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# Studies on bionomics of aphids species on canola crop (*Brassica napus*) sown under different farming systems

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## Abstract

Canola (*Brassica napus* L.) is considered as one of the favorite host for the aphid species i.e. *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi* (Homoptera; Aphididae). The current studies were carried out to investigate the variations in the life history traits of these aphid species on *Brassica napus*, grown in the field under two different treatments i.e. synthetic fertilizer and farm yard manure. The result showed the significant differences in life history traits of aphids species studied on canola crop. The nymphal longevity period of all three tested species i.e. *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi* was more in fertilizer application treatment as compared to farm yard manure application treatment. Similarly average no. of nymphs was high in fertilizer application treatment rather than in farm yard manure application. All other life history traits studied i.e. Pre reproductive period, reproductive period, post reproductive period and total life span were greater in fertilizer application treatment. So high doses of fertilizer application poses a great threat of aphid attack on canola crop. Thus balanced dose of farm yard manure and fertilizer application is recommended as to avoid the crop from pest attack.

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## Introduction

Among rapeseed, Canola is one of the world's leading edible oilseed crop. Its oil is lower in saturated fats (5-8%) than any other vegetable oil (Raymer, 2002). This crop is most vulnerable to a wide range of insect pests from seedling to seed development. Aphids are considered as most notorious pest, three aphids (*Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi)* are reported to attack on canola crop. (Rossa *et al*., 2005). Losses due to insect pests on the crop are estimated to be 70-80% in Pakistan. But in case of severe infestation there may be no grain formation at all (Khattak *et al*., 2002). The adults and nymphs of this pest suck the cell sap from plants (Marwat *et al*., 1985). Secretes honey dews and transmit plant viruses (Ali and Rizvi, 2007). Aphid increases its population by oviparous as well as viviparous methods of reproduction. In viviparous way of reproduction insects having short life cycle which allows them to increase their population quickly (Petherbridae and Wright, 1938).

Quality of food is one of the most significant factors influencing on the population of aphid. In food the role of major and minor nutrients is also an important factor which improves or deteriorates the quality of their nutrition. For example, the amount of nitrogen in plant is a factor, which could show the quality of host plant for herbivorous insect (Mattson, 1980). Further it is reported that increase or decrease in N level effect on insects performance. According to Douglas (1993) that the nitrogen levels in the diet could change the performance of phytophagous insects. Often nitrogenous compounds are scare in plant tissue, particularly in phloem sap (Mattson, 1980). Therefore, aphid shows strong response to change in nitrogen level in host plants (Van Emden, 1966). Other scientists like Evans (1938) stated that reproduction rate of the cabbage aphids is positively correlated with the nitrogen content of the plant. Van Emden (1966) reported that fecundity and reproductive rate of cabbage aphids increase with increasing nitrogen fertilization on Brussels sprouts. Cole (1997) pointed out that, there is a relationship between amino acids in phloem saps of wild Brassica and intrinsic rate of increase in cabbage aphid. According to Koritsas and Garsed (1985) rape plants which needs a lots of nitrogen contents to grow. By applying more nitrogen fertilization to produce more yields resulted in higher aphids' damage. From previous studies it is revealed that excessive use of fertilizer application could increase the aphid attack on crop.

Keeping in view significance of nutrient application on population and biological parameters of pest, present investigation was aimed to study the impact of fertilizer and farmyard manure application on life history traits of aphids. This information could be helpful in developing the integrated pest management strategies for aphids.

## Material and methods

Rearing of Aphids i.e. *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi*

Aphids were collected from canola field located at University of Agriculture, Faisalabad. The species i.e. *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi* were reared separately on the canola plants grown on the pots kept under cages up to two generations at temperature of 25±5 Ċ, 65±5% relative humidity (R.H) and 16:8 (L:D) h photoperiods in laboratory. The experiments were conducted during 2015 and 2016 in University of Agriculture, Faisalabad.

*Growing of Plants*

In this experiment, susceptible strain of canola, Oscar was grown in the field with two different treatments, fertilizers @ 75:75:60kg NPK/hectare and farm yard manure @ 20 ton/hectare were applied. The farm yard manure was applied one month before the sowing of crop and field was irrigated after application. The row to row and plant to plant distance was kept 30cm each. Irrigation, fertilizers and all agronomical practices were followed at its adequate times.

*Experimental Design*

There were five replicates under Randomized Complete Block Design. The adult aphids were placed on the underside of plant leaves with no. 2 camel hair brush and confined them in the leaf cages for multiplication to produce the nymphs.

The aphids in the leaf cage were visited daily until it produce the nymphs, all nymphs and adults were removed except for a single nymph left in cage. The nymph in the cage was observed regularly till its death, and data on total nymphal period from birth to final molt was recorded. Nymph was monitored daily till maturity, no. of nymph produced by these adults were recorded and removed from the cages. Adults' longevity, nymphal period, reproductive period and post reproductive period were also recorded during the study (Srinivasan *et al.*, 2008).

*Data Analysis*

The data so recorded were subjected to ANOVA analysis statistical software to determine whether the effects of farming systems on adults' longevity, nymphal period, reproductive period and post reproductive period. Effects of the treatments (two farming systems), their means were compared by Tukey HSD.

**Results**

The results are presented in Fig.s. Following life history parameters were studied, details of which are given below.

*Nymphal longevity*

Nymphal longevity period of aphids is presented in the Fig. 1. The results indicate that the nymph longevity of aphid species (*Brevicoryne brassicae, Myzus persicae and Lipaphis erysimi)* among farming system was statistically significant. It was noted that nymphal longevity period during 2015 was 6,5, 4.5 days in *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi* respectively in the fertilizer treatment. While it was 4.2,4.3 and 4.3 days in *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi*. It was observed that *Brevicoryne brassicae* showed more nymphal longevity 6 days in fertilizer treatment and minimum in farm yard manure treatment. During 2016 again nymphal longevity period 6.5, 7 and 5.5 days in *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi* respectively in the fertilizer treatment. While it was 4.3, 4.4 and 4.3 days in *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi.*

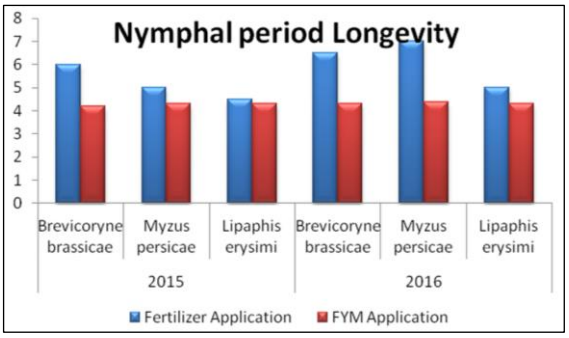


**Fig. 1.** Nymphal longevity period of *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi* on FYM and fertilizer application on canola crop.

*Adult longevity*

Adult longevity period of aphids is presented in the Fig. 2. The result revealed that adult longevity of aphid on canola grown under organic (farm yard manure) and conventional farming system (synthetic fertilizer) was statistically significant among different species studied. During 2015 adult longevity were 12, 13 and 9 days in *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi* respectively. While in farm yard manure treatment adult longevity period was 8.1, 9.1 and 8.6 days in *brassicae, Myzus persicae* and *Lipaphis erysimi* respectively. During 2016 adult longevity period was 13, 12 and 9 days in *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi* respectively. While in farmyard manure treatment adult longevity period was 9, 9.9 and 7 days *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi* respectively.

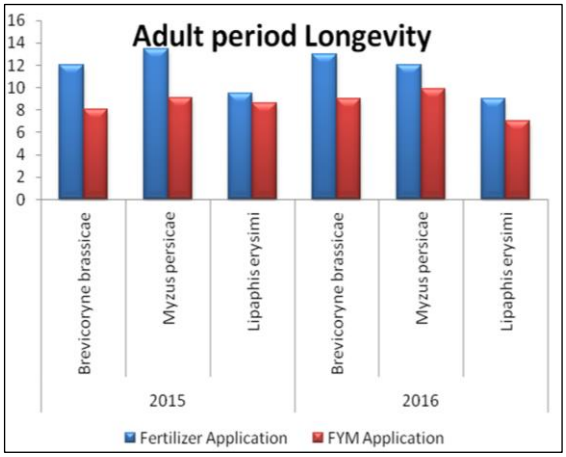


**Fig. 2.** Adult longevity period of *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi* on FYM and fertilizer application on canola crop.

*Average number of nymphs*

The average number of nymphs and adults produced per adults is presented in the Fig. 3. The results depicted that the application of different farming system effects significantly on the number of nymphs produced by female. Canola grown under synthetic fertilizer application received maximum number of nymphs (27.4-68.9 nymphs) followed by the plot treated with farm yard manure application (13.6-43.4). Among the species the green peach aphid produces maximum numbers of aphids under synthetic fertilizer application (78.9 nymphs), while cabbage aphid produce maximum under farm yard manure application (42 nymphs).

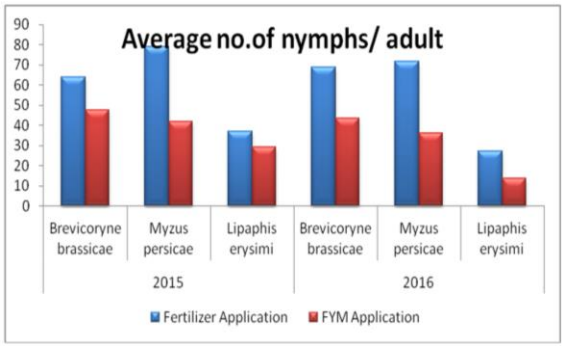


**Fig. 3.** Average no. of Nymphs/adults of *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi* on FYM and fertilizer application on canola crop.

*Pre-reproductive period*

Pre reproductive period of aphids is presented in the Fig. 4. The result indicated that pre reproductive period of aphid species was more in fertilizer treatment as compared to farmyard manure treatment. The pre reproductive period ranges from 2 to 3 days in the fertilizer treatment while in farmyard manure treatment it ranges from 1.2 to 1.5 days.

The cabbage aphid showed slightly more pre reproductive period under farm yard manure application as compared to other two species.

*Reproductive period*

Reproductive period of aphids is presented in the Fig. 5. The reproductive period during 2015 was 9,11 and 8.5 days under fertilizer treatment and 5.5, 8.8 and 6.7 days under farmyard manure treatment.

During 2016 the reproductive period 5.5, 6.7 and 8.8 days in *Brassicae, Myzus persicae* and *Lipaphis erysimi*. During 2016 reproductive period was 9.5, 8.7 and 7 days under fertilizer treatment while under farmyard manure treatment reproductive period was 5.9, 7.7 and 5.5 days and under farmyard manure treatment reproductive period was 5.9, 7 and 5.5 days in the *Brassicae, Myzus persicae* and *Lipaphis erysimi* respectively.

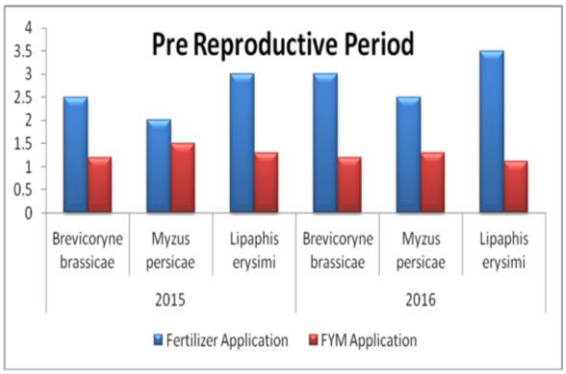


**Fig. 4.** Pre reproductive period of *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi* on FYM and fertilizer application on canola crop.

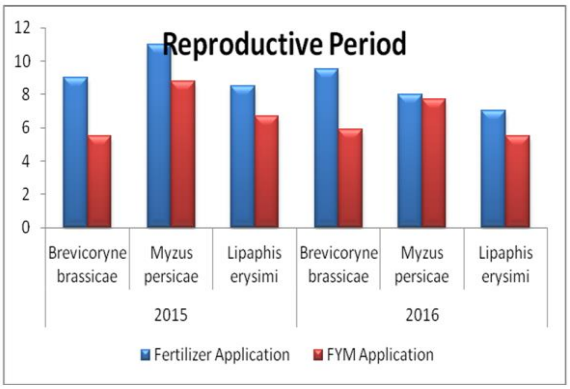


**Fig. 5.** Reproductive period of *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi* on FYM and fertilizer application on canola crop.

*Post reproductive period*

Post reproductive period of aphids is presented in the Fig. 6. During 2015 post reproductive period was of the species *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi* was more on canola synthetic fertilizer application as compared with farmyard manure application while it was less in the farmyard manure application treatment

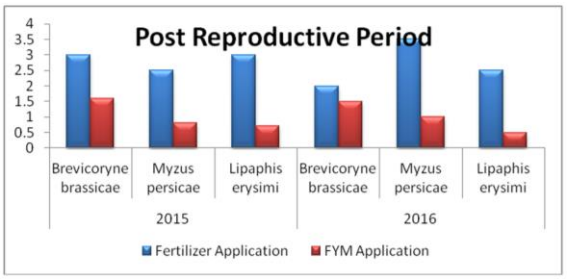


**Fig. 6.** Post Reproductive period of *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi* on FYM and fertilizer application on canola crop.

*Total life span*

Fig.7 Total life span of aphids is presented in the Fig. 7. The result revealed that the life span of green peach aphid was longer than that in the other species studied (26.5 days) under organic and conventional farmings. The life span of cabbage aphid under synthetic fertilizer application was longer than the farm yard manure application. The specie mustard aphids had similar life span on both studied systems of framing. Same trend was observed during the 2nd year of studies.

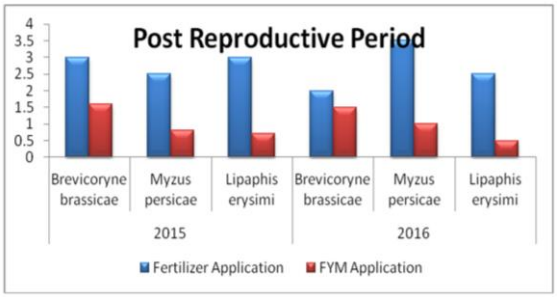


**Fig. 7.** Total life span of *Brevicoryne brassicae, Myzus persicae* and *Lipaphis erysimi* on FYM and fertilizer application on canola crop.

**Discussion**

Nutrients level in host plant affects the biology and life cycle of aphid (Dixon, 1987; Dixon *et al.*, 1993). A comprehensive knowledge of the effects of farming system through host plants on the biology of insect pests is of paramount importance for understanding the population dynamics of insect pests and devising the effective pest management program (Mirmohammad *et al.*, 2009). Nutritional value and secondary chemical compounds in host plants, which effects the herbivory and biology of insect pests, depend on the farming system in which the plants are sown and grown (Slansky and Feeny 1977, Norris and Kogan 1980). The results of present studies exhibited that life history parameter were affected by the farming systems. The nymph longevity of all the aphid's species was more on canola grown under synthetic fertilizer treatment as compared to farmyard manure application, however adult longevity was found slightly more in green peach aphid as compared to other species in both farming systems studied.

The different farming system significantly affects the number of nymph produced per adult. It was noted that more nymph were produced on canola grown under synthetic fertilizer application as compared to farm yard manure application in all tested species.

The reason behind this variation may be the more attractive and conducive nutritional value of the plants they get under synthetic fertilizer application as compared to organic farming system. According to Staley *et al.,* (2010), *Brevicoryne brassicae* was most abundant in the fertilizer treatment due to more production of nymphs and less abundant in organic treatments due to less production of nymphal population. The present studies also show that specie green peach aphid produce maximum nymphs followed by cabbage aphids and mustard aphids in fertilizer treatments.

The pre- and post-reproductive period were also affected by farming systems in all species studied. Moreover the reproductive period was also affected by the farming systems however it is found different among the different species.

The green peach aphid has maximum reproductive period followed by cabbage aphid and mustard aphid both having similar reproductive period. Post reproductive period is comparatively more in cabbage aphid and similar in rest of both species.

In green peach aphid maximum life span was observed similar in both systems of farmings, while cabbage aphid produces more nymphs in synthetic fertilizer

application as compared to farm yard manure application. The findings of the present field studies are contradictory with those of Mirmohammadi (2009) and Razzaq (2011), who studied the aphids' biology under lab conditions.

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**References**

**Ali A, Rizvi PQ.** 2007. Development and predatory performance of *Coccinella septempunctata* L. (Coleoptera: Coccinellidae) on different aphid species. Journal of Biological Science **7,** 1478-1483.

**Bonnemaison L.** 1965. Insect pests of crucifer and their control. annual Review of Entomology **10,** 233-256.

**Cividanes FJ.** 2002. Age-specific life tables of *Brevicoryne brassicae* (Hemiptera: Aphididae) under field conditions. Neotropical Entomology **31,** 419-427.

**Cole RA.** 1997. The relative importance of glucosinolates and amino acids to the development of two aphid pests *Brevicoryne brassicae* and *Myzus persicae* on wild and cultivated Brassica species. Entomologia Experimentalis et Applicata **85,** 121-133.

**Douglasa E.**1993. The nutritional quality of phloem sap utilized by natural aphid populations. Ecological Entomology **18,** 31-38.

**Evansa C.** 1938. Physiological relationships between insects and their host plants. The effect of the chemical composition of the plant on reproduction and production of winged Forms in *Brevicoryne brassicae* L. (Aphididae). Annals of Applied Biology **25,** 558-572.

**Kandil H, Gad N.** 2012. Growth and oil production of canola as affected by different sulphur sources. Journal of Basic and Applied Scientific Research **2,** 5196-5202.

**Koritsas V, Garseds MG.** 1985. The effects of nitrogen and sulphur nutrition on the response of Brussels sprout plants to infestation by the aphid *Brevicoryne brassicae*. Annals of Applied Biology **106,** 1-15.

**Mahmoud MF, Shebl M.** 2016. Insect fauna of canola and phenology of the diamondback moth, *Plutella xylostella* L. (Lepidoptera: Plutellidae) as a key pest. REDIA, Journal of Zoology **97,** 125-132.

**Marwat GN, Ahmad I, Khatoon S.** 1985. Role of different levels of potassium on population densities of cabbage aphids, *Brevicoryne brassicae* L. on sarsoon and its yield potential. Sarhad Journal of Agriculture **1,** 223-229.

**Mattson WJ.** 1980. Herbivory in relation to plant nitrogen content. Annual Review of Ecology and Systematic **11,** 119-161.

**Miri HR.** 2007. Morpho-physiological basis of variation in rapeseed (*Brassica napus* L.) yield. International Journal of Agriculture and Biology **9,** 701-706.

**Mirmohammadi S, Allahyari H, Nematollahi MR, Saboori A.** 2009. Effect of host plant on biology and life table parameters of *Brevicoryne brassicae* (Hemiptera: Aphididae) Annals of the Entomological Society of America **120,** 450-455. 2009.

**Petherbridge FR. Wright DW.** 1938. The cabbage aphis *Brevicoryne brassicae* (L.) J Min Agri Fish **45,** 140-148.

**Razaq M, Mehmood A, Aslam M, Ismail M, Afzal M, Shad SA.** 2011. Losses in yield and yield components caused by aphids to late sown *Brassica napus* L., *Brassica juncea* L. and *Brassica carrinata* a. *Braun atmultan*, Punjab (Pakistan) Pakistan Journal of Botany **43,** 319-324.

**Rossa F, Vasicek A, lopez A, Mendy M, Paglioni A.** 2005. Biology and demography of *Brevicoryne brassicae* (L.) (Hemiptera: Aphididae) on four cultivars of *Brassica oleracea* L. under laboratory conditions (II). Revis Investiga Agrop **34,** 105-114.

**Rossa LA, Vasicek F, Lopez A, Mendy M, Paglioni A.** 2005. Biology and demography of *Brevicoryne brassicae* (L.) on four cultivars of *Brassica oleracea* L. under laboratory condition (II). Revista de Investigaciones Agropecuarias **34,** 105-114.

**Satar S, Kersting U, Ulusoy MR.** 2005. Temperature dependent life history traits of *Brevicoryne brassicae* L. (Hom.: Aphididae) on white cabbage. Turkish Journal of Agricultural Forestry **29,** 341-346.

**Slansky F, Feeny P.** 1977. Stabilization of the rate of nitrogen accumulation by larvae of the cabbage butter by on wild and cultivated food plants. Ecol. Monogr **47,** 209-228.

**Srinivasan RB, Alvarez JMPE, Rez NAB, Eigenbrode SD, Novy RG.** 2008. Effect of an Alternate Weed Host, Hairy Nightshade, *Solanum sarrachoides*, on the Biology of the Two Most Important Potato Leafroll Virus (Luteoviridae: Polerovirus) Vectors, *Myzus persicae* and *Macrosiphum euphorbiae* (Aphididae: Homoptera) Journal of Enevironmental Entomology **37,** 441-446.

**Staley TJ, Jones AS, Pope TW, Wright DJ, leather SR, Hadley P, Rossiter J T, Van Emden HF, Poppy GM.** 2009. Varying responses of insect herbivores to altered plant chemistry under organic and conventional treatments Proc. R. Soc. B **277,** 779-786.

**Van Emden HF, Sponagl B, Baker T, Ganguly S, Douloumpaka S.** 1996. Hopkins 'host selection principle', another nail in its coffin. Physiological Entomology **21,** 325-328.

**Van Emdenh F.** 1966. Studies on the relations of insect and host plant. III. A comparison of the reproduction of *Brevicoryne brassicae* and *Myzus persicae* (Hem. Aphididae) on *Brussels sprout* plants supplied with different rates of nitrogen and potassium. Entomologia Experimentalis et Applicata **9,** 444-460.