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POPULATION DYNAMICS OF PULSE BEETLE (*CALLOSOBRUCHUS CHINENSIS* (L.)) ON FIELD PEA GENOTYPES UNDER TEMPERATE KASHMIR CONDITIONS

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ABSTRACT

The present investigation entitled "Population Dynamics of Pulse Beetle on Field Pea Genotypes under Temperate Kashmir Conditions" was conducted during Rabi 2022–23 at the Experimental Farm of the Division of Entomology, Faculty of Agriculture, Wadura, SKUAST-Kashmir, to study the seasonal incidence and population build-up of pulse beetle, *Callosobruchus chinensis* (L.), on different field pea genotypes under temperate agro-climatic conditions of Kashmir. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications using three field pea genotypes viz., Shalimar Pea-1, Pant Pea-42 and HFP-715. Weekly observations on adult beetle population were recorded through sweep net sampling from flowering stage till crop maturity. The results revealed that no pulse beetle activity was observed during vegetative and early flowering stages of the crop. The first incidence of pulse beetle was recorded during the 22nd Standard Meteorological Week (SMW), corresponding to pod initiation stage. Pest population increased progressively with advancement of crop maturity and attained peak population during the 28th SMW with a mean population of 4.53 beetles per sweep. Among the tested genotypes, Shalimar Pea-1 exhibited comparatively lower infestation throughout the cropping period, whereas higher infestation was recorded in HFP-715 and Pant Pea-42. Population build-up of pulse beetle showed positive association with increasing temperature and relative humidity during pod filling and physiological maturity stages. The study further indicated that field infestation serves as an important source of carryover infestation under storage conditions. The findings of the present investigation emphasize the importance of varietal resistance and timely monitoring of pulse beetle populations for developing sustainable integrated pest management strategies in field pea ecosystems under temperate Kashmir conditions.

***Keywords*:** *Callosobruchus chinensis*, field pea, population dynamics, seasonal incidence, varietal susceptibility, Kashmir, pulse beetle, weather parameters.

Introduction

Field pea (*Pisum sativum* L.) is one of the most important cool-season pulse crops cultivated extensively throughout temperate and subtropical regions of the world. It belongs to the family Fabaceae and is valued for its high nutritional composition, nitrogen-fixing ability and role in sustainable agriculture. Pulses constitute an important source of plant protein, carbohydrates, minerals and vitamins, particularly in developing countries where a large section of the population depends upon plant-based protein for dietary requirements. Field pea occupies a significant position among pulse crops owing to its high nutritive value and wide adaptability under diverse agro-climatic conditions. In India, field pea is cultivated both as a grain legume and vegetable crop and contributes substantially towards pulse production. Apart from its nutritional importance, field pea improves soil fertility through biological nitrogen fixation and plays a significant role in maintaining

ecological sustainability. The inclusion of pulses in crop rotation systems enhances soil health, improves productivity of succeeding crops and reduces dependence on synthetic fertilizers. Despite its economic significance, field pea production is severely constrained by various biotic and abiotic stresses. Among the biotic constraints, insect pests are regarded as major limiting factors responsible for substantial reduction in crop yield and quality. Several insect pests attack field pea during different growth stages under both field and storage conditions. Among storage pests, pulse beetles belonging to the genus *Callosobruchus* are considered highly destructive pests of stored legumes. Pulse beetle, *Callosobruchus chinensis* (L.) (Coleoptera: Chrysomelidae: Bruchinae), is widely distributed in tropical and subtropical regions and infests several pulse crops including mungbean, chickpea, cowpea, lentil and field pea. Although the pest is primarily considered a storage insect, recent studies have demonstrated that infestation begins under field conditions during pod development and physiological maturity stages and subsequently continues in storage. Such infestation is commonly referred to as field carryover infestation. Adult female beetles lay eggs on developing pods or exposed seeds. Upon hatching, larvae penetrate the seeds and feed internally, making infestation difficult to detect during early stages. Damaged seeds exhibit reduced weight, poor germination, deterioration in nutritional quality and reduced market value. Under favourable environmental conditions, pulse beetles multiply rapidly and may cause severe qualitative and quantitative losses during storage. Pulse beetle infestation not only affects seed quality but also reduces viability and vigour of seeds intended for planting purposes. Studies have reported severe storage losses caused by *Callosobruchus* species, particularly in regions characterized by warm and humid environmental conditions. Infestation initiated under field conditions serves as the primary source of storage infestation, where hidden stages of the insect continue development and population multiplication under favourable storage conditions. Studies on seasonal incidence help identify susceptible crop stages and peak pest activity periods, thereby facilitating timely implementation of management practices. Information regarding pest population dynamics also assists in forecasting infestation trends under changing climatic conditions.

In Kashmir valley, field pea is cultivated under temperate climatic conditions; however, detailed information regarding population dynamics and seasonal incidence of pulse beetle on field pea genotypes is limited. Most available studies have primarily focused on storage infestation under laboratory conditions, while field incidence and population build-up under temperate Kashmir conditions have received little attention. Therefore, understanding seasonal occurrence and population dynamics of pulse beetle under field conditions is essential for developing suitable pest management strategies.

Materials and Methods

The present investigation was conducted during Rabi 2022–23 at the Experimental Farm of the Division of Entomology, Faculty of Agriculture, Wadura, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-K). The experimental site is situated at an altitude of approximately 1610 m above mean sea level between 34°20′ N latitude and 74°24′ E longitude.

Experimental Design and Crop Details

The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. Three field pea genotypes viz., Shalimar Pea-1, Pant Pea-42 and HFP-715 were evaluated during the study. The crop was sown during October 2022 following recommended agronomic practices. Each experimental plot measured 3 × 2 m with spacing of 30–40 cm between rows.

Recording of Pulse Beetle Population

Weekly observations on pulse beetle population were recorded from flowering stage till crop maturity using a standard sweep net. Six sweeps per plot were taken during morning hours and the number of adult beetles collected per sweep was recorded and expressed as mean beetles per sweep.

Recording of Oviposition

Ten plants from each replication were selected randomly and observations on egg laying were recorded from ten randomly selected pods during pod maturity stages.

Statistical Analysis

The data obtained during the investigation were subjected to Analysis of Variance (ANOVA) under RCBD.

Results and Discussion

Seasonal Incidence and Population Dynamics of Pulse Beetle

The data pertaining to seasonal incidence and population dynamics of pulse beetle on different field pea genotypes are presented in Table 1.

No pulse beetle infestation was observed during vegetative and early flowering stages of the crop in any of the tested genotypes. The first appearance of adult pulse beetles was recorded during the 22nd Standard Meteorological Week (SMW), corresponding to pod initiation stage. The pest population increased gradually with advancement of crop maturity and attained peak levels during the 28th SMW. The highest mean population of 4.53 beetles per sweep was recorded during this period. The increase in pest population during pod filling and physiological maturity stages may be attributed to availability of suitable oviposition sites and favourable environmental conditions. Among the tested genotypes, Shalimar Pea-1 consistently recorded lower pulse beetle population throughout the observation period, whereas HFP-715 and Pant Pea-42 recorded comparatively higher infestation levels. The present findings clearly indicate that pulse beetle infestation initiates under field conditions and subsequently serves as a source of storage infestation. Similar observations were reported by Khanvilkar and Dalvi (1984), who observed field carryover infestation of pulse beetles from field to storage. The increased pest population observed during later crop growth stages coincided with higher temperature and relative humidity prevailing during the cropping period. Warm and humid weather conditions favour multiplication and oviposition activity of pulse beetles.

Table 2 : Seasonal incidence of pulse beetle, *Callosobruchus chinensis* (L.) on field pea genotypes during Rabi 2022–23

Month	SMW	Mean no. of pulse beetles caught/sweep			Mean	Max. temp	Min. temp	RH
		Shalimar Pea-1	HFP-175	Pant-42				
May, 2023	18	0.0	0.0	0.0	0.0	22.28	10.21	79
	19	0.0	0.0	0.0	0.0	28.64	10.22	69.71
	20	0.0	0.0	0.0	0.0	26.28	10.57	68.85
	21	0.0	0.0	0.0	0.0	25.00	10.00	74.00
June, 2023	22	1.20	2.0	2.50	1.90	24.92	11.67	68.28
	23	0.70	1.50	1.20	0.0	29.85	12.05	57.57
	24	2.55	3.30	3.40	3.08	28.71	13.78	69.14
	25	3.16	4.60	4.19	3.98	19.34	12.14	85.28
July, 2023	26	3.44	4.80	3.99	4.08	32.6	17.5	75.71
	27	2.85	3.41	4.71	3.66	31.31	20.32	77.42
	28	3.49	5.80	4.30	4.53	26.41	17.28	88.57
	29	2.50	3.60	4.63	3.57	29.28	18.42	83.00
	30	3.50	4.75	3.20	3.81	28.08	18.92	85.57

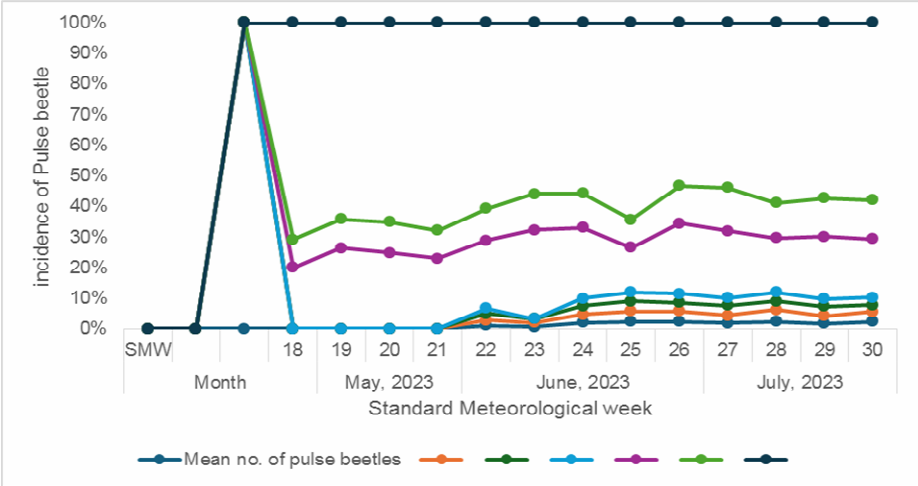

Fig. 1: Population dynamics of Pulse beetle (*Callosobruchus chinensis* (L.)

Oviposition Preference on Field Pea Genotypes

Considerable variation in oviposition behaviour of pulse beetle was observed among different field pea genotypes. Maximum oviposition was observed on Pant Pea-42 and HFP-715, whereas minimum egg laying was recorded on Shalimar Pea-1. The lower oviposition observed on Shalimar Pea-1 may be due to presence of morphological and biochemical traits adversely affecting egg laying and larval development. Similar variation in varietal susceptibility against *Callosobruchus* species has been reported by earlier workers.

Conclusion

The present investigation revealed that infestation of pulse beetle, *Callosobruchus chinensis* (L.) on field pea initiates during pod development and physiological maturity stages of the crop. Peak population of the pest was recorded during the 28th Standard Meteorological Week. Among the tested genotypes, Shalimar Pea-1 exhibited comparatively lower infestation and oviposition indicating relative tolerance against pulse beetle infestation. The study further established that weather parameters particularly temperature and relative humidity significantly influence pest population build-up under temperate Kashmir conditions.

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