Studies on floral biology and seed setting in Bird's eye chilli (*Capsicum frutescens* L.)

Comment [MF1]: Reformulation

Abstract

The present investigation on "Studies on floral biology and seed setting in bird's eye chilli (*Capsicum frutescens* L.)" was carried out at the Department of Horticulture,Faculty of Agriculture, Annamalai University, Annamalai Nagar, during the year2022-2023. The experiment was conducted in Completely Randomized Design (CRD) withthreereplicationsandtendifferentlandracesofbird'seyechilli.Significant variation was observed among the landraces for all the characters. Among the tenlandraces, LR-1 (Green bird's eye chilli) recorded the highest values for the growthcharacters*viz*.,germinationpercentage(89.19%),seedlingvigourindex(993.57),plant height (63.02 cm) and number of primary branches plant^{-1} (16.01). The minimumnumberofdaystakenfor50%flowering(88.84days)wasregisteredinLR-10 (Suryamukhi).For the floral characters, the peak period of anthesis and antherdehiscence was recorded between time periods 6:00 to 7:00 a.m. and 9:00 to 10:00 a.m.,respectively. However, the maximum pollen viability (83.59%) was observed in thelandraceLR-6(Purplebird'seye chilli).Themaximumvaluefortheyieldcharacters*viz*.,numberofflowersplant^{-1}(74.86),numberoffruitsplant^{-1}(53.64)andfruitsetpercentage (71.65%) was recorded in the landrace LR-1 (Green bird's eye chilli). The landraceLR-10(Suryamukhi)recordedthemaximumfruitlength(5.54cm),fruitgirth(2.69cm),average fruit weight (3.75 g) and number of seeds fruit^{-1} (23.77). Regarding the qualitycharacters, the maximum ascorbic acid (141.08 mg 100 g^{-1})and capsaicin content(1.43%)wererecordedinthelandrace LR-8(Thaibird'seye chilli).Based on the overall performance of the landraces under study, the landraces LR-1 and LR-10 were found to be best with respect to yield indicating that these landraces can be considered for further improvement.

Keywords:*Capsicum frutescens*, anthesis, anther dehiscence, quality, capsaicin.

Introduction

Chilliisoneofthemostcommerciallyimportantvegetableandspicecropsinthe world. A wide variability in chilli fruit morphology,pungency, bearing habit and crop duration is found throughout India. The genus*Capsicum*consists of approximately27speciesincluding22wildspeciesand5domesticatedspecies.(Singh*etal*.2023).The domesticatedchillispeciesinclude*Capsicumannuum*L.,*Capsicum frutescens*L.,*Capsicumchinense*Jacq.,*Capsicumpubescens*Ruiz&Pav.,and*Capsicumbaccatum*L.which have been largely cultivated in the world because of their high economic value.

Comment [MF2]: Where is the source?

Bird's eye chilli (*Capsicum frutescens L.*) is a tropical berry belonging to thefamily

Solanaceae.Itisoneamongthetenhottestchilliesintheworld.InIndia,bird'seyechilliesarewidelydistributedinal most allpartsofthetropical and sub-tropical regions and still grows wild today.The North-Eastern Hill (NEH) region, being one of the hot-spots of biodiversity in the Indian gene centre,is also known for its richness in ethnic diversity and traditional culture (Ralte and Ekhe,2022).

Theplants of bird's eyechilli (*Capsicumfrutescens*L.)areslowgrowing,typicallyuprightperennialbushesgrowing astallas2mandmaysurviveupto10years with one or sometimes two flowers per node. The fruits are 12 to 25 mm long and up to7 mm wide being oblong-conical in shape. Fruits are small sized, highly pungent, green to yellow when immature and dark red when mature. The fruit is made up of two cells separated by a membranousdissepiment to which the seeds (around 15-20 in number) are attached (Muthuswamy *et al*.,2021).

*Capsicumfrutescens*L.hassevenalkaloidrelatedcompoundswhichareassociatedwithburning,scathi ngorspicycharacteristics(Kishore*etal*.,2021).Among these, capsaicinoids are usually found in seeds and are responsible for 90% of thepungency.Capsaicin(8-methyl-N-vanillyl-trans-6-nonenamide)isacolourless,crystalline pungent alkaloid that is thermolabile, often soluble in oils and alcohols.Capsaicin and di-hydro capsaicin (DHC) are major contributors to pungency and formsaboutone-third(69%)ofthetotalcapsaicin. The capsaicin content ranges from 0.26 to 1.21% w/w or 1,00,000 to1,50,000ScovilleHeatUnits(SHU). Apart from this, 100g edible portion of fruits contains86.0gofwater,1.9gofprotein,9.2gofcarbohydrates,1.2mgofiron,14.4mg ofcalcium,700-21600 IUofVitamin-A,242.0mg of Vitamin-Cand 257.0kJofenergy value (Vaishnavi *etal*.,2017). Besides being used as spice and vegetable, they are also used as a very goodsourceofethno-medicinesforanumber ofdiseases bythetraditional healers.

A widerangeof variabilityinchilliis availablewhich provideagreatscopeforimprovingdifferenttraitsofchillithroughasystemicandplannedselectionprogramme. The success of the fruit formation depends on the anthesis, anther dehiscence, pollenviabilityandthesuccessfultransferofviablepollenfromtheantherstoareceptivestigma of a flower.Thus, the knowledge of floral biology is fundamental in obtaining higher fruit and seedset.In view of the above facts, the present study wasunder takento observe the performance of different landraces for various traits and to screen the bestperforminglandracefor utilization in further breeding program.

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Materials and Methods

Thebasicmaterial for the study included ten landraces of bird's eye chilli(*Capsicum frutescens*L.) collected from the diverse origins, which showed diverse fruit and other economic characters.Theexperimentwith tenlandraces of bird's eyechilli was conductedin aCompletelyRandomizedDesign(CRD)with threereplications.For the purpose of raising seedlings, the protrays were taken and filled withsuitablesoilmixture. The sowing of all the landraces were done in the portrays and forty-five-day oldseedlings of uniform size and growth were transplanted.Recommended dose of balanced inorganic fertilizers at 100:50:50 kg NPK ha^{-1}were applied to the crop. Irrigation was given at frequent intervals for the good growthanddevelopmentofthecrop.Interculturaloperationswhichincludeweeding,hoeingand earthing up, were done regularly as when required to the crop. Plant growth regulatorslike NAA was sprayed to reduce the flower drop and increase the fruit set. Plant protection measures were carried out to maintain

the plants free from pests anddisease causingpathogens. Theexperimentaldatarecordedonvariouscharacteristicsduringtheinvestigation were statistically analysed as applicable to a Completely RandomizedDesign (CRD) by Fisher and Yates (1957)

Table 1. List of ten landraces of *Capsicum frutescens*

S.No.	Identity	Landraces	Source of seeds
1	LR-1	Green bird's eye chilli	Local Nursery, Thanjavur
2	LR-2	Orange bird's eye chilli	PDK Gardens, Trichy
3	LR-3	Cream bird's eye chilli	PDK Gardens, Trichy
4	LR-4	Giant bird's eye chilli	Kerala
5	LR-5	Black bird's eye chilli	Kerala
6	LR-6	Purple bird's eye chilli	Kodaikanal
7	LR-7	White bird's eye chilli	Kerala
8	LR-8	Thai bird's eye chilli	Pondicherry
9	LR-9	Double shade bird's eye chilli	PDK Gardens, Trichy
10	LR-10	Suryamukhi	Sardar Grow Seeds Company (P) Ltd.

Results and Discussion

Significant differences were observed among the landraces for all the characters under study indicating the presence of wide genetic variability and considerable scope among the landraces for their improvement in the further breeding program.

Table 2. Mean performance among the landraces of bird's eye chilli (*C. frutescens* L.) for growth characters

S.No	Identity	Germination percentage (%)	Seedling vigour index	Plant height (cm)			No. of branches plant^{-1}	Days to 50% flowering (days)
				30 DAT	60 DAT	90 DAT		
1	LR-1	89.19	993.57	29.02	44.34	63.02	16.01	91.58
2	LR-2	60.96	291.38	18.99	30.40	46.07	8.03	105.21
3	LR-3	64.18	343.36	20.27	32.35	48.23	9.77	109.63
4	LR-4	67.29	398.35	25.34	39.50	56.76	11.57	102.84
5	LR-5	70.47	473.55	21.61	34.24	50.37	8.89	98.66
6	LR-6	80.48	592.33	26.57	41.23	58.89	15.13	107.49
7	LR-7	77.51	748.74	24.18	37.82	54.64	13.34	96.40
8	LR-8	83.59	879.36	27.75	42.71	60.96	14.25	93.92
9	LR-9	73.98	656.94	22.87	36.07	52.53	12.46	100.85
10	LR-10	86.44	699.29	17.32	28.32	43.98	10.66	88.84
General mean		75.40	608.10	23.39	36.69	53.54	12.01	99.64
S.Ed.		1.23	19.80	0.43	0.62	0.97	0.40	0.89
CD (*P* = .05)		2.59	41.60	0.91	1.31	2.04	0.84	1.87

In the present study, the germination percentage ranged from 60.96 to 89.19% with a general mean of 75.40%. The highest germination percentage (89.29%) was recorded in landrace LR-1, while the lowest was recorded in LR-2 (60.92%). Thedifferentialresponse of theseedlot to germination percentagemightbedue to the variable geneticmakeupof the landraces. The results also correlate with the findings of Kumar *et al*. (2018) andHameedi*etal*.(2023).

Theseedlingvigourindexishelpfulinmonitoringandensuringthesurvivaland growth ofseedlingsaftergermination. Themaximumseedlingvigourindexwas exhibitedinthelandraceLR-1 (993.57), while the minimum value was recorded in LR-2 (291.38).Theseedlingrootandshootlengths,influencestheseedlingcharactersthatcanbeattributedtotheinh

erentgenotypiccapacity and differential response for seedling vigour indices. These results were in conformitywith thefindingsof Kumar*etal*.(2018) and Verma*etal*.(2018)

Theplantheightrepresentstheextensionofprimary growthand isagoodpredictorofgrowthanddevelopment. The landraces under study possessed a large amount of variability for this character. The maximum plant height was attained by LR-1 (63.02 cm) and minimum height was attained by LR-10 (43.98 cm).Thisvariationinplantheight mightbeduetospecificgeneticmakeup, inherentproperties,hormonalfactor,vigouroftheand cropandnutrientutilization.Theseresultsareinaccordance withthefindingofSatam*etal*.(2020), Molonaro*etal*.(2022) andArainandSial(2022).

Number of branches ranged from 8.03 to 16.01 with an average mean of 12.01. The maximum number of branches was observed in LR-1 (16.01) and minimum number of branches was observed in LR-2 (8.03). The greater number of branches in LR-1 can be justified by the properrecommended dose of NPK which might have helped the plant to have a good vegetative growth. These findings are in close conformity with theresultsreportedbyNivedha*etal*.(2019),Awasthi*etal*.(2021)andIndrabi*etal*.(2022).

Daysto50percentplantfloweringindicatetheearlinessofcropwhichdifferedsignificantly. Earliest 50% flowering was recorded in LR-10 (88.84 days) and delayed 50% flowering was recorded in LR-3 (109.63 days).Early andlatefloweringmaybeattributedpurelytogeneticvariationof landrace andlessinfluence of environmentandsoil type.Similar results were alsoreported by Dhumal*et al*.(2020)and Molonaro*etal*.(2022).

Table 3. Mean performance among the landraces of bird's eye chilli (*C. frutescens* L.) for floral characters

S.No	Identity	Anthesis					Anther dehiscence					Pollen viability (%)
		5hrs	6hrs	7hrs	8hrs	9hrs	6hrs	7hrs	8hrs	9hrs	10hrs	
1	LR-1	15.19	50.89	52.97	26.18	14.12	1.27	6.71	25.63	49.65	46.72	78.76
2	LR-2	7.11	25.44	26.51	16.38	6.18	0.00	0.04	4.38	30.47	17.32	60.41
3	LR-3	6.54	27.26	29.62	12.65	4.60	0.00	1.15	6.03	25.99	22.53	67.23
4	LR-4	8.36	35.31	38.16	23.74	3.21	0.00	1.27	5.95	29.83	33.59	62.77
5	LR-5	7.73	37.03	37.58	17.00	5.54	0.00	3.69	8.17	34.36	26.47	69.62
6	LR-6	11.28	41.63	43.79	18.93	3.92	0.00	2.00	8.54	43.48	37.28	83.59
7	LR-7	10.94	44.18	46.83	14.48	4.76	0.00	4.32	14.59	38.70	28.14	65.00
8	LR-8	13.45	47.75	48.34	21.27	2.19	0.52	5.83	21.54	47.31	43.10	81.23
9	LR-9	9.00	33.80	35.27	15.31	2.01	0.00	3.01	11.33	32.18	35.37	74.98
10	LR-10	9.87	39.52	39.98	22.49	1.15	0.00	2.76	16.82	40.24	39.81	72.28
General mean		9.95	38.29	39.90	18.84	4.78	0.17	3.08	12.28	37.22	33.03	71.58
S.Ed.		0.38	1.02	1.25	0.72	0.28	0.02	0.14	0.52	0.99	1.91	1.03
CD (*P*= .05)		0.813	2.14	2.64	1.51	0.60	0.03	0.29	1.09	2.10	0.91	2.17

According to the observations carried out, the highest number of flowers in anthesis andantherdehiscencewereregisteredat7:00a.m.and9:00a.m in LR-1respectively.The anther dehiscence is an important step inpollination, which startedat6:00a.m.intwolandraces*viz*.,LR-1andLR-8. However,thepeakperiod forthedehiscencewasfrom9:00to10:00a.m.,whichindicatedtheneedforthefreshpollen

tobecollected.Theresultsareconsistent withthefindingsof Dhall*etal*.(2011) and Vinodhini*etal*.(2019).

Pollen viability is one of the important characters in the cultivated plants. Inthe present investigation, the pollen viability ranged from 60.41 to 83.59% with a general mean of 71.58%. The highestand lowest pollen viability was recordedin the landraceLR-6 (83.59%) and LR-2 (60.41%) respectively. Thiswas in supportwith thefindings ofVinothini*etal*.(2019)andHazarika*etal*.(2023).

Table 4. Mean performance among the landraces of bird's eye chilli (*C. frutescens* L.) for yield characters

S.No	Identity	No.offlowersplant^{-1}	No.offruits plant^{-1}	Fruit set percentage (%)	Fruit length (cm)	Fruit girth (cm)	Average fruit weight (g)	No. of seeds fruit^{-1}	Fruit yield plant^{-1}(g)
1	LR-1	74.86	53.64	71.65	4.83	2.35	3.16	20.40	303.13
2	LR-2	56.47	27.19	48.14	3.31	1.58	1.05	10.98	217.04
3	LR-3	54.12	24.34	44.97	2.49	1.32	1.64	9.56	249.62
4	LR-4	61.08	31.01	50.76	4.10	1.95	2.55	15.61	204.55
5	LR-5	58.75	33.48	56.98	2.22	1.20	1.33	12.47	232.73
6	LR-6	70.27	44.84	63.81	3.79	1.73	2.24	18.78	185.90
7	LR-7	67.98	36.11	53.11	4.42	2.08	2.87	17.14	177.34
8	LR-8	72.58	50.04	68.94	5.16	2.57	3.46	22.09	294.18
9	LR-9	63.37	41.99	66.26	2.87	1.44	1.93	13.98	196.46
10	LR-10	65.66	38.95	59.32	5.54	2.69	3.75	23.77	261.28
General mean		64.51	38.15	58.39	3.87	1.89	2.39	16.47	232.22
S.Ed.		1.09	1.02	1.11	0.11	0.05	0.13	0.66	3.58
CD (*P*= .05)		2.07	2.16	2.34	0.24	0.11	0.27	1.39	7.53

Number of flowers plant^{-1} is the most vital character, as ultimately it is the flowerwhich bears the fruit that leads to yield. This character showed considerable variation from 54.12 to 74.86. with an overall mean of 64.51. The maximum number of flowers was observed for LR -1 (74.86) and minimum number of flowers was found in LR-3 (54.12).These resultsareconsistentwiththefindingsof Parulekar*etal*.(2020),Jayanthi*etal*.(2023)andMeghana*etal*.(2023).

Number of fruit plant^{-1} ranged 24.34 to 53.64 with an overall mean of 38.15. LR-1 recorded the maximum (53.64) and LR-3 recorded the minimum (24.34) number of fruits plant^{-1}.Thehighernumberoffruits plant^{-1}inthe landrace LR-1canbe justified by its higher assimilatory surface area due to the maximum plant height and agreater number of primary branches which in turn altered the canopy. Similar findings were alsoreported by Purad *et al.* (2019), Lakshmidevamma*et al*. (2021) and Molonaro*etal*.(2022).

The percentage of fruit set varied significantly from 44.97 to 71.65%,with the highestbeingrecordedinthelandraceLR-1 (71.65%) and lowest in LR-3 (44.97).The higher fruit set in LR-1 may be due tomoreconvenient condition for pollination, higher rate of anther dehiscence and higher pollenviability.Theseresultsareinconformitywiththefindingsof Pujar*etal*.(2017)andDhaliwal *etal*.(2020).

The length and girth of fruit is one of the major factors for deciding the yield of the crop.The maximum value for fruit length was recorded for LR-10 (5.54 cm) and minimum value in LR-5 (2.22 cm), while the maximum value for fruit girth was registered in LR-10 (2.69 cm) and minimum value in LR-5 (1.20). This variation is closelycorrelatedwiththequantityofnutrientsconsumedandtheplant'svegetativestate. These outcomes are

consistent with those of Katheek*et al*.(2018) and Jeevitha *et al*. (2021) who noted variance in fruit length among several cultivars intheirstudies.

The genotypes under study possessed a large amount of variability for average fruit weight. Average fruit weight of landraces ranged from 1.05 to 3.75 g with an average of 2.39 g. The maximum value was recorded for LR-10 (3.75 g) and minimum value was recorded in LR-2 (1.05 g). The landrace LR-10 recorded the highest average fruit weight thatmight havebeencontributedbythefleshthickness.These results align with those reported by Awasthi *et al*. (2021), Arain and Sial (2022) and Sharath *et al*. (2023).

Number of seeds fruit^{-1}exhibited significant variation ranging from 9.56 to 23.77 with a general mean of 16.47. The maximum numberof seedsfruit^{-1}was recorded in LR-10 (23.77) and the minimum value was recorded in LR-3(9.56).The result wasmostlikelyduetothevariationof geneticmaterialsinchilli. These findings are in close conformity with the results reported byPawar*etal*.(2022)andAimol*etal*.(2023).

Fruit yield plant^{-1} ranged from 177.34 to 303.13 g with a general mean of 232.22 g. The maximum yield plant^{-1} was observed in LR-1 (303.13 g) and the lowest yield was found in LR-7 (177.34 g). The maximum fruit yield may be due to the higher number of fruits as wellasgreatercanopysizewhichisassociatedwithmorenumber ofbranches. The similar results were also reported Vaishnavi*etal*.(2017) andSanthosha*etal*.(2020).

Table 5. Mean performance among the landraces of bird's eye chilli (*C. frutescens* L.) for quality characters

S.No	Identity	Ascorbic acid content (mg 100g^{-1})	Capsaicin content (%)
1	LR-1	119.93	1.35
2	LR-2	95.45	0.63
3	LR-3	108.01	0.75
4	LR-4	114.15	0.93
5	LR-5	90.06	1.01
6	LR-6	135.76	1.10
7	LR-7	130.60	1.18
8	LR-8	141.08	1.43
9	LR-9	125.17	0.87
10	LR-10	102.21	1.26
General mean		116.24	1.04
S.Ed.		2.37	0.03
CD (*P*= .05)		4.97	0.07

Thenutritivevalueofchilliislargelydeterminedbythecontentofascorbicacid.Ascorbic acid content ranged from 90.06 to 141.08 mg 100g^{-1} with an average mean of 116.24 mg 100g^{-1}. The maximum ascorbic acid content was recorded in LR-8 (141.08 mg 100g^{-1}) and LR-5 showed minimum ascorbic acid content (90.06 mg 100g^{-1}). Also, capsaicin,the pungentprinciple of chilli,wasfound tovary from 0.63 to1.43%, withthehighestbeingrecordedinLR-8 (1.43%) and lowest in LR-2 (0.63%). This difference in ascorbic acid and capsaicin content might be attributed to thefruitsizeandgeneticmakeup.Thesimilarresultswerealsoreported byKopta *etal*.(2020) and Phairong*etal*.(2020).

Conclusion

Inthisstudy,thelandracesshowedwiderangeofvariabilityfor mostofthegrowth and yield

characters.Based on the overall performanceof the landraces understudy,thelandracesLR-1andLR-10werefoundtobebestwithrespecttoyieldindicatingthatthesegenotypesshouldbe consideredforfurtherimprovement.

Comment [MF5]: Reformulation

References

Aimol RT, Bahadur V, Topno SE, Kerketta A. Performance of various chilli hybrids for growth, yield and quality attributes. Int J Environ Clim Chang. 2023;13(9):451-459.

Arain SM, Sial MA. Association analysis of fruit yield and other relatedattributes in four chilli(*Capsicum annuum*L.) genotypes grown in Sindh province,Pakistan.PakJBot. 2022;54(3):817.

Awasthi M, Singh D, Bahadur V. Varietal evaluation of chilli (Capsicum annuum) for growth, yield and quality in Prayagraj Agro climatic condition. Pharma Innov J. 2021;10(10):1267-1269.

Dhaliwal KK, Ghai N, Jindal SK. Variations in Fruit quality parameters ofchilli genotypes during early and timely sown conditions. Int J CurrMicrobiolAppSci. 2020;9(6):2178-2186.

Dhall RD, Hundal JS, Saxena A. Floral biology studies in chilli (*Capsicumannuum*L.). VegSci. 2011;38(2):221-224.

Dhumal VT,Pharle NR,Kapse VD,Naik HP,Vaidya KPandMeshram NA. Evaluation of F_1progenies of chilli (*Capsicum annuum*L.) underKonkan agroclimatic condition.PharmaInnovJ. 2020;9(1):180-182.

Fisher RA, Yates F. Statistical tables for biological, agricultural and medicalresearch. 1957EdinburghandLondon,44.

Hameedi A, Kumar S, Samnotra RK, Rai SK, Sharma MK, Abrol V. Genetic variability studies for growth, yield and quality traits in chilli (*Capsicumannuum*L.) germplasm under sub-tropical conditions of Jammu. Biological Forum. 2023;15(1):243-247.

Hazarika G,Phukan R,Sarma D, Sarma RN, Deka SD,Neog B,Sarma A,Gogoi S,Das RT, Ojha H. Genetic relatedness among interspecific hybrids in thegenus *Capsicum* and their implications in breeding King chilli. S Afr J Bot. 2023;163:744-755.

Indrabi SA,Malik AA,Hussain K,Malik G,Narayan S,Akhter A,Sultan A,Javeed I, Rashid M. Evaluation of chilli (*Capsicum annuum* L.) genotypes forgrowth and yield attributing traits.J Community Mobilization Sustain Dev. 2022;17(2):1-8.

Jayanthi BV, Kolakar SS, Lakshmana D, Nadukeri S. Assessment of genetic diversityinchilli(*Capsicumannuum*L.)genotypes.PharmaInnovJ. 2023;12(5):2274-2277.

JeevithaJ,Devi HUN,Pugalendhi L,Premalatha N.Performanceassessment ofvariouschillispeciesgrownundershadenetforgrowth,yieldandquality charactersinCoimbatoreregion,India.PharmaInnovJ. 2021;10(11S):625-630.

KatheekR,Bharadwaza PV,Adinarayana M, NarayanaSwamy G.Evaluationof chilli (*Capsicum annuum* L.) genotypes for yield and yield attributes in Allahabadagro-climaticconditions.IntJCurrMicrobiolAppSci. 2018;7:773-776.

Kishore V, Loach N, Srivastava CN, Mohan L. Toxicity evaluation andchemical composition of *Capsicum frutescens* for natural control of Asian blue tick, *Rhipicephalus*(Boophilus)*microplus*(Acari:Ixodidae).J BasicApplZool. 2021;82(1):1-10.

Kopta T, Sekara A,Pokluda R,Ferby V, Caruso G.Screeningofchillipepper genotypesasasourceofcapsaicinoidsandantioxidantsunderconditionsofsimulateddroughtstress.Plants. 2020;9(3):364.

Kumar V,Bhandari S, Mishra AC.Evaluationofchilli(*Capsicumannuum*L.)genotypesforseedqualityparameters. JPharmacognPhytochem. 2018;7(5):2163-2166.

LakshmidevammaTN,Jagadeesha RC,Imamsaheb SJ, Vijalaxmi P.Assessmentofgeneticdiversityindifferentchilli(*Capsicumannuum*L.)genotypes. IntJChemStud. 2021;9(1):2214-2216.

Meghana D, Vikram A, Mehta DK, Gupta M, Dogra RK. MorphologicalcharacterizationinChilli.PharmaInnovJ. 2023;12(12):945-951.

MolonaroAO,Topno SE, Kerketta A.Varietalevaluationofchilli(*Capsicum annuum*) under Prayagraj agro-climatic conditions. Pharma Innov J. 2022;11(2):2454-2556.

Muthuswamy R, Asish S, Nison M. Review on *Capsicum frutescens*: A tribalherbalfoodusedasMedicine.Res JPharmacognPhytochem 2021;13(4):191-194.

Nivedha P, Rajasree V, Arumugam T, Karthikeyan M, Thiruvengadam V. Evaluation of parents and hybrids of chilli (*Capsicum annuum* L.) for yield andresistancetochillileafcurldisease.JPharmacognPhytochem. 2019;8(3):4763-4766.

Parulekar YR, Haldankar PM, Haldavnekar PC, Salvi BR, Sawardekar SV, Dalvi VV,Surve NR, Nirmal OA. Fieldevaluationofgunduchillies(*Capsicumannuum*L.)underKonkanagro-climaticconditionsforgrowth,yieldand yieldattributingcharacters.IntJCurrMicrobiol AppSci. 2020;11:1870-1883.

Pawar AP, Parulekar YR,Haldavnekar PC, Mali PC. Evaluation of variouschilli(*Capsicumannuum*L.)genotypesgrownunderKonkanagroclimaticcondition.PharmaInnovJ. 2022;11(5):977-979.

PhairongMM,Lalbiaknunga J, Lalnunmawia F.Mizochilli (*Capsicumfrutescens*):Apotentialsourceofcapsaicinwithbroad-spectrumethnopharmacologicalapplications.J PharmacognPhytochem. 2020;9(5):670-672.

Pujar UU, Tirakannanavar S, Jagadeesha RC, Gasti VD, Sandhyarani N. Genetic variability, heritability, correlation and path analysis in chilli(*Capsicumannuum*L.). IntJ Pure ApplBiosci. 2017;5(5):579-586.

Purad PB,Arumugam T,Karthikeyan M.Growthandperformanceofdifferent chilligenotypesforyieldandyieldattributingcharacters. JPharmacognPhytochem. 2019;8(4):210-213.

Ralte R,Ekhe B. Majorspicesofnortheasternhill regionofIndia:Areview.PharmaInnovJ. 2022;11(10):437-445.

Santhosha HM.Geneticdiversity inbirdeyechilli(*Capsicumfrutescens*L.)germplasm.J KrishiVigyan. 2020;9(1):156-159.

Satam PP, Malshe KV, Sanap PB. Evaluation of growth character andphysical parameters of fruits in selected F4 progenies of chilli (*Capsicum annum* L.)under Konkan agroclimatic conditions. J PharmacognPhytochem. 2020;9(1):1494-1496.

Sharath MN, Srinivasa V, Devaraju DL, Chandrashekar SY, Gowda MN. Performance studies of chilli (*Capsicum annuum*L.) hybrids for growth and yieldtraitsunderhillzone ofKarnataka.EnvironEcol. 2023;41(1C):732-736.

Singh S,Joshi AK,Vikram A,Kansal S,Singh S.Divergencestudiesinchilli genotypes(*Capsicum annuum*L.).IntJEconPlants. 2023;10:027-030.

Vaishnavi BA, Bhoomika HR, Shruti AM. Evaluation of bird's eye chilliaccessions (*Capsicum frutescens* L.) for growth and yield traits. EnvironEcol. 2017;35(3):1775-1781.

Verma VK, Jha AK, Patel RK, Ngachan SV. Studies on storage life, andeffect of temperature and pre-sowing seed treatments on germination behaviour and maturityindicesinKing-chilli(*Capsicum*spp.). IndianJ AgricSci. 2018;88(8):1162-1167.

VinodhiniM,Dalvi VV,Desai SS,Bhave SG, Mahadik SG.FloralbiologyofCMSlinesinChilli.IntJ CurrMicrobiolAppSci. 2019;8(6):655-661.