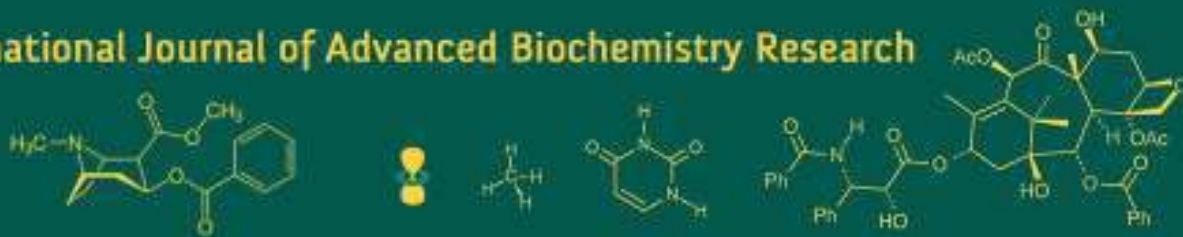


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DH Patel

P. G. Student, Department of
Entomology, B. A. College of
Agriculture, Anand
Agricultural University,
Anand, Gujarat, India

NB Patel

Principal Research Scientist,
Biological Control Research
Laboratory, ICAR Unit-9,
Anand Agricultural
University, Anand, Gujarat,
India

Egg-laying preference of green lacewing, *Chrysoperla* sp. on different types of coloured paper

DH Patel and NB PatelDOI: <https://www.doi.org/10.33545/26174693.2025.v9.i12l.6688>**Abstract**

The green lacewing is recognized as an effective biological control agent as it preys on a wide variety of insect-pests. A laboratory study was conducted to investigate the effect of different types of paper and colours on egg-laying behaviour of the green lacewing. Egg receiving sheets were pasted with different colours (white, light green, black, peach, yellow, pink, magenta and orange) and paper type (glossy vs. matte). The findings revealed that both the texture of the paper and its colour played significant role in influencing its oviposition behaviour. Glossy papers consistently attracted more eggs compared to matte ones. The highest number of eggs (376.52 eggs) was recorded on glossy black paper, regarded as the best combination, followed by matte black, glossy white, glossy light pink, matte white and glossy light green. On the other hand, colours like matte yellow, glossy orange and glossy peach were least preferred. This information can be useful to improve mass-rearing efficiency and aid in designing more effective oviposition substrates for biological pest control programs.

Keywords: Green lacewing, Egg laying preference, Coloured paper**Introduction**

Biological control is the action of parasitoids, predators and pathogens in maintaining other organisms' density at a lower average level than would occur in their absence (DeBach, 1964) [5]. By relying on biological control, farmers and growers can reduce their use of chemical pesticides, supporting more sustainable and eco-friendly pest management. Biological control, within the context of pest management, refers to the use of natural enemies to regulate the pest population. Natural enemies play an important role in agroecosystems, offering a valid alternative to or integration with other control methods (Salerno *et al.*, 2002) [12].

It is estimated that about one-third of successful biological insect control efforts are due to the introduction and release of insect predators (Williamson and Smith, 1994) [16]. Predatory insects are found across about 167 families within 14 orders of the insect class. Some insect orders like Coleoptera, Neuroptera, Hymenoptera, Diptera and Hemiptera consist largely or entirely of these natural predators. Well-known examples of these helpful predators include ladybird beetles, lacewings and praying mantids, all playing important roles in managing pest populations in nature.

The green lacewing, *Chrysoperla carnea* (Stephens) (Neuroptera: Chrysopidae), is a widely distributed predatory insect commonly found in agricultural fields around the world. Often called the "golden eye" or "aphid lion" considered as one of the most valuable species for pest control. The family Chrysopidae includes about 1200 species worldwide, grouped into 75 genera and 11 subgenera (Brooks and Barnard, 1990) [3]. In India, researchers have identified roughly 65 lacewing species across 21 genera in different cropping systems, including horticulture, agroforestry and agriculture (Singh *et al.*, 1994). Green lacewings help to control populations of soft-bodied insects in both agricultural and forest ecosystems due to their wide presence, large numbers and ability to feed on wide variety of preys (Tauber *et al.*, 2000) [15].

The grubs of this lacewing are generalist predators, whereas the adults feed on nectar, honeydew and pollen produced by hemipteran insects (Garland, 1985) [6]. According to Saminathan *et al.* (1999) [13], green lacewing larvae prey on around 80 different insect

Corresponding Author:**DH Patel**

P. G. Student, Department of
Entomology, B. A. College of
Agriculture, Anand
Agricultural University,
Anand, Gujarat, India

species and 12 species of spider mites. It includes soft-bodied insect-pests viz., aphids, jassids, red spider mites, psyllids, scales, thrips, mealybugs, whiteflies, eggs and larvae of some lepidopteran pests because of widespread occurrence, polyphagous habits and compatibility with certain chemical pesticides, microbial agents and mass-rearing methods make green lacewings especially useful for integrated pest management programs (Ridgway *et al.*, 1970) [9].

The release of laboratory-reared green lacewing has proven effective in controlling various pests on a range of crops (Ridgway and McMurphy, 1984) [10]. Successful mass-rearing relies heavily on understanding their egg-laying behaviour. Female green lacewings show clear preferences for certain colours when choosing where to lay their eggs, an important behaviour that helps to protect their vulnerable offspring during development. In laboratory conditions, black cloth or black card sheets are commonly used as egg-laying substrates (Anonymous, 1994) [11]. Under natural conditions, females tend to choose colours that blend with their surroundings, like brown or green leaves, to help conceal eggs from predators. Their oviposition behaviour is additionally affected by surface texture. Rough surfaces are often preferred over smooth ones, offering better protection against predators such as *Propylea quatuordecimpunctata* and *Harmonia axyridis* (Sahayaraj and Hassan, 2023) [11]. Keeping this in mind, an attempt was made to evaluate how different paper types and colours influence egg-laying preference. Understanding these preferences can help to improve the effectiveness of mass-rearing programs and guide the development of more attractive egg-laying materials for biological control efforts.

Materials and Methods

Rearing of green lacewing

The initial culture of green lacewing was raised by collecting adults from the cotton field. These adults were kept in an ovipositional cage measuring 75 × 30 × 15 cm, with smooth nylon mesh on the sides and a cloth-covered sliding top to allow easy egg collection. The lacewings were fed a balanced diet made from equal parts protinex powder,

honey, fructose and powdered yeast mixed with a small amount of distilled water. The stalked eggs laid by the females on the cloth-covered top were gently removed using a brush and placed in a plastic container with paper pieces to reduce cannibalism. The newly hatched larvae were reared individually in plastic tubes. The eggs of *Corcyra cephalonica* were provided to each larva individually until cocoon formation. The emerged adults were collected individually using a plastic tube and transferred again to the oviposition cage where they continued to receive the same nutritious diet.

Preparation of oviposition cage

The two paper types (A) matte & glossy and different colours (B) white, light green, black, peach, yellow, pink, magenta and orange were assessed (Plate 1). The egg-receiving sheets of the oviposition cage were lined with different type and coloured papers. Each sheet was considered as an individual treatment.

Experimental setup

The experiment was conducted at Biological Control Research Laboratory, ICAR Unit-9, Anand Agricultural University, Anand, during 2024-25. The design used was a factorial Completely Randomized Design (fCRD). Newly emerged adults were reared separately until its pre-oviposition stage. Groups of five male and female adults were allowed to mate and lay eggs into an oviposition cage for 20 days. Food and wet cotton were provided inside the oviposition cage, which was replaced daily. The experiment was repeated three times to determine the best substrate colour and texture preference.

Egg harvesting

The egg-receiving sheets were replaced and eggs were carefully collected using a brush daily to maintain accuracy and reduce the risk of cannibalism. The number of eggs laid on the different coloured sheets was recorded and the data were transformed using a square root transformation before statistical analysis.



Plate 1: Oviposition preference of green lacewing on different types of coloured paper

Results and Discussion

Effect of paper type on egg-laying of green lacewing (A)

The type of paper had a significant impact on the egg-laying behaviour of female green lacewings. As shown in Table 1, the average total number of eggs laid on glossy paper

(A2) ranged from 141.98 to 376.52, while on matte paper (A1), it ranged from 133.26 to 339.78 eggs. Overall, glossy surfaces received more eggs compared to matte paper of the same colour. A glossy paper surface supported higher egg deposition across most treatments, having highest

oviposition observed on glossy surface (232.06 eggs), whereas matte surfaces received 201 eggs. This suggests that glossy textures are generally more attractive for oviposition, possibly due to their reflective nature or smoother tactile surface.

Effect of different coloured paper on egg-laying of green lacewing (B)

The data on the egg-laying of green lacewing on different paper colours was presented in Table 1. Among the eight colours tested, black-coloured papers (B₃) both matte and glossy, attracted highest number of eggs (357.92 eggs)

followed by white (B₁) and light green (B₂) papers with 297.52 and 275.85 eggs, respectively. On the other hand, orange (B₈) and magenta (B₇) colours received the fewest eggs, with only 145.43 and 147.17 eggs, respectively.

Interaction effect of paper type and colour (A × B)

The combined effect of paper type (A) and paper colour (B) had a significant impact on the egg-laying behaviour of female green lacewings, as shown by the number of eggs laid across different treatment combinations (Table 1 and Figure 1).

Table 1: Effect of egg-laying preference of green lacewing on different types of coloured paper

Paper colour (B) Paper type (A)	B ₁ : White	B ₂ : Light green	B ₃ : Black	B ₄ : Peach	B ₅ : Yellow	B ₆ : Light pink	B ₇ : Magenta	B ₈ : Orange	Mean (A)
A ₁ : Matte	17.07 (291.04)	16.18 (261.23)	18.45 (339.78)	12.31 (151.07)	11.57 (133.26)	13.58 (183.99)	12.18 (147.79)	12.22 (148.93)	14.20 (201.00)
A ₂ : Glossy	17.45 (304.06)	17.07 (290.87)	19.42 (376.52)	12.01 (143.64)	14.70 (215.69)	17.29 (298.46)	12.13 (146.54)	11.94 (141.98)	15.25 (232.06)
Mean (B)	17.26 (297.52)	16.62 (275.85)	18.93 (357.92)	12.16 (147.33)	13.13 (172.01)	15.43 (237.79)	12.15 (147.17)	12.08 (145.43)	-
S. Em. ± (A)	0.19								
(B)	0.37								
A × B	0.53								
C.D. at 5 % A	0.54								
B	1.07								
A × B	1.51								
C.V. (%)	6.18								

Note: Figures in parentheses are retransformed values and those outside are $\sqrt{x + 0.5}$ transformed values

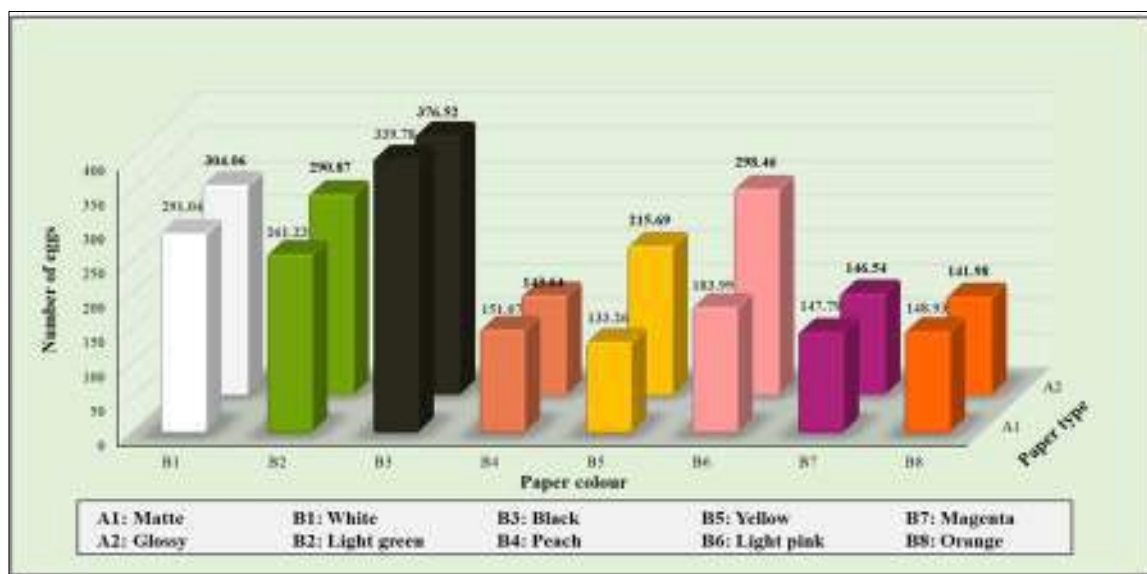


Fig 1: Influence of different types of coloured paper on oviposition behaviour of green lacewing

Among all combinations, the highest number of eggs (376.52) was laid on glossy black paper (A₂B₃), which was significantly more than other treatments. This was followed by matte black paper (A₁B₃), with 339.78 eggs, indicating a slightly lower but statistically similar preference. Other combinations that showed relatively higher egg deposition included glossy white (A₂B₁) with 304.06 eggs, which was statistically comparable with glossy light pink (A₂B₆) having 298.46 eggs as well as matte white (A₁B₁) with 291.04 eggs and glossy light green (A₂B₂) with 290.87 eggs. On the lower end, the combination of matte yellow (A₁B₅) received the fewest eggs, with 133.26, followed closely by glossy orange (A₂B₈) with 141.98 eggs. These findings indicated that both surface texture and colour play a significant role in

the egg-laying behaviour of green lacewings. Black-coloured surfaces, regardless of texture, were the most preferred, suggesting that darker shades provide favourable visual or environmental cues. Glossy textures generally enhanced egg deposition, due to increased visual or tactile surface. The variation in preference across colours clearly highlights the strong interaction between surface texture and colour in influencing lacewing oviposition.

Female green lacewings are able to visually differentiate between various colours and surface textures when selecting sites for egg-laying. The strong preference for black surfaces was supported by Anonymous (1994) [1] and Osman and Selman (2003) [8] reported that *Chrysoperla carnea* females laid significantly more eggs on black

oviposition surfaces compared to other colours. Similarly, Beerendra *et al.* (2021) ^[2] found that *Chrysoperla* sp. deposited the highest number of eggs on black substrates, followed by green, white, pink, red and brown, which closely reflects the preference pattern observed in this study. Regarding surface texture, Chakraborty *et al.* (2011) ^[4] reported that rough surfaces were generally preferred for egg attachment in field conditions, although black was still the most favoured colour substrate in the laboratory. Similarly, Mahla *et al.* (2024) ^[7] found that females of *C. zastrowi sillemi* showed a strong preference for brown and black colours, while orange and red were the least favoured, regardless of surface texture. Additionally, rough surfaces tend to be more attractive for egg-laying compared to smoother ones, likely because they provide better grip and protection for the eggs.

Conclusion

The study demonstrates that female green lacewings rely on both visual and tactile cues when choosing where to lay their eggs, showing a strong preference for darker, glossier substrates. These findings offer valuable insights into the oviposition preferences of *Chrysoperla* species based on colour and texture, which can be used to enhance biological control strategies in pest management. By understanding these preferences, mass-rearing programs can be made more efficient and more attractive egg-laying substrates can be designed to support biological control efforts. Additionally, this knowledge can contribute to the development of improved traps or lures, helping to optimize the use of *Chrysoperla* in agricultural fields for effective pest suppression.

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