Per cent bud damage was calculated on the basis of following formula.

$$\text{Bud damage (\%)} = \frac{\text{No. of damaged buds}}{\text{Total no. of buds}} \text{ x } 100$$

Results and discussion

The results of Table-1 indicated that all the treatments of botanical extracts were significantly superior over control and all treatments showed significant difference. However, the lowest larval population of lily caterpillar was recorded in treatment of *Azadirachta indica* (Neem) leaves extract 10 per cent recorded (1.44 larvae per plant). *Azadirachta indica* (Neem) was found significantly superior as compared with other treatments of botanical extracts. The next effective treatment was *Ipomoea fistulosa* (Naffatiya) recorded (1.81 larvae/plant), which was at par with *Melia dubia* (Bakane neem) (1.86 larvae/plant).The order of botanical extracts for their effectiveness based on lily caterpillar population per plant after first and second spray was *A. indica* (Neem)>*I. fistulosa* (Naffatiya)>*M. dubia* (Bakaneneem)> *O. basilicum* (Damro)> *A. vasica* (Ardusi)> *J. curcus* (Ratanjyot)> *N. indicum* (Karen)> Control.

Lowest per cent flower bud damage (Table-2) was observed in treatment of *A. indica* (Neem) leaves extract 10 per cent recorded (24.95 per cent flower bud damage per plant). *A. indica* (Neem) treatment was found to be significantly superior as compared with other treatments of botanical extracts. The next effective treatment was *I. fistulosa* (Naffatiya) recorded (32.40 per cent flower bud damage per plant), which was at par with *M. dubia* (Bakane neem) (32.84 per cent flower bud damage per plant). The order of botanical extracts for their effectiveness based on per cent flower bud damage per plant by lily caterpillar after first and second spray was *A. indica* (Neem)>*I. fistulosa* (Naffatiya)>*M. dubia* (Bakane neem)>*O. basilicum* (Damro)>*A. vasica* (Ardusi)>*J. curcus* (Ratanjyot)>*N. indicum* (Karen)> Control.

In case of yield (Table-3), the highest flower bud yield was received in the treatment of *A. indica* (Neem) leaves extract 10 per cent (29.63 lakhs flower buds/ha/year and 1440 no. of flower buds/net plot/year). The highest yield was obtained from *A. indica* (Neem) leaves extract treated plots because neem possessed very strong antifeedent, repellent and deterrent effect. Mean loss in flower bud yield by lily caterpillar was recorded 48.90% in spider lily by using following formula.

Hanumanthaswamy and Rajgopal (1993) [12] found Neemark (neem based botanical pesticide) caused 59.74% mortality in *P. gloriosae* after 13 days of spraying. Chandravanshi *et al*. (2013) [13] evaluated some botanical extracts against *P. gloriosae* and observed highest mortality by the extract of *A. indica*, which is in close confirmation with the present findings. Rathikannu (2005) [14] observed NSKE 5% and Neemazal 1% at 900 ml/ha was effective against *P. gloriosae* on glory lily. Chandravanshi *et al*. (2013) [13] found highest mortality in *P. gloriosae* by the extract of *A. indica*. Sathe (2015) [15] found 0.03% azadirachtin could control lily caterpillar successfully.

Hanumanthaswamy and Rajgopal (1993) [12] noticed that lily caterpillar caused severe loss to *G. superba* varied from 6 to 80%.Chandravanshi *et al*. (2013) [13] found lily caterpillar caused 48% plants damaged out of 430 plants. According to, Sathe (2015) [15] lily caterpillar caused 90 to 100% damage to yellow rain lily and pink rain lily. Present observations regarding loss caused by lily caterpillar is more or less similar with past findings. It might be due to different environmental and ecological conditions at different locations.

Table 1: Evaluation of various botanical extracts on larval population of lily caterpillar infesting spider lily (Pooled)

No.	Treatment	No. of larvae/plant #		
		First Spray	Second Spray	Overall Pooled
T1	*Adhatoda vasica* L.(Ardusi)	2.16 (4.20)	2.03 (3.64)	2.10 (3.92)
T2	*Azadirachta indica* (A. Juss.) (Neem)	1.60 (2.18)	1.26 (1.16)	**1.44 (1.67)**
T3	*Ocimum basilicum* L. (Damro)	2.13 (4.04)	2.01 (3.53)	2.07 (3.79)
T4	*Nerium indicum* L. (Karen)	2.18 (4.29)	2.06 (3.76)	2.12 (4.02)
T5	*Ipomoea fistulosa* Jace. (Naffatia)	1.89 (3.13)	1.72 (2.47)	1.81 (2.80)
T6	*Melia dubia* L. (Bakane neem)	1.96 (3.38)	1.75 (2.60)	1.86 (2.99)
T7	*Jatropha curcus* L. (Ratanjyot)	2.17 (4.24)	2.04 (3.69)	2.11 (3.97)
T8	Untreated Control	2.36 (5.07)	2.30 (4.78)	2.33 (4.92)
	S.Em. ± (T)	0.08	0.08	0.05
	C.D. at 5 % (T)	0.23	0.25	0.15
	S.Em. ± (P X T)	0.08	0.05	0.04

	C.D. at 5 % (P X T)	NS	NS	0.12
	C.V. (%)	6.54	4.44	5.68

Figures in parentheses are original mean values and those outside are square root √ X + 0.5 transformed values

Table 2: Evaluation of various botanical extracts on flower bud damage by lily caterpillar in spider lily (Pooled)

No.	Treatment	Flower bud damage (%)/plant #		
		First Spray	Second Spray	Overall Pooled
T1	*Adhatoda vasica* L.(Ardusi)	38.85 (39.42)	34.84 (32.74)	36.84 (36.08)
T2	*Azadirachta indica* (A. Juss.) (Neem)	29.04 (23.92)	20.86 (12.97)	**24.95 (18.45)**
T3	*Ocimum basilicum* L. (Damro)	38.12 (38.37)	34.51 (32.20)	36.32 (35.29)
T4	*Nerium indicum* L. (Karen)	39.67 (40.88)	36.30 (35.14)	37.99 (38.01)
T5	*Ipomoea fistulosa* Jace. (Naffatia)	35.14 (33.27)	29.65 (24.57)	32.40 (28.92)
T6	*Melia dubia* L. (Bakane neem)	35.73 (34.23)	29.95 (25.15)	32.84 (29.69)
T7	*Jatropha curcus* L. (Ratanjyot)	39.26 (40.13)	35.47 (33.75)	37.37 (36.94)
T8	Untreated Control	44.77 (49.63)	43.78 (47.90)	44.27 (48.77)
	S.Em. ± (T)	1.37	1.16	0.93
	C.D. at 5 % (T)	4.17	3.50	2.68
	S.Em. ± (P X T)	1.72	1.32	1.01
	C.D. at 5 % (P X T)	NS	NS	NS
	C.V. (%)	7.91	6.88	7.49

Figures in parentheses are original mean values and those outside are arcsine transformed values.

Table 3: Impact of lily caterpillar damage on yield of spider lily

Sr. No	Treatment name	Yield (No. of flower buds/net plot/year)	Yield (No. of flower buds/ha/year) in lakhs
T_1	*Adhatoda vasica* L.(Ardusi)	1020.00	20.99
T_2	*Azadirachta indica* (A. Juss.) (Neem)	1440.00	29.63
T_3	*Ocimum basilicum* L. (Damro)	1112.00	22.88
T_4	*Nerium indicum* L. (Karen)	840.00	17.28
T_5	*Ipomoea fistulosa* Jace. (Naffatia)	1296.00	26.67
T_6	*Melia dubia* L. (Bakane neem)	1232.00	25.35
T_7	*Jatropha curcus* L. (Ratanjyot)	920.00	18.93
T_8	Untreated Control	736.00	15.14
	S.Em. ± (T)	18.34	0.38
	C.D. at 5 % (T)	55.63	1.14
	C.V. (%)	2.96	2.95

Conclusion

Lowest population of lily caterpillar, lowest bud damage and Maximum healthy flower bud yield was recorded in neem leaves extract 10 per cent treatment. Mean loss in yield by lily caterpillar could be avoided by neem to the tune of 48.90 per cent. For effective control of lily caterpillar infesting spider lily, it is advised to apply neem leaves extract for higher yield and better results.

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