Plant Archives Vol. 26, No. 1, 2026 pp. 1454-1458 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2026.v26.no.1.199

EFFICACY OF BIO-PESTICIDES AND INSECTICIDES AGAINST MAJOR INSECT PESTS OF BITTER GOURD (*MOMORDICA CHARANTIA* L.)

Sandhya Gautam, Saniya Tyagi, Aditya Kumar Sharma*, Shailendra Kumar Mishra and Ankit Kumar
Department of Ag. Entomology, Baba Raghav Das Post Graduate College, Deoria - 274 001, Uttar Pradesh, India
*Corresponding author E-mail: adisharmajmd098@gmail.com
(Date of Receiving : 14-01-2026; Date of Revision : 09-03-2026; Date of Acceptance : 27-03-2026)

ABSTRACT

A field experiment was conducted during *Kharif* 2022 at the Agricultural Research Farm of Baba Raghav Das Post Graduate College, Deoria, Uttar Pradesh to evaluate the efficacy of selected bio-pesticides and insecticides against major insect pests of bitter gourd (*Momordica charantia* L.). The experiment was laid out in a Randomized Block Design with eight treatments including an untreated control and three replications. Observations on Epilachna beetle (*Henosepilachna vigintioctopunctata*), red pumpkin beetle (*Aulacophora foveicollis*) and whitefly (*Bemisia tabaci*) were recorded from five randomly selected plants at 3, 5, 7 and 10 days after spraying. The results indicated that Lambda-cyhalothrin 5 EC @ 1 ml l^{-1} was most effective against Epilachna beetle and red pumpkin beetle, recording the lowest pest population during all observation intervals. Imidacloprid 17.8 SL @ 1 ml l^{-1} showed maximum efficacy against whitefly, followed by Fipronil 5 SC. Botanical treatments such as Dr. Neem and Neem oil were comparatively less effective against the tested pests. The study suggests that Lambda-cyhalothrin and Imidacloprid are promising options for the effective management of major insect pests of bitter gourd under field conditions.
Keywords **:** Bitter gourd, *Momordica charantia*, Epilachna beetle, Red pumpkin beetle, Whitefly, Bio-pesticides, Insecticides.

Introduction

Bitter gourd (*Momordica charantia* L.) is an important cucurbitaceous vegetable widely cultivated in tropical and subtropical regions. It belongs to the family Cucurbitaceae along with cucumber, squash, watermelon and muskmelon (Palada and Chang, 2003). The crop is valued for its nutritional and medicinal properties and is rich in ascorbic acid, iron, vitamins A, B and C and carbohydrates (Ashrafuzzaman *et al*., 2010). Bitter gourd also contains bioactive compounds such as charantin and momordicin, which possess antidiabetic and therapeutic properties (Dhillon *et al*., 2005; Goo *et al*., 2016).

In India, bitter gourd is cultivated on about 1.13 lakh hectares with an annual production of 14.33 lakh metric tonnes and productivity of 12.68 t ha^{-1}. The crop is mainly grown in Madhya Pradesh, Uttar Pradesh, Odisha, Tamil Nadu, Karnataka, Chhattisgarh and Kerala (DA&FW, 2025). However, its productivity is often reduced due to infestation of various insect pests.

Bitter gourd is attacked by several insect pests during different growth stages, including melon fruit fly (*Bactrocera cucurbitae* Coquillett), aphids (*Aphis gossypii* Glover), red pumpkin beetle (*Aulacophora foveicollis* Lucas), hadda beetle (*Henosepilachna vigintioctopunctata* Fabricius), pumpkin caterpillar (*Diaphania indica* Saunders) and whitefly (*Bemisia tabaci* Gennadius) (Sunil *et al*., 2017). Among these, hadda beetle, red pumpkin beetle and whitefly are major pests causing significant damage to foliage and reducing crop yield.

The hadda beetle (*Henosepilachna vigintioctopunctata* Fabricius) feeds on the epidermal tissues of leaves, causing skeletonization and defoliation, which may result in severe crop losses (Anant and Painkra, 2019). Similarly, red pumpkin beetle (*Aulacophora foveicollis* Lucas) is a serious pest of cucurbits, particularly at the seedling stage, feeding on leaves, flowers and roots and causing heavy damage (Rashid *et al*., 2014; Rahman and Prodhan, 2007). Whitefly (*Bemisia tabaci* Gennadius) damages plants by sucking sap and transmitting viral diseases, resulting in significant yield losses (Liburd *et al*., 2015; Navas-Castillo *et al*., 2011).

Farmers largely depend on chemical insecticides for pest management; however, excessive use of insecticides often leads to resistance development and environmental concerns. Therefore, evaluation of effective insecticides along with bio-pesticides is essential for sustainable pest management. Keeping this in view, the present study was conducted during *Kharif* 2022 to evaluate the efficacy of

selected bio-pesticides and insecticides against major insect pests of bitter gourd.

Materials and Methods

The field experiment was conducted during the *Kharif* season of 2022 at the Agricultural Research Farm of B.R.D. P.G. College, Deoria, Uttar Pradesh, to evaluate the efficacy of bio-pesticides and insecticides against major insect pests of bitter gourd. The experiment was laid out in a Randomized Block Design (RBD) with eight treatments including an untreated control and three replications. The local bitter gourd variety 'Katari' was transplanted at a spacing of 1 m × 40 cm (row × plant).

The treatments consisted of Spinetoram 11.7 SC @ 0.25 ml l^{-1}, Lambda-cyhalothrin 5 EC @ 1 ml l^{-1}, Fipronil 5 SC @ 1 ml l^{-1}, Emamectin benzoate 5 SG @ 1 ml l^{-1}, Dr. Neem @ 2 ml l^{-1}, Neem oil @ 5 ml l^{-1} and Imidacloprid 17.8 SL @ 1 ml l^{-1}. Insecticidal sprays were applied when the pest population reached the economic threshold level (ETL). Observations were recorded at 3, 5, 7 and 10 days after spraying (DAS).

The population of major insect pests, namely Epilachna beetle (*Henosepilachna vigintioctopunctata*), red pumpkin beetle (*Aulacophora foveicollis*) and whitefly (*Bemisia tabaci*), was recorded per 10 leaves from five randomly selected plants in each plot. All recommended agronomic practices were followed to raise the crop.

Results and Discussion

Efficacy of bio-pesticides and insecticides against Epilachna beetle

The data presented in Table 1 and Figure 1 indicated that the pre-treatment population of Epilachna beetle was uniformly distributed in the experimental plots and did not differ significantly among treatments, ranging from 2.31 to 4.12 beetles per 10 leaves. After application of treatments, all insecticides significantly reduced the pest population compared with the untreated control.

At 3 days after spraying (DAS), the lowest population of Epilachna beetle (0.57 beetle/10 leaves) was recorded in the Lambda-cyhalothrin 5 EC @ 1 ml l^{-1} treated plots, followed by Emamectin benzoate 5 SG @ 1 ml l^{-1} (0.92 beetle/10 leaves) and Spinetoram 11.7 SC @ 0.25 ml l^{-1} (1.34 beetle/10 leaves). Fipronil 5 SC (1.87 beetle/10 leaves) and Imidacloprid 17.8 SL (2.46 beetle/10 leaves) showed moderate effectiveness, whereas the botanical treatments Dr. Neem (3.12 beetle/10 leaves) and Neem oil (3.53 beetle/10 leaves) were comparatively less effective. The highest population was recorded in the untreated control (4.29 beetle/10 leaves).

A similar trend was observed at 5, 7 and 10 DAS. Lambda-cyhalothrin 5 EC consistently recorded the lowest pest population (0.40, 0.37 and 0.43 beetle/10 leaves, respectively), followed by Emamectin benzoate 5 SG (0.78, 0.70 and 0.73 beetle/10 leaves) and Spinetoram 11.7 SC (1.20, 1.14 and 1.18 beetle/10 leaves). Fipronil 5 SC and Imidacloprid 17.8 SL showed moderate effectiveness, whereas the botanical treatments Dr. Neem and Neem oil remained least effective throughout the observation period. The untreated control plots recorded the highest beetle population at all observation intervals.

The higher efficacy of Lambda-cyhalothrin against Epilachna beetle observed in the present study is in agreement with the findings of Sharma *et al*. (2025), who reported the lowest population of Epilachna beetle in Lambda-cyhalothrin treated plots. Similar results were also reported by Khursheed and Desh Raj (2013), who found Lambda-cyhalothrin and carbaryl highly effective against *Henosepilachna vigintioctopunctata* in bitter gourd.

Efficacy of bio-pesticides and insecticides against Red pumpkin beetle

The data presented in Table 2 and Figure 2 indicated that the pre-treatment population of red pumpkin beetle was uniformly distributed among treatments and did not differ significantly, ranging from 4.44 to 4.83 beetles per 10 leaves. After application of treatments, all insecticidal treatments significantly reduced the pest population compared with the untreated control.

At 3 days after spraying (DAS), the lowest population of red pumpkin beetle (0.73 beetle/10 leaves) was recorded in Lambda-cyhalothrin 5 EC @ 1 ml l^{-1} treated plots, followed by Emamectin benzoate 5 SG (1.12 beetle/10 leaves) and Spinetoram 11.7 SC (1.60 beetle/10 leaves). Fipronil 5 SC (2.17 beetle/10 leaves) and Imidacloprid 17.8 SL (2.83 beetle/10 leaves) showed moderate effectiveness, whereas the botanical treatments Dr. Neem (3.55 beetle/10 leaves) and Neem oil (4.29 beetle/10 leaves) were comparatively less effective. The highest population was observed in the untreated control (4.57 beetle/10 leaves).

A similar trend was observed at 5, 7 and 10 DAS. Lambda-cyhalothrin 5 EC consistently recorded the lowest beetle population (0.62, 1.05 and 0.93 beetle/10 leaves, respectively), followed by Emamectin benzoate 5 SG (1.00, 1.56 and 1.41 beetle/10 leaves) and Spinetoram 11.7 SC (1.46, 2.18 and 1.95 beetle/10 leaves). Fipronil 5 SC and Imidacloprid 17.8 SL showed moderate efficacy, while Dr. Neem and Neem oil remained the least effective treatments. The untreated control plots recorded the highest beetle population throughout the observation period.

The present findings are supported by Dhakad *et al*. (2025), who reported beta-cyfluthrin 5% + Imidacloprid 10% as the most effective treatment against red pumpkin beetle. Similar results were also reported by Bhattarai *et al*. (2025), who found deltamethrin highly effective in reducing beetle population and leaf damage in cucurbit crops.

Efficacy of bio-pesticides and insecticides against whitefly

The data presented in Table 3 and Figure 3 revealed that the pre-treatment population of whitefly was uniformly distributed among treatments and did not differ significantly, ranging from 11.19 to 12.67 whiteflies per 10 leaves. Application of insecticides resulted in a significant reduction in pest population compared with the untreated control.

At 3 days after spraying (DAS), the lowest population of whitefly (2.50/10 leaves) was recorded in Imidacloprid 17.8 SL @ 1 ml l^{-1} treated plots, followed by Fipronil 5 SC (3.67/10 leaves) and Spinetoram 11.7 SC (5.08/10 leaves). Lambda-cyhalothrin 5 EC (6.60/10 leaves) and Emamectin benzoate 5 SG (8.37/10 leaves) showed moderate effectiveness, whereas the botanical treatments Dr. Neem (8.42/10 leaves) and Neem oil (8.46/10 leaves) were comparatively less effective. The highest population was recorded in the untreated control (11.93/10 leaves).

A similar trend was observed at 5, 7 and 10 DAS. Imidacloprid 17.8 SL consistently recorded the lowest whitefly population (2.20, 1.85 and 2.13/10 leaves, respectively), followed by Fipronil 5 SC (3.34, 2.74 and 3.12/10 leaves) and Spinetoram 11.7 SC (4.54, 3.73 and 4.58/10 leaves). Lambda-cyhalothrin 5 EC and Emamectin benzoate 5 SG showed moderate efficacy, whereas Dr. Neem and Neem oil remained the least effective treatments. The untreated control plots recorded the highest whitefly population throughout the observation period.

The higher efficacy of Imidacloprid against whitefly observed in the present study is in agreement with the findings of Banshiwal *et al.* (2018), who reported acetamiprid 20 SP as highly effective in reducing whitefly population in cucumber. Similar results were also reported by Mahato (2022), who observed significant reduction in whitefly population with Fipronil compared to untreated control.

Conclusion

The study revealed that all tested treatments significantly reduced the population of major insect pests of bitter gourd compared with the untreated control. Lambda-cyhalothrin 5 EC @ 1 ml l^{-1} was found most effective against Epilachna beetle (*Henosepilachna vigintioctopunctata*) and red pumpkin beetle (*Aulacophora foveicollis*), while Imidacloprid 17.8 SL @ 1 ml l^{-1} proved most effective against whitefly (*Bemisia tabaci*). Fipronil 5 SC and Spinetoram 11.7 SC showed moderate efficacy, whereas the botanical treatments Dr. Neem and Neem oil were comparatively less effective. Therefore, Lambda-cyhalothrin and Imidacloprid can be recommended for effective management of major insect pests of bitter gourd under field conditions.

Table 1 : Efficacy of Bio-pesticides and Insecticides against Epilachna beetle on Bitter gourd

Treatments	Dose (ml/g)	Mean Population of Epilachna beetle/ 10 Leaves				
		DBS	3 DAS	5 DAS	7 DAS	10 DAS
Spinetoram 11.7 % SC	**0.25 ml**	2.37 (1.54)*	1.34 (1.16)	1.20 (1.10)	1.14 (1.07)	1.18 (1.08)
Lambda-cyhalothrin 5% EC	**1 ml**	2.32 (1.52)	0.57 (0.75)	0.40 (0.63)	0.37 (0.60)	0.43 (0.66)
Fipronil 5% SC	**1 ml**	2.31 (1.52)	1.87 (1.37)	1.67 (1.29)	1.58 (1.26)	1.61 (1.27)
Emamectin Benzoate 5% SG	**1 ml**	2.84 (1.68)	0.92 (0.96)	0.78 (0.88)	0.70 (0.84)	0.73 (0.86)
Dr. Neem	**2 ml**	3.22 (1.80)	3.12 (1.77)	2.86 (1.69)	2.96 (1.72)	2.92 (1.71)
Neem Oil 5%	**5 ml**	3.98 (2.00)	3.53 (1.88)	3.60 (1.90)	3.97 (1.99)	3.63 (1.90)
Imidacloprid 17.8 SL	**1 ml**	3.31 (1.82)	2.46 (1.57)	2.26 (1.50)	2.17 (1.47)	2.23 (1.49)
Untreated	-	4.12 (2.02)	4.29 (2.07)	4.33 (2.07)	4.37 (2.09)	4.43 (2.11)
SeM±		-	0.05	0.06	0.05	0.06
C.D. (5%)			0.16	0.19	0.16	0.18

*Figure in parenthesis are square root transformed value

Table 2 : Efficacy of Bio-pesticides and Insecticides against Red Pumpkin beetle on Bitter gourd

Treatments	Dose (ml/g)	Mean Population of Red Pumpkin beetle/ 10 Leaves				
		DBS	3 DAS	5 DAS	7 DAS	10 DAS
Spinetoram 11.7 % SC	**0.25 ml**	4.77 (2.18)*	1.60 (1.26)	1.46 (1.21)	2.18 (1.48)	1.95 (1.40)
Lambda-cyhalothrin 5% EC	**1 ml**	4.44 (2.11)	0.73 (0.85)	0.62 (0.79)	1.05 (1.02)	0.93 (0.96)
Fipronil 5% SC	**1 ml**	4.83 (2.20)	2.17 (1.47)	2.02 (1.42)	2.87 (1.69)	2.50 (1.58)
Emamectin Benzoate 5% SG	**1 ml**	4.80 (2.18)	1.12 (1.05)	1.00 (1.00)	1.56 (1.25)	1.41 (1.19)
Dr. Neem	**2 ml**	4.55 (2.13)	3.55 (1.88)	3.40 (1.84)	4.35 (2.09)	3.83 (1.96)
Neem Oil 5%	**5 ml**	4.53 (2.13)	4.29 (2.07)	4.17 (2.04)	4.49 (2.12)	4.30 (2.07)
Imidacloprid 17.8 SL	**1 ml**	4.60 (2.14)	2.83 (1.68)	2.70 (1.64)	3.61 (1.90)	3.30 (1.82)
Untreated		4.53 (2.13)	4.57 (2.13)	4.60 (2.14)	4.65 (2.15)	4.75 (2.17)
SeM±		-	0.07	0.06	0.07	0.06
C.D. (5%)		NS	0.20	0.18	0.20	0.18

*Figure in parenthesis are square root transformed value

Table 3 : Efficacy of Bio-pesticides and Insecticides against Whitefly on Bitter gourd

Treatments	Dose (ml/g)	Mean Population of Whitefly/ 10 Leaves				
		DBS	3 DAS	5 DAS	7 DAS	10 DAS
Spinetoram 11.7 % SC	**0.25 ml**	11.74 (3.43)*	5.08 (2.25)	4.54 (2.13)	3.73 (1.93)	4.58 (2.14)
Lambda-cyhalothrin 5% EC	**1 ml**	11.78 (3.43)	6.60 (2.57)	5.79 (2.41)	4.97 (2.23)	6.27 (2.50)
Fipronil 5% SC	**1 ml**	12.00 (3.46)	3.67 (1.91)	3.34 (1.83)	2.74 (1.65)	3.12 (1.77)
Emamectin Benzoate 5% SG	**1 ml**	11.77 (3.43)	8.37 (2.89)	7.46 (2.73)	6.45 (2.54)	8.13 (2.85)
Dr. Neem	**2 ml**	11.52 (3.39)	8.42 (2.90)	8.17 (2.86)	7.11 (2.67)	8.17 (2.86)
Neem Oil 5%	**5 ml**	11.19 (3.34)	8.46 (2.91)	8.25 (2.87)	7.35 (2.71)	8.46 (2.91)
Imidacloprid 17.8 SL	**1 ml**	12.67 (3.54)	2.50 (1.58)	2.20 (1.48)	1.85 (1.36)	2.13 (1.46)
Untreated		11.77 (3.43)	11.93 (3.44)	12.08 (3.46)	12.10 (3.47)	12.17 (3.48)
SeM±		-	0.10	0.09	0.09	0.09
C.D. (5%)		NS	0.30	0.27	0.28	0.27

*Figure in parenthesis are square root transformed value

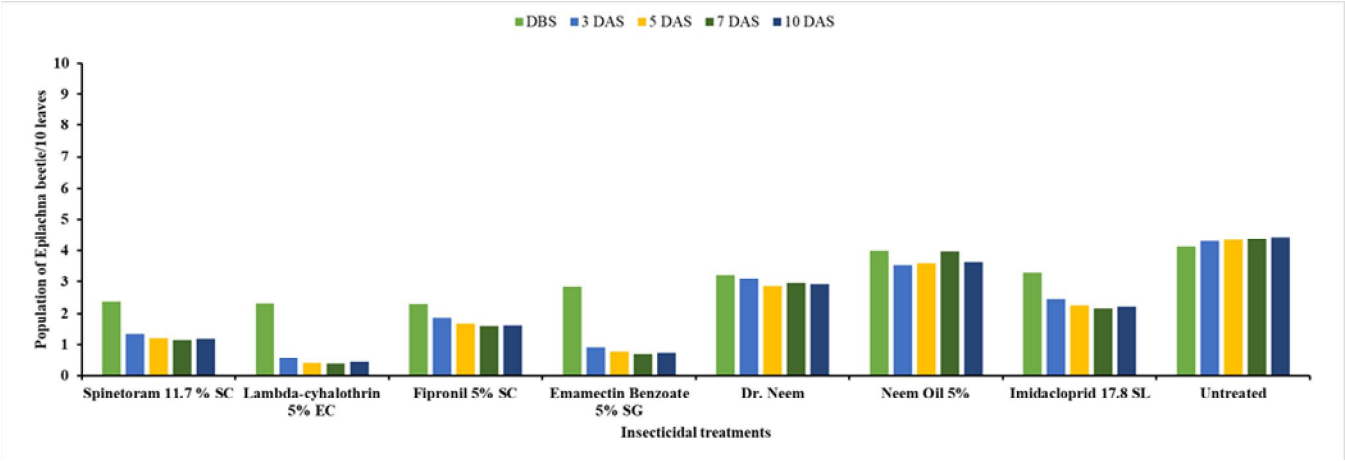

Fig. 1 : Efficacy of Bio-pesticides and Insecticides against Epilachna beetle on Bitter gourd

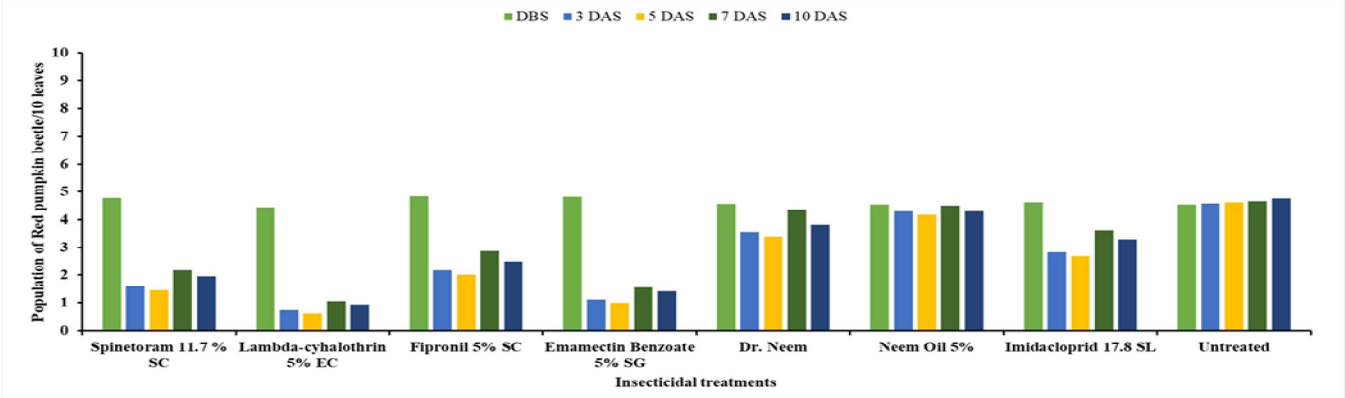

Fig. 2 : Efficacy of Bio-pesticides and Insecticides against Red Pumpkin beetle on Bitter gourd

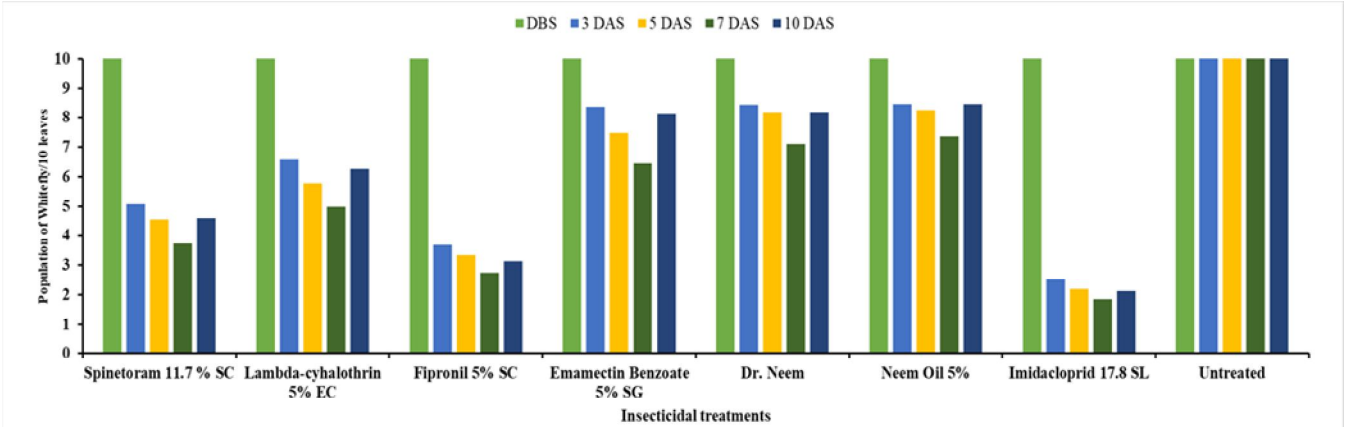

Fig. 3 : Efficacy of Bio-pesticides and Insecticides against Whitefly on Bitter gourd

Acknowledgement

The authors express their sincere gratitude to Prof. Rajnish Kumar, Professor and Head, Department of Entomology, B.R.D. P.G. College, Deoria, for his valuable guidance, constant encouragement and constructive suggestions throughout the course of this investigation. His continuous support and academic insight greatly contributed to the successful completion of the research work.

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