# *Original Research Article*

# Integrated Assessment of Pesticide Efficacy Against *Aceria litchi* (Keifer) in Litchi Orchards of Bihar, India

# Abstract

This study evaluated the efficacy and toxicity of various pesticides against *Aceria litchii*(Keifer), a major pest threatening litchi production in Bihar, through integrated laboratoryand field trials. Laboratorybioassays,basedonamodifiedVoss–Dittrichmethod,determined LC₅₀ valuesandrelative toxicity for nine pesticides, revealing that sulphur and dicofolexhibited superior efficacywith the lowest LC₅₀ values and highest relative toxicity, while tetrodifon and malathion were less effective. Field evaluations conducted over two consecutive years on 10-year-old litchi trees corroborated laboratory findings, with sulphur (0.05%) and dicofol (0.05%) significantlyreducing mite populations and leaf distortion compared to untreated controls.Amodified algicidal trial further assessed commonlyavailablealgicides,demonstratingthatwettablesulphur,sulphurcombinedwithdicofol,and Bordeaux mixture effectively reduced both mite populations and subsequent leaf re-infestation. The findings underscore the potential of integrating sulphur and dicofol into pest management programs, while also highlighting the necessity for rotation strategies to prevent resistance. This comprehensive evaluation provides a valuable framework for sustainable control of *Acerialitchii*, ultimately contributing to improved litchi yield and quality.

**Keywords:***Acerialitchii*,LitchiOrchards,PesticideEfficacy,LitchiErinoseMite,Sustainable Litchi Cultivation.

# Introduction

India is one ofthe largest litchi producers (*Litchi chinensis*), contributing significantly to global production.Thefruitisprimarilycultivatedinthecountry'ssubtropicalregions,withBihar,West Bengal, Uttar Pradesh, and Jharkhand being the major litchi-growing states [1].Indiaproducesapproximately500,000metrictonsoflitchiannually,withBiharaccountingfor over 40% of the total production [2, 3].Bihar is the leading producer of litchi in India, with districts such as Muzaffarpur, Vaishali, and Samastipurbeingthemajorhubs.The favorableclimaticconditionsand fertilesoiloftheregionmake it ideal for litchi cultivation.Muzaffarpur, often referred to asthe "LitchiCapitalofIndia," is the largest producerof litchi in Bihar. Theregioncontributesapproximately300,000 metrictonsoflitchiannually,accounting fornearly80% of Bihar’s total litchi production [4]. The district has around 28,000 hectares of land under litchi cultivation, withthe majorityoffarmersrelying onthis fruit fortheir livelihood.Theprominent variety grown in Muzaffarpur is Shahi litchi, which is known for its superior quality, aroma, and sweetness. Thedistrict’slitchiisexportedto internationalmarkets,includingtheMiddleEast andEurope, contributing significantly to the region's economy.Litchi production is severely threatened by *Acerialitchii*(Keifer), a microscopic eriophyid mite that causes considerable damage to litchi orchards [5]. Pest infestations, particularly caused by *Acerialitchii*(Keifer), poseaseriousthreatto litchiproductioninMuzaffarpur. Infestationscanleadto ayield loss of 30–40% annually, depending on the severityof the attack [6]. In severe cases, the damage can escalate,resulting inupto 50%croploss.*Acerialitchii*,thelitchimite,damagesyoung leaves, flowers, and fruits, resulting in leaf curling, necrosis, flower abortion, and fruit malformation. Severe infestations can lead to significant economic losses byreducing both yield and fruit quality, thereby impacting farmers' livelihoods and the litchi industrycausingmalformation and reducing market value. Other pests, such as fruit borers and bark-eating caterpillars, also contribute toproduction losses.Economic lossesduetopestinfestationsinMuzaffarpurhave beenestimatedataround ₹150–200crore annually, significantlyaffecting farmers’incomes. Inaddition, the compromised qualityofthe produce impacts export potential, leading to further financialsetbacks for the litchi industry. The economic impact of *A. litchii*infestations has prompted growers to relyon a varietyof management strategies, including cultural practices and chemical control [29]. However, inconsistent field performance and concerns over resistance development underscore the need for precise evaluation of pesticide efficacy [7].To combatthispest,chemicalcontrolusingpesticideshasbeenthe mostwidelyadoptedapproachdue to its rapid action and effectiveness. However, the efficacy and toxicityof pesticides against*Acerialitchii*can vary under different conditions. Laboratory studies allow for controlled experiments to determine the contact toxicityofpesticides on adult mites, while field evaluations provide a practical understanding of pesticide performance in natural environments where factors such as weather, plant physiology, and other environmental variables play a role [8].The integrationoflaboratoryand fieldassessmentsiscriticalforobtainingcomprehensive insightsinto pesticide performance. Laboratorytests help identifypotential toxicants and their lethal doses, while field experiments validate these results under real-world conditions, ensuring that the selected pesticides maintainefficacy inpracticalapplications. Moreover, evaluating the toxicityofpesticides is essentialto assess their environmental impact [31, 32] and safetyfor beneficialorganisms, thus contributing to the development of sustainable pest management strategies [9].This studyaims to combine laboratoryand field evaluations to assess the toxicityand efficacyof various pesticides against adult *Acerialitchii*. Byidentifying the most effective pesticides that balance high efficacy with minimal environmental impact, the study seeks to provide valuable recommendations for integrated pest management (IPM) programs. The Studyreflects a holisticview ofruraldevelopment,where improvingenvironmentalfactorscanyieldbenefitsacrossmultiplesectors [10]. The ultimate goal is to develop a holistic and sustainable approach to managing *Acerialitchii*infestations, thereby ensuring improved production and safeguarding the ecological balance.

MATERIALSAND METHODS

Surveyswereconductedin8districtsofnorthBihar,viz.,Begusarai,Darbhanga,Madhubani,Motihari, Muzaffarpur, Samastipur, Sitamarhi, and Vaishali, during the year 2023-24.Ineachrouteseveralstepsweremade fordatacollectioninlitchiorchards.Thepercentage infestations were calculated using the following formulas:-

Percenttree infestation=[Sumofinfestedtreesindistrict/Totalno.oftreesofdistrictObserved]×100

Percentleafinfestation=[Sumofinfestedleafinadistrict/Totalno.ofleavesofthedistrictsObserved]

×100

List 1: Leafinfestation incidenceindex:

|  |  |
| --- | --- |
| **Grade** | **Rangeofleaf infestation** |
| Noincidence | Lessthan1% |
| Lessincidence | 1to10% |
| Moderateincidence | 11to30% |
| Heavyincidence | 31%above |

While estimating the leaf infestation 10 twigs (6 cm long) containing approximately20 leaves were plucked fromboth sides ofa tree, i.e., 5 twigs facing towardsthe trunk and 5 twigs facing away from thetrunk,atrandom,and thepercentageleafinfestationwascalculated.Insolidplanting, i.e.,inlarger orchards, such observations were recorded at every 6th tree. The total number of infested trees in an orchard revealed the percentage of tree infestation. For estimation population dynamics mite/2.5 cm² leafsurface, outof200 leavescollected fromanorchards, 5 leaveswere chosenat random, brought to laboratory for recording mite/2.5 cm² under stereo zoom binocular microscope.For the studyof the toxicityof different pesticides as contact poison to the adults of *Acerialitchii*(Keifer) under laboratoryconditions, the method originated byVoss and improved byDittrich was followed[11, 12].Theadultsofthelitchimitewereobtained fromanuntreatedfarmer’s fieldwhere no pesticidaltreatment had been given for the last two years. The heavily infested old litchi leaves were brought tothe laboratoryand kept under anelectric bulb100 wattto crawloutthe mite fromperineum. Pesticidal emulsions were prepared from their commercial formations using distilled water. For the toxicitytest, amicroscopicslidewaspastedwithstickymaterial(eggalbumen)andaknownnumber of mites were released on it bysticking a piece ofdried infested leafwith a small glass rodover the slide. The prepared slide was dipped in serial dilution of various pesticides for five seconds. Theywere drained byplacing themonedge for 15 minutes at roomtemperature (26± 1ºC inslide holder). Forthe assessment of mortality, counts were made after 24 hours. Mites moving when disturbed with a fine brush were recorded. Each experiment was replicated four times. The mortality in control (Mites released on egg albumen) was also recorded.The mortality data thus obtained were subjected to probit analysis [13], and LC 50 values for each pesticide were calculated. Based on LC 50 values relative toxicityofdifferent pesticides has been calculated bytaking the LC 50 values ofendosulfan as unity.For Studyfield evaluationofdifferent pesticidesagainst *Acerialitchii*(keifer),field trialswerecarried outduring2023and2024on10yearoldlitchitreesat NRCLfarmusingrandomised blockdesignwith three replications [14]. The pesticides were evaluated for 2 years during January-April. Spraying was done in the midJanuarywith an HTPpower sprayer.Approximately10-15 liters ofspraysolution was requiredtocovertheentire foliageofeachtree.Thecheckplantsweresprayedwithplainwater. Newly infested mite colonies at different niches in different directions were earmarked. Pre and Post mite population counts of living mites per 2.5 cm² leafsurface were recorded at 2, 7 and 14 days after spraying. Predatory mites inhabiting the same niches were counted/100 leaves (entire leaf surface).Mortalitycountswereworkedout bycomputingdifferences betweenPreandpost treatment population of mites by applyingAbbots (1925) correction factor [15]. The data thus obtained were statistically analyzed after angular transformation [16]and presented inTable-2. Re-infestation in term of percentage leaf infestation 3 months after treatment was recorded based on damage to assess the re- infestation by the mite.For studyofefficacyofsome algicides against *Acerialitchii*(Keifer) and reappearance ofsymptomof leaf curling, AField trialon the ‘Shahi’varietywas conducted during July 2024, just after pruning at NRCL, Mushahari, Muzaffarpur. Basedontheunfavorable responseofinsecticideaswellasacaricidal trials conducted during previous years. The treatments were replicated thrice using randomised block design. Spraying was done with an HTPpower sprayer on 10-12 year oldplants.Approximately 20 litersofspraysolutionwerepreparedtocovertheirentire foliageofthetree.Thedatawerestatistically analyses after angular transformation.

# Resultsand Discussion

# *Evaluation of pesticides Toxicityagainst adult Acerialitchii under laboratoryconditions*

The relative toxicityof nine pesticides was evaluated as contact poisons against adult *Acerialitchii*(Keifer) under laboratoryconditions. The results presented inTable-1, provide insights into the effectivenessandtoxicitylevelsofthetestedpesticides, as indicatedbytheirLC₅₀ valuesandrelative toxicity. TheLC₅₀ valuesofthetestedpesticides ranged from0.0051ppm(Sulphur)to0.0953ppm(Tetrodifon), indicating a wide variation in their effectiveness. Sulphur demonstrated the highest toxicity with the lowest LC₅₀ value of0.0051 ppm, suggesting that it required the least concentration to achieve 50% mortality ofadult *Acerialitchii*. Ramos et. al. use ofthe Bordeaux mixture and lime sulfur showed a significant effect in reducing the incidence ofthe same [17]. Sulphur and dicfolwere the most efficacious insecticides in reducing the mite population as compare to other. This conforms to the findings of Patel (2020) and Siddhapara (2016) [18,19]. In contrast, Tetrodifon exhibited the highest LC₅₀ value of0.0953 ppm, making it the least effective among the tested pesticides. The relative toxicityvalues revealed significant differences inpesticide efficacy. Sulphur showedthe highest relative toxicity (0.052), followed by Dicofol (0.151), indicating their superior effectiveness against *Acerialitchii*.Ontheotherhand,Tetrodifonhadthehighest LC₅₀valueandthelowest relative toxicity (1.060), suggesting limited effectiveness. Amongtheorganophosphateandorganochlorinepesticides,Endosulfan(0.734),Phenthoate(0.682), Phosphamidon (0.828), and Ethion (0.850) demonstrated moderate toxicity. Malathion (0.892) and Phosalone (0.779) showed slightly lower toxicity compared to other pesticides in this group. The heterogeneity factor (χ²) values for allpesticides were non-significant at P< 0.05, indicating that thedataobtainedwereconsistent andreliable.Thissuggeststhatthedose-responserelationships forall pesticides were homogeneous and fit the probit regression model. The findings underscore the importance of selecting appropriate pesticides to control *Acerialitchii*. Sulphur and Dicofol, with their high relative toxicityand lower LC₅₀ values, can be incorporated effectivelyinto IPMprograms.However,theprolongeduseofthesepesticidesmayleadtoresistance development, necessitating the adoption of rotation strategies and integrated approaches involving biological and cultural control methods.

Table-2 showed the studyduring boththe years of 2023 & 2024).Allthe insecticides/acaricides were significantlyeffective against the mite *Acerialitchii*as compared to the check. During 2023, amongst various pesticides, sulphur (0.05%) proved as the most efficacious over other insecticides following 2, 7, and 14 days after application. These insecticides provided maximum reduction (%) of thepest,i.e.,93.84,97.17,and71.07atthesedurations,respectively.Dicofol(0.05%)wasnext inorder ofefficacy, followed byphenthoate, endosulfan, ethion, tetradifon, phosalone, and phosphamidon.The results obtained during the second consecutive year, i.e., 2024, were consistent with those ofresults obtained during 2023, as evident fromTable-2. During 2024, also, the sulphur (0.05) and dicofol (0.05%)werethemost efficaciousinsecticidesinreducingthe mitepopulationascomparedtoothers. This confirms the findings of Sharma and Rahman [20] and Lall and Rahman [21, 35]. Theyalso found dicofolas very effective against this pest on litchi when treated at pre-bloomand post-bloomstages. Inboththe years(2023and2024), sulphur(0.05%), dicofol(0.05%),andendosulfan(0.05%)were most effective in reducing the symptom, i.e., distortion of litchi leaves (Table-2). However, the maximum effect was noticed with sulphur (0.05%), followed bydicofol and endosulphan.Inthesetreatments, curlingoflitchileaveswasrecordedless(17.43)ascomparedtothe check (68.92); other pesticides failed to protect the foliage for a longer time.

# *Impactofpesticidetreatmentonthemortalityof Acerialitchii underfieldconditions*

The population build-up of these mites starts in March and increases graduallytill June, after which there is a decline in their population. The effects of conduct toxicity of eight insecticides/acaricides to predatory mite of *Acerialitchii* are presented inTable-3.Among the pesticides tested, sulphur and dicofol each (0.05%) are found to be significantly less toxic and produced 0.66to 1.33 percent mortality,respectivelyduring48hoursafterspraying,whereasthetoxicityofotherpesticides.Suchas endosulfan, phenthoate, phosphamidon, ethion, phosalone, andtetradefonhave indicated76.00to100 mortality during 48 hours after spraying. The percent mortality of predatory mites obtained due to the persistence of pesticide residue is also indicated (Table-3). The residue ofsulphur was not found to be totally innocuouswhereas the residue ofdicofolwas found to be less toxic, causing 10 percent mortalityto predatorymites whenrecorded7 days after treatment. Eighty to hundred per cent mortality was recorded in residue of endosulfan, phenthoate,phosphamidon,ethion,phosaloneand tetradifonon7thdayaftertreatment.Thus,based on the results obtained, sulphur and dicofol were found to least toxic to the predatory mites. The present finding supports the observations made byOverneer and Vanzon [22, 33] that the chemical endosulfanwasfoundtobehighlytoxictovariouspredatorymitelikeTyphlodromuspyri,Amblyseiuspotentillae andAmblyseiusbibenes but does not support the observation made by several authors [23, 30, 24]; and Hislop and Prokopy[24]; theythat endosulfan was found to be non-toxic or less toxic to Amblyseiusfallocis(German).Theresultofthepresent studyindicatedthattheacaricides likesulphur and dicofolcan be used safely against the *Acerialitchii*whose residue do not show anydeleterious effect on predatory mites present in the same ecological niche in association with *Acerialitchii*. The other pesticides like endosulphan, phenthoate, phosphamidon, ethion, phosalone, and tetradifon could be recommended against *Acerialitchii*.In light ofthe results ofthe two years, a modified algicidal trail was conducted to determine the efficacy of some commonly available algicides against the *Acerialitchii*.

***Bio-efficacyofvariousinsecticidesagainstmiteAcerialitchii***

The trail comprised to six treatments,includingcontrol,andeachtreatmentwasreplicatedthrice.Beforespraying,thepopulation densityof mites per 2.5 cm² leaf surface was estimated.After the treatment, observations onthe population reduction (%) were recorded at the intervals of2, 7, and 14 days interval.After one month, the leaf infestation(%) was also recorded.

The resultsofthe experiment are summarized inTable-4. Inperusal ofdata,it is evident that inthe 2 days afterthe applicationofthe algicide, allthe algicide was found to reduce the mite population significantly in comparison to the control. Wettablesulphur (50 WP) was found highly effective in reducing the mite population (90.25%). Sulphur followed bydicofol (0.3%) and boardeaux mixture (1%) were at par. After7days, 75.25to88.25percent populationreductionwasrecordedintreatmentsbordeauxmixture (1%) Sulphur + dicofol(0.2 + 0.3) and wettablesulphur. These algicides were found statistically superior over Bordeaux (0.5) and copper oxichloride (0.5%).At 14 days after treatment, the wettablesulphur was the only effective treatment, which gave the highest population reduction (79.25%). Thepercentageofnew leafre-infestationwasalso recordedinthenext flushingseasoni.e. duringJuly- August. It is clear fromTable-4 that the minimum (3.88%) re-infestation was recorded ontreestreated with wettablesulphur, followed by sulphur + dicofol(0.2 + 0.3 %) and the Bordeaux mixture (1%). Thus,foreffectivecontrolofAcerialitchii,thesethreealgicidesviz.Sulphur(0.1%),sulphur+dicofol (0.2 + 0.3%), and bordeaux mixture (1%) could be recommended profitable. Kim(2010)recommendedcrudeoilemulsionandlimesulphuragainstthemiteatthetimeofnew flush [25, 28]. PrasadandSingh(1981)reportedthat microwetsulphurormicro-999@0.04percent, consecutively for 2-3 years during June-Julywas found highly effective and economical. To date, authors recommended various insecticides/acaricides viz., dimethoate, dicofol, endosalfan, Malathion, Phosphamidon, wettablesulphur against the mist [26]. None of the workers have emphasized the control of Cephaleurosvirescens, which harbor the mite *Acerialitchii*on litchi. Sood*et.al*.(1987)reportedthat sprayingoflimesulphurat least thriceduringautumnandspring season and burning of pruned infected twigs had reduced the infection by 94 percent [27].

# Conclusion

This studyprovides a comprehensive evaluation of pesticide efficacyagainst *Acerialitchii*in litchi orchards through both laboratoryand field trials. The laboratory bioassays revealed that sulphur and dicofolwere the most effective, exhibiting the lowest LC₅₀ values and highest relative toxicityagainst the mite, while tetrodifon and malathion were comparatively less effective. Field trials conducted over two consecutive years confirmed these findings, with sulphur (0.05%) and dicofol (0.05%) significantlyreducing mite populations and mitigating leaf distortion. In addition, the modified algicidal trial demonstratedthat wettablesulphur, sulphur combined with dicofol, and Bordeaux mixturesubstantiallyloweredmitepopulationsandminimizedre-infestationinthesubsequent flushing season. Furthermore, the studyhighlights the importance of selecting pesticides that not onlytarget *Acerialitchii*effectively but also exhibit minimaladverse effects on beneficial predatory mites. The integration of these findings into an Integrated Pest Management (IPM) framework, with rotation strategies to prevent resistance development, offers a promising approach for sustainable litchi production.Ultimately,thisworkcontributesvaluableinsightsforoptimizingpestcontrolmeasures, ensuring improved yield and quality in litchi orchards while safeguarding the ecological balance.

**Recommendation:**

It is recommended that litchi cultivation practices be optimized by implementing advanced irrigation techniques, pest management strategies, and improved post-harvest handling to enhance yield and quality. Furthermore, market accessibility should be strengthened through better supply chain management and farmer training programs to ensure economic sustainability. Investment in research and development, particularly in climate-resilient varieties, will also play a crucial role in the long-term success of litchi production

**Future scope of study:**

Future research on litchi cultivation can focus on developing climate-resilient litchi varieties to withstand changing environmental conditions and improve yield consistency. Exploring advanced irrigation techniques, soil health management, and organic farming practices can further enhance productivity and fruit quality. Additionally, studies on pest and disease resistance, along with the development of eco-friendly pest control methods, will contribute to sustainable cultivation. Research on post-harvest technologies, including storage, transportation, and packaging, can help reduce spoilage and extend shelf life. Market research and analysis of consumer preferences, both domestically and internationally, will provide valuable insights for improving market access and profitability. Finally, integrating modern technology such as precision agriculture and data-driven farming can revolutionize litchi cultivation and ensure long-term sustainability

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# Table-1:Relativetoxicityofsomepesticidesascontactpoisonto*Acerialitchii*(Keifer) (Laboratory condition)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Pesticides** | **Heterogeneity** | **Regression equation** | **LC50**  **ppm** | **Fiduciallimit (ppm)** | **Relative toxicity** |
| Sulphur | x²(3)= 0.242041 | Y=0.0641x+ 4.851 | 0.0051 | 0.00174499–0.01466023 | 0.052 |
| Dicofol | x²(3) = 0.00409765 | Y=1.0714x+ 3.760 | 0.0144 | 0.00639072–0.03251251 | 0.151 |
| Endosulfan | x²(3) = 0.02578780 | Y=2.1828x+ 0.990 | 0.0700 | 0.04671518–0.10205989 | 0.734 |
| Phenthoate | x²(3) = 0.0053299 | Y=1.870x+ 1.612 | 0.0650 | 0.04565695–0.09370306 | 0.682 |
| Phosphamidon | x²(3) = 0.0037871 | Y=1.761x+ 1.660 | 0.0790 | 0.05315249–0.11752590 | 0.828 |
| Ethion | x²(3) = 0.00250051 | Y=2.521x+ 0.191 | 0.0810 | 0.06672403–0.09852047 | 0.850 |
| Phosalone | x²(3) = 0.02414432 | Y=1.5511x+ 2.101 | 0.0743 | 0.04536777–0.0779 | 0.779 |
| Tetrodifon | x²(3) = 0.0002160 | Y=1.441x+ 2.151 | 0.0953 | 0.05853330–0.16274637 | 1.060 |
| Malathion | x²(3)=0.99970924 | Y=2.200x+0.751 | 0.0851 | 0.06107311–0.11861178 | 0.892 |

Y=Probit Kill;x= log(concentration×10³);LC₅₀= concentrationcalculatedtogive50%kill. In none of the cases were the data found to be significantly heterogeneous at P< 0.05.

# Table-2Bio-efficacyofvariousinsecticidesagainstmite*Acerialitchii*infestinglitchi with respect to percent reduction.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Insecticides** | **Concentration**  **%** | **Percent Reduction (2023)** | | | **Percent Reduction (2024)** | | |
| **After2 days** | **After7 days** | **After14 days** | **After2 days** | **After7 days** | **After14 days** |
| Sulphur(Sulflex- 80WP) | 0.05 | 93.84  (78.33) | 97.17  (82.50) | 71.07  (57.96) | 100.00  (90.00) | 98.27  (83.99) | 89.25  (71.62) |
| Dicofol(Kelthane 18SEC) | 0.05 | 88.92  (97.05) | 84.33  (69.92) | 68.90  (56.26) | 88.20  (96.67) | 80.62  (65.86) | 78.50  (62.97) |
| Endosulfan(Thiodon35EC) | 0.05 | 49.66  (44.81) | 47.39  (44.56) | 48.76  (44.28) | 79.27  (65.67) | 78.50  (65.67) | 58.50  (50.10) |
| Phenthoate(Elasan50EC) | 0.05 | 83.42  (66.42) | 81.15  (68.37) | 51.33  (45.71) | 82.71  (66.69) | 76.61  (60.63) | 54.50  (47.62) |
| Phosphamidon(Dimecron100EC) | 0.05 | 38.56  (31.49) | 49.01  (43.27) | 47.80  (43.08) | 73.60  (59.34) | 64.50  (53.62) | 40.50  (39.45) |
| Ethion(Mitici50EC) | 0.05 | 71.33  (58.92) | 68.92  (57.47) | 45.66  (42.49) | 82.50  (66.14) | 80.50  (47.95) | 35.50  (37.20) |
| Phosalone(Zolohe 35EC) | 0.05 | 64.62  (46.84) | 64.83  (53.73) | 44.00  (41.42) | 66.83  (54.52) | 63.47  (52.95) | 46.50  (42.95) |
| Tetrodifon(Tedion 18WP) | 0.05 | 76.24  (61.91) | 73.64  (56.11) | 43.30  (41.74) | 80.87  (65.71) | 80.70  (57.86) | 40.20  (39.44) |
| Check | - | 0.54  (31.13) | 0.32  (3.25) | 0.23  (2.75) | 0.43  (3.74) | 0.31  (3.11) | 0.30  (3.11) |
| S.Em (±) | - | 1.93 | 11.09 | 5.57 | 4.84 | 3.86 | 4.99 |
| C.D.(P=0.05) |  | 5.36 | 32.97 | 16.55 | 14.37 | 11.46 | 14.84 |

Note:

Eachfigureisanaverageof3replications. Figures in parentheses are angular values.

**Table-3Residualeffectofpesticideonreappearanceofsymptomandonmortalityofadults(Predatory Mites).**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Treatments | %Damagednew leaf (2012) | %Damagednew leaf (2013) | % Mortality due to residues  (2daysp.t.) | % Mortality due to residues  (7daysp.t.) |
| Sulphur(0.05) | 17.76(24.83) | 17.90(25.10) | 0.66(4.63) | 0.33(1.91) |
| Dicofol(0.05) | 14.43(24.67) | 19.45(6.31) | 1.33(6.31) | 1.00(4.62) |
| Endosulfan (0.05) | 20.94(28.17) | 17.19(24.37) | 76.00(61.11) | 60.16(51.49) |
| Phenthoate (0.05) | 53.01(46.75) | 58.75(50.06) | 81.50(64.63) | 72.00(58.82) |
| Phosphamidon (0.05) | 64.40(52.85) | 65.33(54.01) | 75.83(61.05) | 64.00(53.29) |
| Ethion(0.05) | 66.56(54.68) | 64.00(53.34) | 35.83(68.07) | 74.50(6.79) |
| Phosalone(0.05) | 57.46(50.98) | 58.93(50.70) | 85.66(50.19) | 79.00(62.90) |
| Tetridifon(0.05) | 67.55(55.34) | 56.06(48.68) | 100.00(90.10) | 100.00(90.00) |
| Check | 68.92(56.13) | 70.58(57.23) | 3.00(9.55) | 0.00(0.00) |

Note:p.t.=Posttreatment; Figures inparenthesesareangular values

StatisticalParameters

|  |  |
| --- | --- |
| Parameter | Value |
| S.Em(±) | 1.93,3.91 |
| C.D.(P=0.05) | 5.79, ---- |
| C.D. (P=0.05)betweentreatment | 4.70 |
| C.D.(P=0.01) | 7.98,16.16 |
| C.D.(P=0.01) Period | 4.49 |
| Interactionbetweentreatmentand period | 13.48 |

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**Table-4Percentagereductionofmitepopulation*Acerialitchii*(Keifer)aftercombinedapplication ofAcaricides, insecticides, fungicide &algaecide (during 2024)**.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Treatment** | **Concentration**  **(%)** | **Mean pre- treatmentmite population** | **Percentage reduction** | | | **Percentage re-infestation / mite** |
| **(After 2 days)** | **(After 7 days)** | **(After14 days)** |
| T1WettableSulphur | 0.1 | 264.00 | 90.72  (72.37) | 88.25  (69.85) | 79.25  (62.93) | 3.88  (9.12) |
| T2 Sulphur followedby dicofol | 0.2+3.0 | 273.00 | 85.75  (67.83) | 76.50  (61.00) | 64.50  (53.43) | 8.09  (13.21) |
| T3Bordeaux Mixture | 1.0 | 284.00 | 85.50  (67.53) | 75.25  (60.17) | 62.00  (51.95) | 8.26  (15.29) |
| T4Bordeaux Mixture | 0.5 | 292.00 | 83.00  (65.68) | 70.00  (56.80) | 44.50  (41.84) | 22.92  (28.41) |
| T5Copper oxychloride | 0.5 | 294.00 | 82.50  (56.29) | 71.00  (57.43) | 40.62  (39.44) | 29.62  (32.98) |
| T6Control | - | 264.00 | 0.74  (4.36) | 0.70  (4.80) | 0.41  (3.74) | 38.08  (37.89) |
| S.E.Mean (±) |  |  | 0.62 | 0.40 | 0.70 | 4.90 |
| C.D.at5% |  |  | 1.84 | 1.19 | 2.08 | 15.09 |
| C.D.at1% |  |  | 1.52 | 1.63 | 2.85 | 21.15 |

\*Figuresinparenthesesindicatethedegreetransformedvalue.