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Research Article

Seasonal Incidence of Pod Fly, *M. obtusa* Infesting Pigeon Pea

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ABSTRACT

Population of M. obtusa ranged from 0.0 to 3.2 maggots per pod with an average 1.24 maggots per pod. The maggot population during 43th SMW i.e. 5th week of October and recorded up to the harvest of the crop. The higher population was noticed during December and January month. The peak (3.2 maggots / pod) infestation was recorded during 1st and 2nd SMW. All weather parameters viz. morning relative humidity, evening relative humidity, mean relative humidity, maximum temperature, minimum temperature, mean temperature, morning vapour pressure, evening vapour pressure, mean vapour pressure, rainfall and rainy days were negative correlated except bright sunshine hours with the maggots population of pod fly.

Key words: *Population, M. obtusa, Correlation.*

INTRODUCTION

Pigeon pea *(Cajanus cajan* (L.) Millspaugh) is one of the major pulse crops of the tropics and subtropics. It is the second most important pulse crop of India, after chickpea. It is commonly known as *arhar* in Hindi, *tuver* in Gujarati and popularly known as red gram in English. It is used as *dal* (split seed); green seeds are used as a vegetable. It is an agricultural crop of rainfed-drylands, which can be grown on mountain slopes to reduce soil erosion.

The major pigeon pea growing states are Maharashtra, Uttar Pradesh, Karnataka, Gujarat and Andhra Pradesh that altogether account for more than 87 per cent area and 83 per cent of the production. In Gujarat, pigeon pea is grown under 1.82 lakh hectares with an annual production of 2.06 lakh tones leading to a productivity of 1132 kg/ha[1]. Pigeon pea is mainly cultivated as a sole crop in Vadodara, Bharuch, Panchmahal, Sabarkantha, Narmada, Tapi, Dahod, Surat, Navsari, Valsad, Kheda, Dang, Banaskantha, Junagadh, Ahmedabad, Rajkot and Anand districts. However, it is also intercropped with maize, sesamum, groundnuts etc., especially in Saurashtra and eastern tribal belt of Gujarat.

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Pigeon pea seed contains 20-22% protein, 1.2% fat 65% carbohydrate and 3.8% ash[2], it also contain thiamin (0.45mg), niacin (2-9 mg) and riboflavin (0.19 mg). It has better quality of fiber (7g/100g of seeds). Beside its nutritional value, it also possesses various medicinal properties due to the presence of a number of polyphenols and flavonoids[2.]

Pigeon pea is tasty, not only to people, but also to insect pests. A large number of insect pests (more than 300 species) are noticed to attack pigeon pea. Insects that attack the reproductive structures of plant cause the maximum yield losses[3]. The most economical pests those attack at flowering and podding stage are pod borer, *Helicoverpa armigera* (Hubner) Hardwick; blue butterflies, *Lampides boeticus* L. and *Catochrysops strabo* (Fabricius); plume moth, *Exelastis atomosa* (Walsingham) and pod fly, *Melanagromyza obtusa* Malloch[4]. Pod borers cause huge annual losses, especially to the poorest farmers who cannot afford chemical control. Damage to pods due to the borer complex was reported to be 20 to 72 per cent[5]. The pod damage in long duration pigeon pea genotype was mostly accounted by pod fly in the range of 26.66% to 43.0%. The grain yield loss recorded due to *M. obtusa* was up to 71 per cent[6] in north India and the grain damage was up to 68 per cent in south India[7]. The grain damage caused due to pod fly varied from 20 to 80% in Varansi, Uttar Pradesh[8].

Of the various insect pests attacking pigeon pea, pod fly is considered the primary biotic constraints to pigeon pea production in South Gujarat. The pod fly shows vital fluctuations in pigeon pea under natural environmental situations. The information on influences of abiotic factors on population dynamics is very scanty under South Gujarat situations. Therefore, it is necessary to study the effect of abiotic factors on fluctuation in population of pod fly in pigeon pea. The information provides a base in the sound eco-based management programme.

MATERIAL AND METHODS

In order to study the population fluctuation of pod fly in pigeon pea under field conditions in relation to abiotic factors, a field experiment was conducted during *Kharif* 2017 and 2018.

2.1 Methods of recording observations

Pigeon pea (*cv*. Vaishali) were sown during 04.07.2017 and 27.06.2018 for the year 2017 and 2018, respectively and the crop were raised successfully by adopting recommended agronomical practices. The whole plot was kept without insecticide umbrella to allow pod borer to multiply throughout the season. The observations on population of pod fly maggots was made when the young pods starts to develop. The population of pod fly (*M. obtusa*) maggots were recorded at weekly interval from randomly plucked 50 pods from each sector. For this purpose, collected pods were split off carefully and the seeds were carefully examined to count the number of maggots.

2.2 Correlation study

In order to find out the specific impact of different weather parameters on pod fly of pigeon pea, the data on maggots population recorded in the experimental plot of population fluctuation were correlated with the different meteorological parameters [bright sunshine hours (BSSH), rainfall (RF), rainy days (RD), maximum temperature (MaxT), minimum temperature (MinT), mean temperature (MeT), morning relative humidity (MoRH), evening relative humidity (EvRH), mean relative humidity (MeRH), morning vapour pressure (MoVP), evening vapour pressure (EvVP), mean vapour pressure (MeVP), wind speed (WS) and evaporation (EP)] recorded at standard meteorological weeks at Department of Meteorology, N. M. College of Agriculture, Navsari Agricultural University, Navsari. The correlation between different weather parameters and infestation of pod borers in pigeon pea was worked out by standard statistical procedure[9] at Department of Agricultural Statistics, N. M. College of Agriculture, Navsari Agricultural University, Navsari.

RESULTS AND DISCUSSION

M. obtusa

During 2017-18

The result presented in Table 1 and Fig. 1 revealed that population of *M. obtusa* ranged from 0.0 to 3.6 maggots per pod with an average 1.20 maggots per pod. The population was first recorded (0.1 maggots/pod) during 45th SMW (Standard Meteorological Week) *i.e.* 2nd week of November and remained in the field up to the crop maturity. The maggot population gradually increased and showed higher infestation (> 2 maggot/pod) during December and January month. The maggot population was highest (3.6 maggots/pod) during 5th SMW *i.e.* 5th week of January at the time of harvesting of crop.

During 2018-19

The result presented in Table 1 and Fig. 1 revealed that population of *M. obtusa* ranged from 0.0 to 3.4 maggots per pod with an average 1.25 maggots per pod. The population was first recorded (0.2 maggots/pod) during 43th SMW *i.e.* 5th week of October and remained in the field up to the crop maturity. The maggot population gradually increased and showed higher infestation during 3rd week of November to 4th week of January. The maggot population was highest (3.4 maggots/pod) during 1st SMW *i.e.* 1st week of January at the time of harvesting of crop.

Table 1: Population of *M. obtusa* on pigeon pea

Month and week		SMW	(Mean maggots/pod)		
			2017-18	2018-19	Average
August	III	33	0.0	0.0	0.0
	IV	34	0.0	0.0	0.0
September	I	35	0.0	0.0	0.0
	II	36	0.0	0.0	0.0
	III	37	0.0	0.0	0.0
	IV	38	0.0	0.0	0.0
October	I	39	0.0	0.0	0.0
	II	40	0.0	0.0	0.0
	III	41	0.0	0.0	0.0
	IV	42	0.0	0.0	0.0
	V	43	0.0	0.2	0.1
November	I	44	0.0	0.6	0.3
	II	45	0.1	1.4	0.8
	III	46	0.9	2.0	1.5
	IV	47	1.9	1.8	1.9
December	I	48	2.2	2.2	2.2
	II	49	2.0	2.6	2.3
	III	50	2.5	2.1	2.3
	IV	51	2.2	2.8	2.5
	V	52	2.5	3.2	2.9
January	I	1	3.0	3.4	3.2
	II	2	3.1	3.2	3.2
	III	3	2.6	3.0	2.8
	IV	4	3.4	2.8	3.1
	V	5	3.6	0.0	1.8
Mean			**1.20**	**1.25**	**1.24**

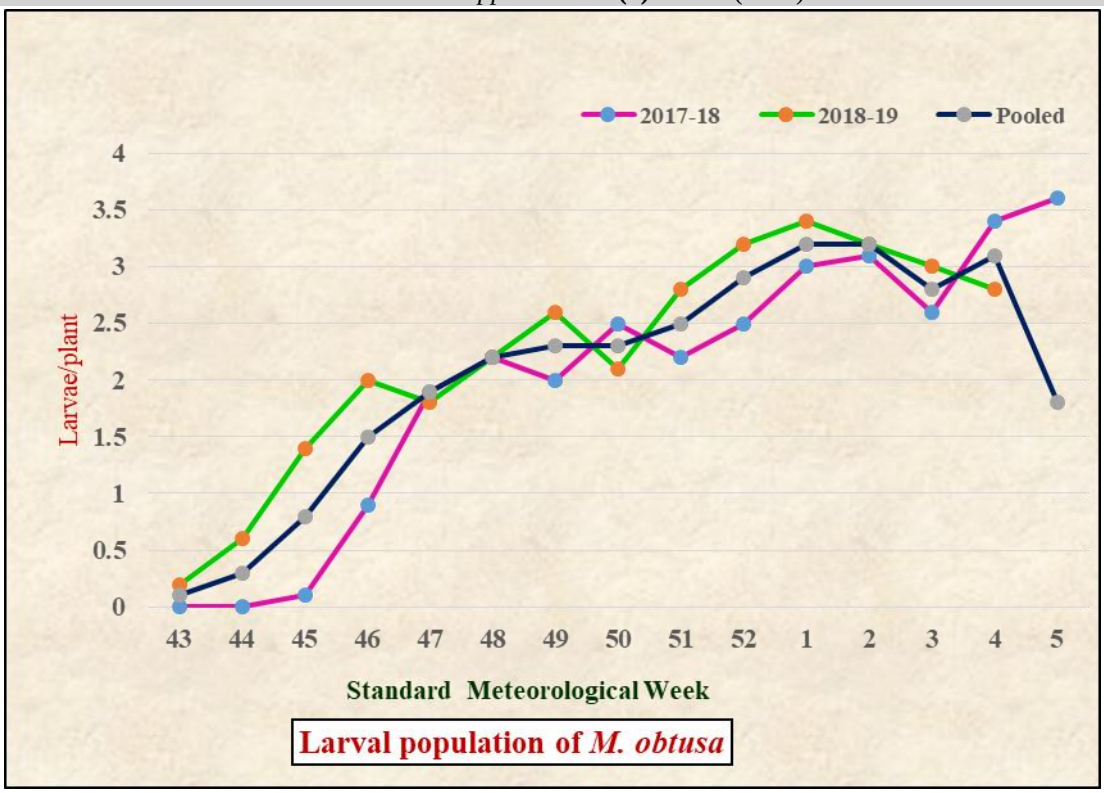

Fig. 1: Larval population of *M. obtusa*

Average (2017-18 and 2018-19)

The result presented in Table 1 and Fig. 1 revealed that population of *M. obtusa* ranged from 0.0 to 3.2 maggots per pod with an average 1.24 maggots per pod. The maggot population appeared (0.1 maggots/pod) during 43th SMW *i.e.* 5th week of October and recorded up to the harvest of the crop. The higher population was noticed during December and January month. The peak (3.2maggots/pod) infestation was recorded during 1st and 2nd SMW *i.e.* 1st and 2nd week of January. Thus, it is indicated that the higher activity of pod fly was noticed during December and January month and it was lower during rest of the cropping periods.

The infestation of *M. obtusa* commenced from the first week of October and subsequently increased till to the harvesting of the crop at Anand in Gujarat[10]. The activity of *M. obtusa* was commenced from 46th SMW (2nd week of November), which was gradually increased up to 6th SMW (1st week of February) at Anand, Gujarat[11].

The maggot of pod fly appeared in third week of December (51st SMW). The highest maggot population (3.2 per ten pods) was noticed during fourth week of January[12]. *M. obtusa* was active from 48th SMW which increased gradually and attained a peak on 51st SMW. The pod damage attained a peak on 3rd SMW. The grain damage due to *M. obtusa* was observed to reach a peak on 3rd SMW and started declining during 10th SMW. The tur pod fly (*M. obtusa*) commenced during 41st SMW on pigeon pea. Thus, the above reports strongly supported the present findings as the pod fly activity and infestation was higher during December and January months[13,14].

Correlation studies

During 2017-18

The correlation between maggot population of *M. obtusa* and weather parameters (Table 2) indicated that morning relative humidity (r = -0.407*), evening relative humidity (r = -0.657**), Mean relative humidity (r = -0.605**), maximum temperature (r = -0. 422*) minimum temperature (r = -0.840**), mean temperature (r = -0.728**), morning vapour pressure (r = -0.821**), evening vapour pressure (r = -0.775**), mean vapour pressure (r = -0.804**) and evaporation (r = -0.551**) showed significant negative correlation with population of *M. obtusa* it indicated that unit

increase or decrease in above weather parameters, the maggot population decreased or increased. The remained weather parameters, bright sunshine hours was positively correlated whereas, rainfall, rainy days and wind speed were negatively correlated but the results were non significant.

During 2018-19

The correlation between maggot population of *M. obtusa* and weather parameters (Table 2) indicated that evening relative humidity (r = -0.533**), mean relative humidity (r = -0.479**), minimum temperature (r = -0.961**), mean temperature (r = -0.911**), morning vapour pressure (r = -0.942**), evening vapour pressure (r = -0.798**), mean vapour pressure (r = -0.935**) and rainy days (r = -0.422*) showed significant negative correlation with population of *M. obtusa* it indicated that unit increase or decrease in above weather parameters, the maggot population decreased or increased. Bright sunshine hours and evaporation were positively correlated whereas, morning relative humidity, rainfall and wind speed were negatively correlated but the results were non significant.

Average (2017-18 and 2018-19)

The average results of correlation between maggot population of *M. obtusa* and weather parameters (Table 2) indicated that morning relative humidity (r = -0.538**), evening relative humidity (r = -0.668**), mean relative humidity (r = -0.677**), maximum temperature (r = -0.549**), minimum temperature (r = -0.920**), mean temperature (r = -0.902**), morning vapour pressure (r = -0.909**), evening vapour pressure (r = -0.873**), mean vapour pressure (r = -0.906**), rainfall (r = -0.406*) and rainy days (r = -0.441*) were significantly negatively correlated with population of *M. obtusa* it indicated that unit increase or decrease in above weather parameters, the maggot population decreased or increased. Bright sunshine hours was positively correlated but the results was non significant.

Table 2: Relationship between weather parameters and larval population of *M. obtusa* infesting pigeon pea

Weather parameters	*M. obtusa*		
	2017-18	**2018-19**	**Average**
MoRH	-0.407*	-0.263	-0.538**
EvRH	-0.657**	-0.533**	-0.668**
MeRH	-0.605**	-0.479*	-0.677**
MaxT	-0.422*	-0.388	-0.549**
MinT	-0.840**	-0.961**	-0.920**
MeT	-0.728**	-0.911**	-0.902**
MoVP	-0.821**	-0.942**	-0.909**
EvVP	-0.775**	-0.798**	-0.873**
MeVP	-0.804**	-0.935**	-0.906**
BSSH	0.068	0.321	0.188
RF (mm)	-0.320	-0.386	-0.406*
RD	-0.361	-0.422*	-0.441*
WS (km/hrs)	-0.333	-0.141	-0.214
EP(mm/day)	-0.551**	0.128	-0.321
* Significant at 5% level of significance ** Significant at 1% level of significance			

In nutshell, the weather parameters *viz.* morning relative humidity, evening relative humidity, mean relative humidity, maximum temperature, minimum temperature, mean temperature, morning vapour pressure, evening vapour pressure, mean vapour pressure, rainfall and rainy days were the most responsible factors for increase or decrease in the *M. obtusa* infestation as they were correlated significantly with each other.

Morning, evening and mean relative humidity had significant negative association

with *M. obtusa* on pigeon pea Rainfall, minimum and average temperature, minimum and average relative humidity as well as wind velocity had non significant negative correlation but sunshine hours had non significant positive correlation with infestation of *M. obtusa* on pigeon pea at Varanasi, Uttar Pradesh[15,16].

There was significant negative association between larval population and maximum temperature (r = -0.765), minimum temperature (r = -0.732), morning vapour pressure (r = -0.683), evening vapour pressure (r = -0.304) and evaporation (r = -0.444). Morning and evening relative humidity and bright sunshine hours showed non significant effect on larval population[11]. Infestation of pod fly showed significant negative correlation with relative humidity and rainfall. Sunshine hours showed positive correlation but rainfall showed negative correlation but results were non significant.[17,18]. The population of *M. obtusa* exhibited a significant positive correlation with sunshine hours (r = 0.690**) whereas a significant negative relationship was found with average relative humidity (r = -0.785**). The larval population of pod fly had negative non significant correlation with relative humidity. Thus, above reports are more or less accordance to present findings[14,19].

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