Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; SP1: 2290-2292

NK Sinha
ICAR-Indian Institute of Natural Resins and Gums, Ranchi, Jharkhand India

J Ghosh
ICAR-Indian Institute of Natural Resins and Gums, Ranchi, Jharkhand India

VD Lohot
ICAR-Indian Institute of Natural Resins and Gums, Ranchi, Jharkhand India

Md. Monobrullah
ICAR Research Complex for Eastern Region, Patna, Bihar India

S Ghosal
ICAR-Indian Institute of Natural Resins and Gums, Ranchi, Jharkhand India

KK Sharma
ICAR-Indian Institute of Natural Resins and Gums, Ranchi, Jharkhand India

AK Singh
ICAR-National Research Centre on Integrated Farming, Motihari, Bihar, India

Brajendra
ICAR-Indian Institute of Rice Research, Hyderabad, Telangana, India

Correspondence
NK Sinha
ICAR-Indian Institute of Natural Resins and Gums, Ranchi, Jharkhand India

Effect of some plant growth regulators on growth, seed setting, seed shattering and seed yield in lac insect host plant *Flemingia Semialata* Roxb

NK Sinha, J Ghosh, VD Lohot, Md. Monobrullah, S Ghosal, KK Sharma, AK Singh and Brajendra

Abstract
The present study was carried out to study the effect of different levels of plant growth regulators on morpho-physiological and biochemical characters and their relationship on yield attributing traits that helps in diminishing seed shattering, improving seed set and yield. Treatment of different plant growth regulators (PGRs) levels including thiourea (500 ppm, 1000 ppm, 1500 ppm), naphthalene acetic acid (NAA) (15 ppm, 30 ppm, 45 ppm), and salicylic acid (100 ppm, 200 ppm, 300 ppm) at different levels were sprayed at pre flowering and anthesis stage and their effects were studied on different morpho-physiological characters of *Flemingia semialata*. The experiment was planned under RBD with three replications for each treatment. It was observed that Thiourea @1000 ppm recorded highest plant height, stem diameter, leaf area, leaves number, number of raceme/bush, floret number/raceme, number of pods/ raceme, seed set %, 1000 seed weight and seed yield. Seed set (%) recorded highest in the plant treated with thiourea @1000 ppm whereas seed shattering (%) recorded lowest in the treatment thiourea @1000 ppm followed by NAA @ 30 ppm. Further, maximum seed yield was recorded in the plants sprayed with thiourea 1000 ppm followed by NAA @ 30 ppm.
Among different plant growth regulators (PGRs) applications in *Flemingia semialata*, thiourea @1000 ppm and NAA @30 ppm were found to be effective in diminishing seed shattering and enhancing number of raceme/plant, floret number/raceme, seed set %, 1000 seed weight, seed yield.

Keywords: Plant growth regulators (PGRs), seed shattering, seed setting, seed yield.

Introduction
Flemingia semialata, a small bushy shrub has been recorded as a very good lac-host plant, especially for *kusmi* strain of *Kerria lacca*. This is one of the most important leguminous species for intensive *lac* production. Seed yield of this species is quite low because of poor seed set and high seed shattering. A very little work has been done so far on the seed production aspect, especially the seed setting and seed shattering by using plant growth regulators (PGRs). Being a leguminous crop, indeterminate plant growth habit of *F. semialata* causes consequential flowering and seed formation. Poor seed setting and high seed shattering might be the major cause of its poor seed yield (Sinha *et al*., 2016). Keeping in view, the present work was proposed with the objectives to enhance the seed setting and diminishing the seed shattering in *F. semialata* by developing suitable technologies of use of plant growth regulators (PGRs). The objective of this study was to determine the effect of three PGRs namely; NAA, thiourea and salicylic acid on seed setting, seed shattering and yield components of *Flemingia semialata.*
PGRs are known to enhance source-sink relationship and stimulate the translocation of photo-assimilates thereby helping in effective vegetative growth, flowering, seed set, seed development, seed abscission, fruit ripening and yield. The plant growth regulators (PGR's) are considered as a new generation agrochemicals after fertilizers, pesticides and herbicides are known to enhance the source sink relationship and stimulate the translocation of photo-assimilates thereby helping better seed set, inhibition of seed shattering and higher seed yield. Use of PGR's might be a useful alternative to increase seed production. PGRs can improve the physiological efficiency including photosynthetic ability and can enhance the effective partitioning of accumulates from source and sink in the field crops (Solamani *et al*., 2001).

Materials and Methods
The experiment was conducted at the Institute Research Farm of ICAR- Indian Institute of Natural Resins and Gums (erstwhile Indian Lac Research Institute), Namkum, Ranchi, Jharkhand during 2014-15, 2015-16 and 2016-17. The soil was clay loam in texture with pH of

5.4. In this study, plant growth regulators (PGRs) at different levels (Control (water); thiourea @500 ppm, @1000 ppm, @1500 ppm, NAA @ 15 ppm, @30ppm, @45 ppm and Salicylic acid @ 100 ppm, @ 200 ppm, @ 300 ppm) were sprayed at pre flowering and anthesis stage and their effects were studied on different morpho-physiological characters of *Flemingia semialata*. There were three replications for each treatment and whole experiment was planned under RBD design. All recommended package and practices of its cultivation was employed. The *F. semialata* were planted on 8th June, 2014 in paired rows of 150 cm apart and 75 cm distance between plants was maintained in a row. The plot area was 21.6 m^2 (6 x 3.6 m).

Morpho-physiological characteristics

Number of raceme/bush, floret number/raceme, peduncle length (cm), and pod number/raceme were recorded at the time of maturity whereas 1000 seed weight (g) and seed yield (g/plant) recorded at harvest.

Yield and its components characteristics

Yield and its components such as number of pods/plant, number of seeds/plant, seed set (%), seed yield were determined at maturity stage. Seed set percent was determined as; Seed set % = total seeded pod/ total opened flower x 100. Seed shattering was studied by comprising of a porous envelope covered throughout the inflorescence after anthesis till to physiological maturity. The inflorescence was manually shaken for 10 s to simulate the wind and provoke seed shattering prior to picking of the inflorescence. After detaching the inflorescence, the envelope was open gently. Thereafter, shattered seeds were collected and weighed. Non-shattered seeds was also collected and weighed after sun drying. Shattering percentage was then calculated as; Shattering percentage = weight of shattered seed/ weight of shattered seed+ weight of non-shattered seed x 100.

Results

Morpho-physiological traits

Treatment of different plant growth regulators (PGRs) levels including thiourea (500 ppm, 1000 ppm, 1500 ppm), naphthaleneacetic acid (NAA) (15 ppm, 30 ppm, 45 ppm) and salicylic acid (100 ppm, 200 ppm, 300 ppm) affected significantly on different morpho-physiological characteristics. Number of raceme/bush (9.4), pod number/raceme (118.4), seed set (69.6 %, 1000-seed weight (25.9 g) and seed yield (17.2 g/plant) were recorded highest whereas peduncle length (7.3 cm) and seed shattering % (8.2) was recorded lowest with the application of thiourea (1000 ppm). The effect of treatment NAA (30 ppm) showed followed by treatment of thiourea (1000 ppm). The percent seed set and seed yield were also improved by the application of different levels of PGRs (Table 1). Thus, maximum seed set (69.6 %) and seed yield (17.2 g/plant) while least seed shattering % (8.2) was recorded in the plants treated with thiourea (1000 ppm).

Character Association

Morpho-physiological traits with seed yield

Association of seed yield was assessed with morphological traits in *Flemingia semialata.* Seed set (%) had significant role in seed yield per plant as they were highly correlated traits (0.87**). Other traits viz., number of raceme per bush, pod number per raceme and 1000 seed weight (g) were also significantly associated with these two traits. 1000 seed weight was significant and positively correlated with number of raceme per bush, pod number per raceme, seed set (%) and seed yield per plant. Peduncle length of inflorescence had also significant and negative role in assessing 1000 seed weight (g), seed set (%) and seed yield (g/plant). Shattering is the dispersal of a crop's seeds upon their ripening. This is generally an undesirable process during seed production in *Flemingia semialata*. Association of these traits was assessed with seed yield attributing traits with ten PGR treatments. Seed shattering was significantly but negatively correlated with seed yield along with 1000 seed weight, pod number and raceme. The positive association of shattering was assessed only with peduncle length.

Discussion

Foliar application of NAA has found to increase plant height, number of leaves per plant, fruit size with consequent enhancement in seed yield in different crops (Lee, 1990) which is also depicted in the experiment carried out in *Flemingia semialata* (Table 1). NAA, a synthetic growth regulator has proved its potentiality that in appropriate concentration NAA affects the growth and yield of a number of plants viz. tomato (Chhonker and Singh, 1959), bitter gourd (Jahan and Fattah, 1991) and cowpea (Ullah *et al*., 2007). Similarly, Govindan *et al*., (2000) indicated that soybean plants sprayed with NAA at 40 ppm after 35 days of sowing had significant increases in growth characters, yield and its attributes including number of pods and seeds, plant, seeds/pod and 100 seed weight. These results are resembled with our findings. Thiourea has been reported to have role in improving photosynthetic efficiency and translocation of photosynthates (Sahu *et al*., 1993). Sahu and Singh (1995) reported that thiourea had a significant role in improving dry matter partitioning towards sink in wheat and enhanced metabolic transport of sucrose to the grain via effect on phloem loading. As thiourea plays significant role in dry matter partitioning towards sink, foliar spray of thiourea at heading stage might be useful in improving overall productivity of wheat. Whereas, Salicylic acid is an endogenous growth regulator of phenolic nature, which participates in the regulation of physiological processes in plant, such as stomatal closure, ion uptake, inhibition of ethylene biosynthesis, transpiration and stress tolerance (Khan *et al*., 2003). Foliar application of salicylic acid exerted a significant effect on plant growth metabolism when applied at physiological concentration and thus acted as one of the plant growth regulating substances (Kalarani *et al*., 2002). Salicylic acid also increased the number of flowers, pods/plant and seed yield of soybean (Gutierrez-Coronado *et al*., 1998); enhanced wheat growth (Shakirova *et al*., 2003) and maize growth (Shakheta *et al*., 2001). The results obtained in our experiment by the use of NAA, thiourea and salicylic acid (Table 1 and 2) are corroborating the findings of the above mentioned investigators.

In summary, among different plant growth regulators (PGRs) applications in *Flemingia semialata*, thiourea @1000 ppm and NAA @30 ppm were found to be effective in enhancing number of raceme/plant, pod number/raceme, seed set %, 1000 seed weight, seed yield and reducing in seed shattering %.

Table 1: Effect of plant growth regulators on yield and yield attributes in *F. semialata*

Treatment	No. of raceme / bush	Floret number/ raceme	Peduncle length (cm)	Pod number/ raceme	Seed set %	Seed shattering %	1000 Seed weight (g)	Seed yield (g/plant)
Control	4.5	117.6	9.5	82.2	52.8	18.2	22.3	9.1
Thiourea @500ppm	7.8	133.8	8.8	98.5	65.2	11.5	24.9	12.6
Thiourea @1000ppm	9.4	147.3	7.3	118.4	69.6	8.2	25.9	17.2
Thiourea @1500ppm	6.3	99.8	8.0	76.0	64.6	12.9	24.4	13.4
NAA @15ppm	6.3	117.7	8.6	82.1	63.8	13.1	24.0	9.8
NAA @30ppm	7.5	173.1	7.8	118.1	69.1	9.1	25.3	15.4
NAA @45ppm	6.1	150.4	8.1	96.7	62.4	14.8	24.5	12.4
Salicylic acid @100ppm	7.2	111.8	8.3	81.3	58.5	16.5	23.7	9.9
Salicylic acid @200ppm	6.9	182.2	8.1	105.4	66.4	10.5	25.0	13.8
Salicylic acid @300ppm	6.4	139.5	9.5	99.3	59.4	15.9	23.1	10.4
Mean	6.8	137.3	8.4	95.8	63.2	13.0	24.3	12.4
CD (0.05)	0.5	23.1	0.6	15.10	4.66	2.78	6.55	2.30

Table 2: Correlation coefficient between morphological traits with seed yield.

Correlation	No. of raceme / bush	Floret number/ raceme	Peduncle length (cm)	Pod number/ raceme	1000 Seed weight (g)	Seed shattering %	Seed set %	Seed yield (g/plant)
No. of raceme / bush	1.0	0.342^{NS}	-0.683^{*}	0.670^{*}	0.833^{**}	-0.787^{**}	0.778^{**}	0.756^{*}
Floret number/ raceme	0.342^{NS}	1.0	-0.333^{NS}	0.849^{**}	0.535^{NS}	-0.574^{NS}	0.529^{NS}	0.559^{NS}
Peduncle length (cm)	-0.683^{*}	-0.333^{NS}	1.0	-0.459^{NS}	-0.868^{**}	0.753^{*}	-0.794^{**}	-0.823^{**}
Pod number/raceme	0.670^{*}	0.849^{**}	-0.459^{NS}	1.0	0.685^{*}	-0.735^{*}	0.669^{*}	0.769^{**}
1000 Seed weight (g)	0.833^{**}	0.535^{NS}	-0.868^{**}	0.685^{*}	1.0	-0.940^{**}	0.959^{**}	0.907^{**}
Seed shattering %	-0.787^{**}	-0.574^{NS}	0.753^{*}	-0.735^{*}	-0.940^{**}	1.0	-0.970^{**}	-0.901^{**}
Seed set %	0.778^{**}	0.529^{NS}	-0.794^{**}	0.669^{*}	0.959^{**}	-0.970^{**}	1.0	0.873^{**}
Seed yield (g/plant)	0.756^{*}	0.559^{NS}	-0.823^{**}	0.769^{**}	0.907^{**}	-0.901^{**}	0.873^{**}	1.0

Reference

1. Chhonkar VS, Singh SN. Effect of Naphthalene acetic acid on growth, quality and yield of tomato. Ind. J Hort. 1959; 16(4):236-242.
2. Govindan K, Thirumurugan V, Arulchelvan S. Response of soybean to growth regulators. Res. Crops India 2000; 1:323-325.
3. Gutierrez-Coronado MA, Trejo-Lopez C, Karque-Saavedra AS. Effect of salicylic acid on the growth of roots and shoots in soybean. Plant Physiol. Biochem. 1998; 36(8):563.
4. Jahan N, Fattah QA. Effect of foliar treatments of NAA and IBA on reproductive and yield parameters of bitter gourd (Momordicacharantia L.). Dhaka Univ. Stud. Part E. Biol. Sci. 1991; 6(1):69-71.
5. Kalarani MK, Thangaraj M, Sivakumar R, Mallika V. Effect of salicylic acid on tomato (Lycoperciconesculentum) productivity. Crop Res. 2002; 23:486-492.
6. Khan W, Balakrishnan P, Donald LS. Photosynthetic responses of corn and soybean to foliar application of salicylates. J. Plant Physiol. 2003; 160:485-492.
7. Lee HS. Effect of pre-sowing seed treatment with GA3 and IAA on flowering and yield components of groundnut. Korean J Crop Sci. 1990; 35(1):1-9
8. Sahu MP, Solanky NS, Dashora LN. Effect of thiourea, thiamine and ascorbic acid on growth and yield of maize (*Zea mays* L.). Journal of Agronomy and Crop Science. 1993; 171:65-69.
9. Sahu MP, Singh D. Role of thiourea in improving productivity of wheat (*Triticumaestivum*L.). Journal of Plant Growth Regulation. 1995; 14:169-178.
10. Shakheta SAM, Ibrahim SI, Zaghlool SAM. Physiological response of flag leaf and ears of maize plant induced by foliar application of kinetin (kin) and acetyl salicylic acid (ASA). Ann. Agric. Sci. Ain Shams Univ. Cairo 2001; 46(2):435-449.
11. Shakirova FM, Skhabutdinova AR, Bezrukova MV, Fathutdinova RA, Fathutdinova DR. Changes in the hormonal status of wheat seedlings induced by salicylic acid and salinity. Plant Science. 2003; 164:317.
12. Sinha NK, Ghosh J, VD Lohot, Monobrullah Md, Bhadana VP, Brajendra. Enhancement in seed set and seed yield in *Flemingia semialata* by using plant growth regulators, Progressive Research – An International Journal. 2016; 11(I):652-658.
13. Solamani A, Sivakumar C, Anbumani S, Suresh T, Arumugam K. Role of plant growth regulators on rice production: A review. Agric. Rev 2001; 23:33-40.
14. Ullah MJ, Fatttah QA, Hossain F. Response of growth, yield attributes and yield to the application of KNap and NAA in cowpea (Vignaunguiculata (L.) Walp.). Bangladesh J Bot. 2007; 36(2):127-132.