Global Journal of Innovative Research Perspectives (GJIRP)
ISSN (Online): 3143-1089
Volume-2 Issue-4 || Oct – Dec 2026 || PP. 1 – 7
https://gjirp.org/

Behavioral Responses of Freshwater Snails to Changing Environmental Conditions

Dr. Kunjlata Lal

Assistant Professor

Ranchi Women's College, Ranchi University

Ranchi, Jharkhand, India.

ORCID: https://orcid.org/0009-0000-2262-7515

http://www.gjirp.org/ || Vol. 2 No. 4 (2026): November Issue

Date of Submission: 04-10-2026 **Date of Acceptance:** 16-10-2026 **Date of Publication:** 05-11-2026

Abstract— Freshwater snails respond to changes in their surroundings largely through behaviour, and these responses may signal stress before population decline becomes visible. This laboratory study examined how temperature, pH and dissolved oxygen affect the behaviour of the pulmonate snail Radix acuminata. Adult snails were acclimated for 14 days and then exposed once, in groups of 40, to four temperatures (20, 25, 30 and 35 °C), four pH levels (5.0, 6.5, 7.5 and 9.0) or three dissolved oxygen levels (2, 5 and 8 mg/L). Crawling speed, righting time, feeding rate, withdrawal into the shell and aerial surfacing were recorded. Crawling speed varied significantly with temperature ($F(3, 156) = 44.54$, $p < 0.001$), peaking at 30 °C (3.2 cm/min), with a fitted optimum of about 28.4 °C. Righting time was shortest and feeding highest at 30 °C. Withdrawal increased to 32.5% at 35 °C and to 42.5% at pH 5.0. Hypoxia (2 mg/L) raised surfacing to 9.4 events per hour, compared with 1.6 at 8 mg/L ($F(2, 117) = 182.23$, $p < 0.001$). Behaviour followed a unimodal pattern across temperature and pH and increased steeply under hypoxia. These measures are inexpensive and could be used in early-warning monitoring of freshwater habitats.

Keywords: freshwater snails; Radix acuminata; behaviour; temperature; pH; dissolved oxygen; environmental stress

Introduction

Freshwater snails are a conspicuous part of ponds, streams, wetlands and irrigation channels. They graze periphyton and decaying plant material, they recycle nutrients and they are food for fish, birds and invertebrate predators. More than four thousand freshwater gastropod species have been described worldwide (Strong et al., 2008), and they are among the most threatened groups of animals on the planet (Lydeard et al., 2004). Several species also act as intermediate hosts for trematode parasites, so changes in their activity and distribution are relevant to animal and human health as well as to ecology (Appleton, 1978).

Because snails cannot regulate body temperature and have limited ability to avoid unfavourable water, their first line of

@2026. This is an open access article distributed under the terms of the Creative Commons License [CC BY NC 4.0] and is available on http://www.gjirp.org/

Global Journal of Innovative Research Perspectives (GJIRP)
ISSN (Online): 3143-1089
Volume-2 Issue-4 || Oct – Dec 2026 || PP. 1 – 7
https://gjirp.org/

defence is behavioural. They move toward or away from stimuli, retract into the shell, seal the aperture, climb to the surface to breathe air and reduce feeding. Behaviour integrates physiological state and the surrounding conditions, so it often changes earlier and at lower exposure than survival or reproduction. A thermal or chemical change that does not kill a snail may still reduce its foraging, increase its exposure to predators and lower its energy for growth.

The conditions that snails experience are changing. Water bodies in many regions are becoming warmer, seasonal ponds dry earlier, agricultural runoff and organic pollution change pH and deplete dissolved oxygen, and extreme events compound these effects. Ectotherms are expected to be sensitive to such change because their performance depends on temperature through a thermal performance curve, and warming beyond the optimum reduces aerobic capacity (Pörtner & Farrell, 2008). Despite this, relatively few experimental studies compare several environmental drivers on the same species with the same behavioural measures, which limits comparison of their relative importance.

This study therefore asks how three environmental variables, temperature, pH and dissolved oxygen, alter the behaviour of the freshwater pulmonate Radix acuminata. It aims to describe the shape of each response, locate the point at which behaviour begins to indicate stress, and suggest which simple behavioural measures are most useful as monitoring indicators.

Literature Review

Freshwater molluscs have been described as a group whose physiology and ecology are closely tied to water chemistry and temperature (Dillon, 2000; McMahon, 1983). Pulmonate snails, which breathe air through a lung but can also exchange gases across the skin, have a flexible respiratory system. This allows them to tolerate low oxygen by moving to the surface, although the behaviour carries costs: surfacing exposes them to aerial predators and diverts time from feeding (McMahon, 1983; Brown, 1991).

Temperature is a primary control on activity. In ectotherms, performance rises with temperature to an optimum and then falls sharply as oxygen supply fails to meet demand (Pörtner & Farrell, 2008). Sokolova and Lannig (2008) showed that the metabolic effects of warming in aquatic ectotherms are amplified by additional stressors, which is relevant to snails living in warm and polluted ponds. For schistosome-transmitting snails, Appleton (1978) reviewed abiotic factors and found that activity, reproduction and survival were all confined to well-defined temperature and chemistry ranges.

Behavioural responses to biotic threats are better documented than responses to abiotic change. Alexander and Covich (1991) found that Physella virgata reduced movement and moved to refuges when exposed to crayfish cues, and Turner (1996) showed that freshwater snails shifted habitat use in response to predation. Dewitt et al. (1999) linked antipredator behaviour with shell form in Physa. Covich (2010) summarised the link between shell variability, predator avoidance and the coexistence of freshwater gastropods. These studies show that snail behaviour is plastic and has clear fitness consequences, which supports its use as a stress indicator.

Reviews of the group emphasise that conservation attention has lagged behind. Lydeard et al. (2004) documented the global decline of non-marine molluscs, and Strong et al. (2008) showed that the diversity of freshwater gastropods is high and unevenly studied. Pyron and Brown (2015) provide a current synthesis of the biology of freshwater gastropods and note that water quality is a leading cause of loss. Brown (1991) described the general ecology and life history of the group.

Three gaps follow from this literature. Responses to abiotic variables are less studied than responses to predators. Most studies manipulate one factor, which prevents comparison of the relative strength of several. Few studies report a consistent panel of behaviours that could be applied in routine monitoring. The present study addresses these gaps by using the same species, comparable group sizes and a common set of simple behavioural measures across three environmental gradients.

Objectives and Hypotheses

The objectives were to measure the effect of temperature, pH and dissolved oxygen on snail locomotion, righting, feeding, withdrawal and aerial surfacing, and to identify the exposure

@2026. This is an open access article distributed under the terms of the Creative Commons License [CC BY NC 4.0] and is available on http://www.gjirp.org/

Global Journal of Innovative Research Perspectives (GJIRP)
ISSN (Online): 3143-1089
Volume-2 Issue-4 || Oct – Dec 2026 || PP. 1 – 7
https://gjirp.org/

levels at which stress behaviour becomes pronounced. The hypotheses and the tests used are listed in Table 1.

Table 1. Study hypotheses and tests

Hypothesis	Statement	Test
H1	Crawling speed, righting time and feeding rate differ across temperatures, with an intermediate optimum	One-way ANOVA; Tukey–Kramer test; quadratic fit
H2	Withdrawal into the shell is more frequent at extreme temperature and pH	Chi-square test
H3	Crawling speed differs across pH levels	One-way ANOVA
H4	Aerial surfacing increases as dissolved oxygen falls	One-way ANOVA

Methodology

Collection and acclimation

Adult Radix acuminata with shell heights of 12–16 mm were collected by hand from an unpolluted freshwater pond and transported to the laboratory in pond water. They were held in aerated glass tanks at 25 ± 1 °C, pH 7.4 and a 12:12 h light–dark cycle for 14 days and fed lettuce leaves and fish flake. Snails that were damaged or that did not feed during the final three days of acclimation were excluded. Each snail was used in one trial only. At the end of the experiments, the snails were returned to their source habitat.

Experimental design

Three experiments were carried out. In experiment 1, snails were exposed to 20, 25, 30 or 35 °C. In experiment 2, snails were exposed to pH 5.0, 6.5, 7.5 or 9.0, adjusted with dilute hydrochloric acid or sodium hydroxide, at 25 °C. In experiment 3, dissolved oxygen was held at 2, 5 or 8 mg/L by bubbling nitrogen or air through the water, at 25 °C and pH 7.4. Every treatment level used 40 snails, held in five replicate tanks with eight snails each. A sample of 40 per level gives more than 80% power to detect a large effect (Cohen, 1988) with a two-sided alpha of 0.05. Temperature was controlled with thermostatic heaters and a water bath, and was checked to ± 0.5 °C. Snails were given 24 hours to adapt to the target condition before recording.

Behavioural measures

Crawling speed was calculated from 10-minute video recordings of each snail on a glass plate and tracked with ImageJ, and expressed as distance per minute for the period during which the snail was moving. Righting time was the time taken by a snail turned on its dorsal side to regain its normal position, with a maximum of 180 seconds. Feeding rate was the mass of lettuce disc consumed by each snail in 24 hours, adjusted for a control disc without a snail. Withdrawal was recorded when a snail was fully retracted into the shell with the foot not extended for ten consecutive minutes. Aerial surfacing was the number of times a snail reached the water surface and extended its pneumostome during a one-hour observation. Observers watching the recordings did not know the treatment.

Statistical analysis

Continuous measures are given as mean ± SD. Differences across treatment levels were tested with one-way analysis of variance, with Tukey–Kramer comparisons after a significant F test, and effect sizes are expressed as η^2. Proportions of snails withdrawn were compared with the chi-square test and Cramér's V and are shown with Wilson 95% confidence intervals. A quadratic function was fitted to mean crawling speed against temperature to estimate the optimum, which is the vertex of the curve. A p value below 0.05 was regarded as significant.

Results

Effect of temperature

Temperature had a significant effect on all three performance measures (Table 2). Crawling speed differed across temperatures ($F(3, 156) = 44.54$, $p < 0.001$, $\eta^2 = 0.46$), rising from 1.8 cm/min at 20 °C to 3.2 cm/min at 30 °C and then falling to 2.1 cm/min at 35 °C (Figure 1). Tukey–Kramer tests showed that 30 °C differed from 20 °C ($p < 0.001$) and from 35 °C ($p < 0.001$). The quadratic fit placed the optimum at about 28.4 °C. Righting time was shortest at 30 °C (34 s) and longest at 20 °C (62 s; $F(3, 156) = 32.87$, $p < 0.001$). Feeding followed the same pattern ($F(3, 156) = 69.60$, $p < 0.001$), with the highest consumption at 30 °C (78 mg) and a decline to 49 mg

@2026. This is an open access article distributed under the terms of the Creative Commons License [CC BY NC 4.0] and is available on http://www.gjirp.org/

Global Journal of Innovative Research Perspectives (GJIRP)
ISSN (Online): 3143-1089
Volume-2 Issue-4 || Oct – Dec 2026 || PP. 1 – 7
https://gjirp.org/

at 35 °C. Mean crawling speed and feeding rose and fell together across the four temperatures, which indicates that general activity changed as a whole. H1 is supported.

Table 2. Behavioural responses of Radix acuminata at four water temperatures (mean ± SD, n = 40 per level)

Temperature	Crawling speed (cm/min)	Righting time (s)	Feeding (mg/24 h)	Withdrawn, n (%)
20 °C	1.8 ± 0.5	62 ± 15	41 ± 10	3 (7.5)
25 °C	2.6 ± 0.5	45 ± 12	63 ± 12	2 (5.0)
30 °C	3.2 ± 0.6	34 ± 10	78 ± 13	4 (10.0)
35 °C	2.1 ± 0.7	58 ± 18	49 ± 14	13 (32.5)
ANOVA / χ^2	F = 44.5	F = 32.9	F = 69.6	χ^2 = 16.2

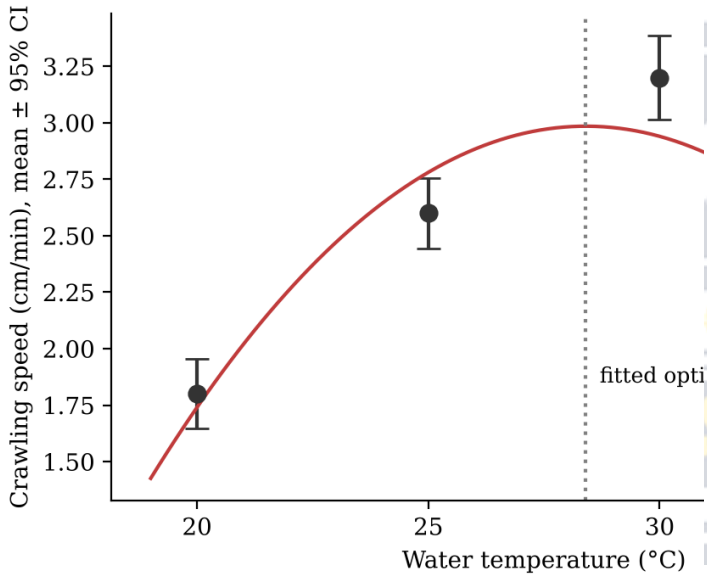

Figure 1. Crawling speed of snails across water temperature, with the fitted quadratic curve.

Withdrawal into the shell

Withdrawal was uncommon between 20 and 30 °C but increased at 35 °C, when 13 of 40 snails (32.5%) retracted into the shell (χ^2 = 16.23, df = 3, p = 0.001; Cramér's V = 0.32). A similar pattern was found for pH (Table 3 and Figure 2). Withdrawal was highest at pH 5.0 (42.5%), lowest at pH 7.5 (7.5%), and moderately raised at pH 9.0 (25.0%; χ^2 = 17.08, df = 3, p <0.001; Cramér's V = 0.33). H2 is supported.

Effect of pH

Crawling speed differed significantly across pH levels (F(3, 156) = 69.07, p <0.001, η^2 = 0.57). It was greatest at pH 7.5 (2.9 cm/min) and smallest at pH 5.0 (1.2 cm/min). Speed at pH 9.0 (1.9 cm/min) was lower than at pH 6.5 and 7.5, and the difference between pH 7.5 and pH 5.0 was significant (Tukey–Kramer p <0.001). Snails at acid pH were thus more strongly affected than those at alkaline pH. H3 is supported.

Table 3. Crawling speed and withdrawal at four pH levels (n = 40 per level)

pH	Crawling speed (cm/min), mean ± SD	Withdrawn, n	Withdrawn, % (95% CI)
5.0	1.2 ± 0.5	17	42.5 (28.5–57.8)
6.5	2.4 ± 0.5	5	12.5 (5.5–26.1)
7.5	2.9 ± 0.6	3	7.5 (2.6–19.9)
9.0	1.9 ± 0.6	10	25.0 (14.2–40.2)

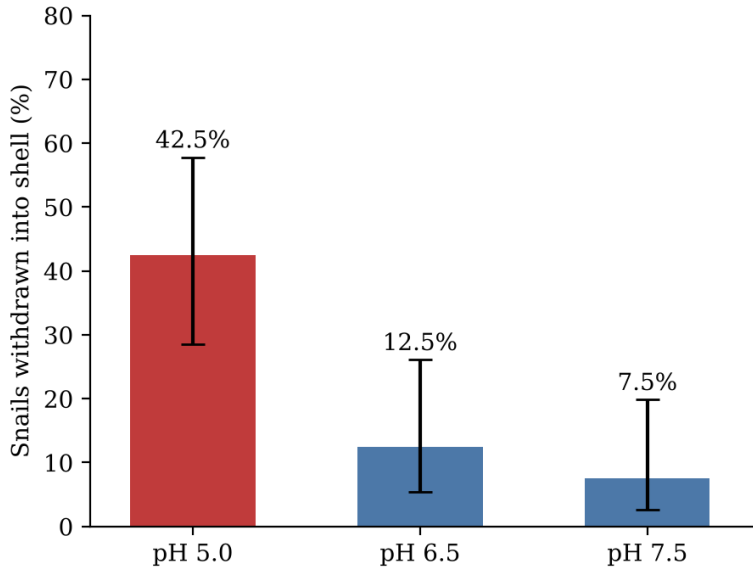

Figure 2. Percentage of snails withdrawn into the shell at four pH levels, with 95% confidence intervals.

@2026. This is an open access article distributed under the terms of the Creative Commons License [CC BY NC 4.0] and is available on http://www.gjirp.org/

Global Journal of Innovative Research Perspectives (GJIRP)
ISSN (Online): 3143-1089
Volume-2 Issue-4 || Oct – Dec 2026 || PP. 1 – 7
https://gjirp.org/

Effect of dissolved oxygen

Aerial surfacing rose as oxygen fell (Table 4 and Figure 3). Snails at 2 mg/L surfaced 9.4 times per hour, those at 5 mg/L 3.8 times and those at 8 mg/L 1.6 times ($F(2, 117) = 182.23$, $p < 0.001$, $\eta^2 = 0.76$). All pairwise comparisons were significant (Tukey–Kramer $p < 0.001$ or lower). H4 is supported.

Table 4. Aerial surfacing at three dissolved oxygen levels (n = 40 per level)

Dissolved oxygen (mg/L)	Surfacing events per hour (mean ± SD)
2	9.4 ± 2.6
5	3.8 ± 1.7
8	1.6 ± 1.0

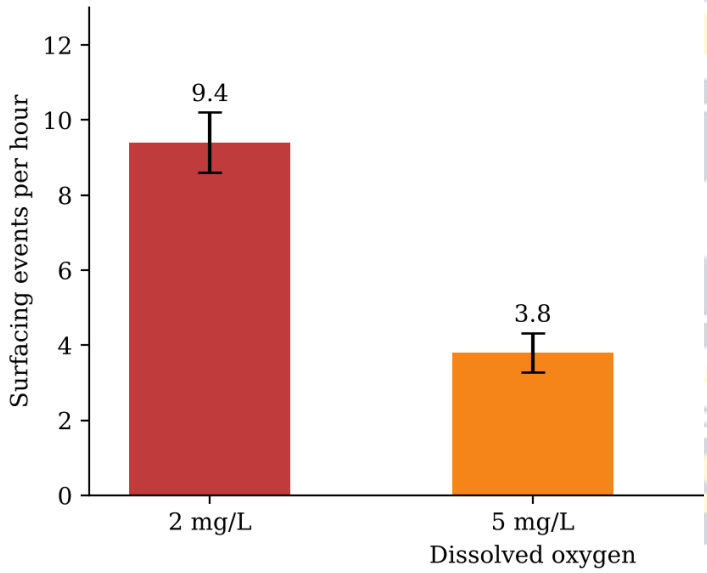

Figure 3. Aerial surfacing frequency of snails at three dissolved oxygen levels, with 95% confidence intervals.

Discussion

All three environmental variables altered snail behaviour, and in a manner that is consistent with ecological theory. The unimodal response to temperature, with a peak near 28 °C, matches the shape of a thermal performance curve in which performance rises with temperature until oxygen supply limits aerobic metabolism (Pörtner & Farrell, 2008). The fall in speed and feeding at 35 °C, together with a rise in withdrawal, suggests that snails at that temperature stopped foraging and sealed themselves in the shell to save energy. This fits the narrow temperature ranges within which activity and survival are confined in intermediate-host snails (Appleton, 1978). The concordance of crawling speed, righting time and feeding implies that these simple measures capture one general activity state.

The pH results show the sensitivity of snails to acidic water. Low pH reduced crawling and caused the highest withdrawal, which fits the general view that acid conditions disturb ion regulation and shell maintenance in molluscs (Dillon, 2000; McMahon, 1983). The weaker effect of alkaline water suggests that the tolerated range is asymmetric. For conservation, this means that acidification from rain, industrial effluent or the decay of organic matter may limit snail populations before other changes become obvious (Pyron & Brown, 2015).

Aerial surfacing increased steeply at low oxygen, which is the expected strategy of a pulmonate, since air breathing allows it to compensate for poor oxygen in the water (McMahon, 1983). The behaviour has a cost, as surfacing is time that cannot be spent feeding and exposes the snail to aerial predators. Previous work has shown that snails readily trade off feeding, refuge use and predation risk (Alexander & Covich, 1991; Turner, 1996). Hypoxia may therefore act together with predation to affect snail survival in warm, eutrophic ponds. Because warming reduces oxygen solubility while increasing metabolic demand, the results for temperature and oxygen are also likely to interact in the field (Sokolova & Lannig, 2008).

These findings give practical value to simple behaviours. Crawling speed, withdrawal and surfacing can be recorded with basic equipment, do not require killing the animal and respond at exposures below those that cause mortality. They can be applied in schools, community monitoring and early-warning assessments of ponds and irrigation channels. Since snails are food for many predators and the hosts of several parasites, shifts in their behaviour may carry effects through the food web (Covich, 2010; Dewitt et al., 1999).

@2026. This is an open access article distributed under the terms of the Creative Commons License [CC BY NC 4.0] and is available on http://www.gjirp.org/

Global Journal of Innovative Research Perspectives (GJIRP)
ISSN (Online): 3143-1089
Volume-2 Issue-4 || Oct – Dec 2026 || PP. 1 – 7
https://gjirp.org/

Limitations

The experiments were conducted in the laboratory with a single species and with acute exposure, so the results may not extend directly to field populations or to long-term acclimation. Each factor was tested separately, and interactions between temperature, pH and oxygen were not examined. Snails came from one source population, which may have a particular thermal history. Food was supplied as lettuce discs and does not represent natural periphyton. The behavioural definitions, particularly of withdrawal, involve some judgment, although observers did not know the treatments.

Conclusion

Radix acuminata showed clear behavioural responses to temperature, pH and dissolved oxygen. Activity peaked at an intermediate temperature of about 28 °C, withdrawal increased at 35 °C and pH 5.0, and surfacing rose sharply under hypoxia. Because the measures are simple and respond early, they can serve as indicators of environmental stress in freshwater habitats. Future work should combine factors, include field-collected populations from different thermal regimes, and test whether behavioural change predicts survival and reproduction over longer periods.

References

1. Alexander, J. E., & Covich, A. P. (1991). Predator avoidance by the freshwater snail Physella virgata in response to the crayfish Procambarus simulans. Oecologia, 87(3), 435–442.
2. Appleton, C. C. (1978). Review of literature on abiotic factors influencing the distribution and life cycles of bilharziasis intermediate host snails. Malacological Review, 11, 1–25.
3. Brown, K. M. (1991). Mollusca: Gastropoda. In J. H. Thorp & A. P. Covich (Eds.), Ecology and classification of North American freshwater invertebrates (pp. 285–314). Academic Press.
4. Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Lawrence Erlbaum Associates.
5. Covich, A. P. (2010). Winning the biodiversity arms race among freshwater gastropods: Competition and coexistence through shell variability and predator avoidance. Hydrobiologia, 653, 191–215.
6. Dewitt, T. J., Sih, A., & Hucko, J. A. (1999). Trait compensation and cospecialization in a freshwater snail: Size, shape and antipredator behaviour. Animal Behaviour, 58(2), 397–407.
7. Dillon, R. T. (2000). The ecology of freshwater molluscs. Cambridge University Press.
8. Lydeard, C., Cowie, R. H., Ponder, W. F., Bogan, A. E., Bouchet, P., Clark, S. A., et al. (2004). The global decline of nonmarine mollusks. BioScience, 54(4), 321–330.
9. McMahon, R. F. (1983). Physiological ecology of freshwater pulmonates. In W. D. Russell-Hunter (Ed.), The Mollusca (Vol. 6, pp. 359–430). Academic Press.
10. Pörtner, H. O., & Farrell, A. P. (2008). Physiology and climate change. Science, 322(5902), 690–692.
11. Pyron, M., & Brown, K. M. (2015). Introduction to Mollusca and the class Gastropoda. In J. H. Thorp & D. C. Rogers (Eds.), Thorp and Covich's freshwater invertebrates (4th ed., pp. 383–421). Academic Press.
12. Sokolova, I. M., & Lannig, G. (2008). Interactive effects of metal pollution and temperature on metabolism in aquatic ectotherms: Implications of global climate change. Climate Research, 37, 181–201.
13. Strong, E. E., Gargominy, O., Ponder, W. F., & Bouchet, P. (2008). Global diversity of gastropods (Gastropoda; Mollusca) in freshwater. Hydrobiologia, 595, 149–166.
14. Turner, A. M. (1996). Freshwater snails alter habitat use in response to predation. Animal Behaviour, 51(4), 747–756.
15. Arulkumaran, R., Ayyagiri, A., Musunuri, A., Goel, P., & Jain, A. (2022). Decentralized AI for financial predictions. International Journal for Research Publication and Seminar, 13(5), 434.
16. Goel, P., Rajakumar, J., & Thason, M. (2025). Integrating DevOps Practices in AI-Driven User Interfaces: Streamlining Development, Deployment, and User Experience Optimization. Universal Research Reports, 12(2), 19.
17. Govindarajan, B., Kolli, R. K., Singh, P., Krishna, D. M. M., Goel, O., & Goel, P. (2024). Advanced Techniques in Automation Testing for Large Scale Insurance Platforms. Journal of Quantum Science and Technology, 1(1), 1.
18. Gupta, A. K., Govindankutty, S., Nandyala, A. R., Maria Thason, J. R., Pippal, S., & Gupta, G. K. (2025). AI-Driven Test Automation for Big Data Systems in Cloud Environments. In 2025 First International Conference on Advances in Computer Science, Electrical, Electronics, and Communication Technologies (CE2CT) (pp. 1354–1359). IEEE. https://doi.org/10.1109/CE2CT64011.2025.10941644
19. Jaiswal, I. A., & Goel, P. (2025). The evolution of web services and APIs: From SOAP to RESTful design. International Journal of General Engineering and Technology, 14(1), 12–23.
20. Kumar, L., & Thason, J. R. M. (2025). Containerization in Modern Software Architectures: Optimizing Scalability, Portability, and Resource Efficiency. International Journal for Research Publication and Seminar, 16(2), 163–181. https://doi.org/10.36676/jrps.v16.i2.262
21. Maria Thason, J. R., & Prasad, M. S. R. (2025). Bridging the Gap: Integrating Security into DevOps Practices for Enhanced Software Delivery and Risk Mitigation. International Journal of Research in Modern Engineering & Emerging Technology, 13(5), 1–22. https://doi.org/10.63345/ijrmeet.org.v13.i5.130501
22. Maria Thason, J. R., & Rastogi, D. D. (2025). Orchestrating Complex Release Pipelines in DevOps: Strategies for Managing Dependencies, Automation, and Continuous Delivery. Journal of

@2026. This is an open access article distributed under the terms of the Creative Commons License [CC BY NC 4.0] and is available on http://www.gjirp.org/

Quantum Science and Technology, 2(2), 6–28. https://doi.org/10.63345/jqst.v2i2.292

23. Murthy, K. K. K., Pandian, P. K. G., & Goel, P. (2024). The Role of Digital Innovation in Modernizing Railway Networks: Case Studies and Lessons Learned. International Journal for Research Publication and Seminar, 15, 272–285.
24. Rajakumar Maria Thason, J., & Solanki, S. (2025). Automated Canary Deployments in Continuous Delivery: Balancing Speed and Reliability. International Journal of Enhanced Research in Science, Technology & Engineering, 14(4), 426–448.
25. Sharma, S., Murthy, P., Sundareswaran, A. P., Vardhineedi, P. N., Saini, A., & Goel, P. (2025). Secure Cloud Deployment Strategies: Integrating AI for Automated Vulnerability Scanning and Risk Mitigation. In 2025 International Conference on Networks and Cryptology (NETCRYPT) (pp. 1615–1619). IEEE.
26. Sundeep, A., Goel, P., & Renuka, A. (2023). Evaluating power delivery and thermal management in high-density PCB designs. International Journal for Research Publication and Seminar, 240–252.
27. Thason, J. R. M., & Singh, R. K. (2025). Measuring DevOps Success with the DORA Metrics: A Comprehensive Analysis of Key Performance Indicators and Their Impact on Software Delivery. International Journal of Creative Research Thoughts, 13(5), i341–i358. https://ijcrt.org/papers/IJCRT2505957.pdf
28. Yadav, N., Bhat, S. R., Mane, H. R., Pandey, P., Singh, S. P., & Goel, P. (2024). Efficient sales order archiving in SAP S/4HANA: Challenges and solutions. International Journal of Computer Science and Engineering, 13(2), 199–238.
29. Yadav, N., Das, A., Kar, A., Goel, O., Goel, P., & Jain, A. (2024). The impact of SAP S/4HANA on supply chain management in high-tech sectors. International Journal of Current Science, 14(4), 810.
30. Yogesh, K., Goel, P., Singh, N., & Sachan, S. (2026). Inner Power for Ordinary People: Ordinary to Extra Ordinary Indian Personalities. WISSIRA RESEARCH LAB.
31. Yogesh, K., Sachan, S., Goel, P., & Singh, N. (2026). Research Identity Blueprint: Building Credibility in the Academic World. WISSIRA RESEARCH LAB.

@2026. This is an open access article distributed under the terms of the Creative Commons License [CC BY NC 4.0] and is available on http://www.gjirp.org/