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Impact of different weather parameters on the population of pollinators visited on Niger flowers

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Abstract
Impact of weather parameters on the population of pollinators visited on niger flowers grown under different dates of sowing showed that the minimum temperature significantly influenced the population of *Apis cerana indica* and *Apis mellifera* in all most all the dates of sowing. Similarly evening relative humidity had significant impact on the population of *Apis dorsata* in 15th July and 15th August sown crop while in other dates of sowing non-significant impacts were observed. Sunshine hours had significant negative impact on the occurrence of *Apis cerana indica* under 5th (25th August) and 6th (6th September) dates sown crop while non-significant impacts were observed in other dates sown crop. The vapor pressure morning and evaporation had significant impact on the population of *Apis mellifera* under 5th August, 25th August and 5th September sown crop however non-significant impacts were observed in other dates crop. Similarly vapor pressure evening had significant impact on the population buildup of *Apis cerana indica* in 15th August, 25th August and 5th September sown crop while for others dates sown crop had non-significant impact on the population of *Apis cerana indica.*

Keywords: Weather parameters, pollinators, Niger flowers, dates of sowing

1. Introduction
Niger [*Guizotia abyssinica* (L.f.) Cass.] is a significant oilseed crop grown in Ethiopia and India, is a native of Tropical Africa and belongs to the family Asteraceae (Compositae). It is commonly known as ramtil, jagni or jatangi (Hindi); ramtal or kharsani (Gujarati); karale or khurasani (Marathi); uhechellu (Kannada); payellu (Tamil); verrinuvvulu (Telugu); alashi (Oriya); sarguza (Bengali); ramtil (Punjabi) and sorguja (Assamese) in different parts of the country. Niger is regarded as a crop for resource-poor farmers, notably in the tribal regions of Madhya Pradesh (Kymore Plateau Zone), Chhattisgarh, Jharkhand, Orissa, Maharashtra, Gujarat and Andhra Pradesh. In Madhya Pradesh its cultivation is restricted to eroded soils, particularly in the state hilly districts of Chhindwara, Dindori, Mandla, Seoni, Jabalpur and Shahdol. Niger is produced on an area of 180.8 million hectares in India, with annual production of 65.4 million tones and an average productivity of 361.8 kg per hectare. Madhya Pradesh supplies 4.2 lakh hectares of land, with an annual yield of 1.7 lakh tones and a seed productivity of 400 kg per hectare (Anonymous, 2020-21) [1]. Madhya Pradesh is first in niger area and second in production. India is the world leader in niger exports, production and in area. Niger is a completely cross pollinated crop with a self-incompatibility mechanism. The stigma lobes curved back enough to touch their pollen in their own unique style. In many oil seed crops, insect pollination is one of the most essential elements for increased seed output. The lack of pollinating insects has a negative impact on seed output (Rao and Suryanarayana, 1990) [4]. It also has been reported that bee pollination results in a 22 to 33% increase in niger yield (Panda *et al.*, 1988) [3]. Different pollinators, such as *Apis dorsata*, *Apis cerana*, *Apis florea*, *Trigona iridipennis*, solitary bees, flies, butterflies, and beetles, have been recorded to pollinate the niger crop among them honey bees are the most important pollinators of Niger (91.30% of total pollinators). Therefore in present investigation the impact of different weather parameters on the population of pollinators visited on Niger flowers grown under different dates of sowing were studied.

2. Material and Methods
The experiment "To study the Impact of different weather parameters on the population of pollinators visited on Niger flowers" was conducted at experimental farm of Project Coordinating Unit Sesame and Niger, College of Agriculture, JNKVV, Jabalpur during

Kharif, 2021 and 2022 under unsprayed condition. The population of different pollinators were recorded by counting number of pollinators visited on flowers in 1 m^2 area for five minutes at different hours of the day. Observations were recorded at weekly interval started from 5% flowering and continued till end of the flowers. The mean number of insect pollinators visited on Niger flowers grown under different dates of sowing were worked out. The impacts of different weather parameters on the populations of pollinators were studied.

3. Result and Discussion

The combined data of all the dates of sowing revealed that the minimum temperature significantly influenced the population of *Apis cerana indica* (r=0.79), (r=0.86), (r=0.90), (r=0.77), (r=0.94) in 2nd, 3rd, 4th, 5th and 6th dates sown crop and *Apis mellifera* (r=0.81), (r=0.93), (r=0.83), (r=0.89) 2nd, 3rd, 5th and 6th dates sown crop in all most all the dates of sowing. Similarly evening relative humidity had significant impact on the population of *Apis dorsata* in 15th July (r=-0.81) and 15th August (r=0.88) sown crop while in other dates of sowing non-significant impacts were observed. Sunshine hours had significant negative impact (r=-0.79), (r=-0.85) on the occurrence of *Apis cerana indica* under 5th (25th August) and 6th (6th September) dates sown crop while non-significant impacts were observed in other dates sown crop. The vapor pressure morning and evaporation had significant impact on the population of *Apis mellifera* in 5th August, 25th August and 5th September sown crop however non-significant impacts were observed in other dates crop. Similarly vapour pressure evening (r=0.83), (r=0.82), (r=0.96) had significant impact on the population of *Apis cerana indica* in 15th August, 25th August and 5th September sown crop while for others dates sown crop had non-significant impact on the population of *Apis cerana indica.* Present findings are supported by the findings of Kachhela (2017) [2] observed significant relationship between the abundance of pollinators and weather parameters minimum temperature (r=0.275), morning relative humidity (r=0.428), evening relative humidity (r=0.310) and rainfall (r=0.129). Negative and non-significant relationship was observed between the abundance of pollinators and weather parameters viz., maximum temperature (r=-0.223) and wind speed (r=-0.445).

Table 1: Impact of weather parameters on the population of pollinators in niger crop grown different dates of sowing (Pooled)

Dates of sowing	Pollinators	Significantly contributed weather parameters on the incidence of pollinators on niger crop									
		Temp. (ºC)		RH (%)		Sun. (hrs)	Rain fall (mm)	Wind speed (km/hr)	Vapur Pr. (mm)		Evap. (mm)
		Max.	Min.	Mor.	Eve.				Mor.	Eve.	
15th July (1st sowing date)	*Apis dorsata*	-	-	-	-0.81*	-	-	-	-	-	-
	Apis florea	-	-	-	-	-	-	-	-	-	-0.79*
	Xylocopa violacea	-	-	-	-	-	-	0.77*	-	-	-0.77*
	E. megacephalus	-	-	-	-0.89**	-	-	-	-	-	-
	Parnara guttatus	-	-	-	-	-	-	0.86*	-	-	-
	Danaus genutia	-	0.80*	-	-	-	-	-	-	-	-
	Zizina otis	-	-	-	-	-	-	0.76*	-	-	-
25th July (2st sowing date)	*Apis cerana indica*	-	0.79*	-	-	-	-	-	-	-	-
	Apis mellifera	-	0.81*	-0.89**	-	-	-	-	-	-	-
	Apis cyssea	-	-	-	-	-	0.78*	0.79*	-	-	-
	Parnara guttatus	-	-	-	-0.80*	-	-	-	-0.77*	-	-
	Danaus genutia	-	-	-	-	-	-	0.84*		-	-
5th Aug. (3st sowing date)	*Apis cerana indica*	-	0.86**	-	-	-	0.83*	-		-	-
	Apis mellifera	-	0.93**	-	-	-	-	-	0.82*	-	0.79*
	Apis dorsata	-		-	-	-	-	-	0.79*	-	-
15th Aug. (4st sowing date)	*Apis cerana indica*	-	0.90**	-	0.76*	-	-	-	0.89**	0.83*	-
	Apis dorsata	-		-	0.88**	-	-	-		-	-
25th Aug. (5st sowing date)	*Apis cerana indica*	-	0.77*	-	0.76*	-0.79*	-	-	0.81*	0.82*	-0.77*
	Apis mellifera	-	0.83*	-	-	-0.88**	-	0.81*	0.84*	0.85*	-0.81*
	Apis dorsata	-0.84*	-	0.83*	-	-	-	-	-	-	-
	Musca domestica	-	-	-		0.80*	-	-0.76*	-0.80*	-	-
5th Sept. (6st sowing date)	*Apis cerana indica*	-	0.94**	-	0.89**	-0.85*	-	-	0.94**	0.96**	-
	Apis mellifera	-	0.89**	-	0.82*		-	-	0.89**	0.92**	-0.77*
	Apis dorsata	-	-	-	-	-	-	-	-	-	-0.79*
	Musca domestica	-	-	-	-	-	-	-	-0.75*	-	-

*Significant at 5% level, **Significant at 1% level.

4. Conclusion

Impact of weather parameters on the population of pollinators visited on Niger flowers of crop grown under different dates of sowing showed that the minimum temperature significantly influenced the population of *Apis cerana indica* and *Apis mellifera* in all most all the dates of sowing. Similarly evening relative humidity had significant impact on the population of *Apis dorsata* in 15th July and 15th August sown crop while in other dates of sowing non-significant impacts were observed.

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