Criteria -3 Research Innovation and Extension

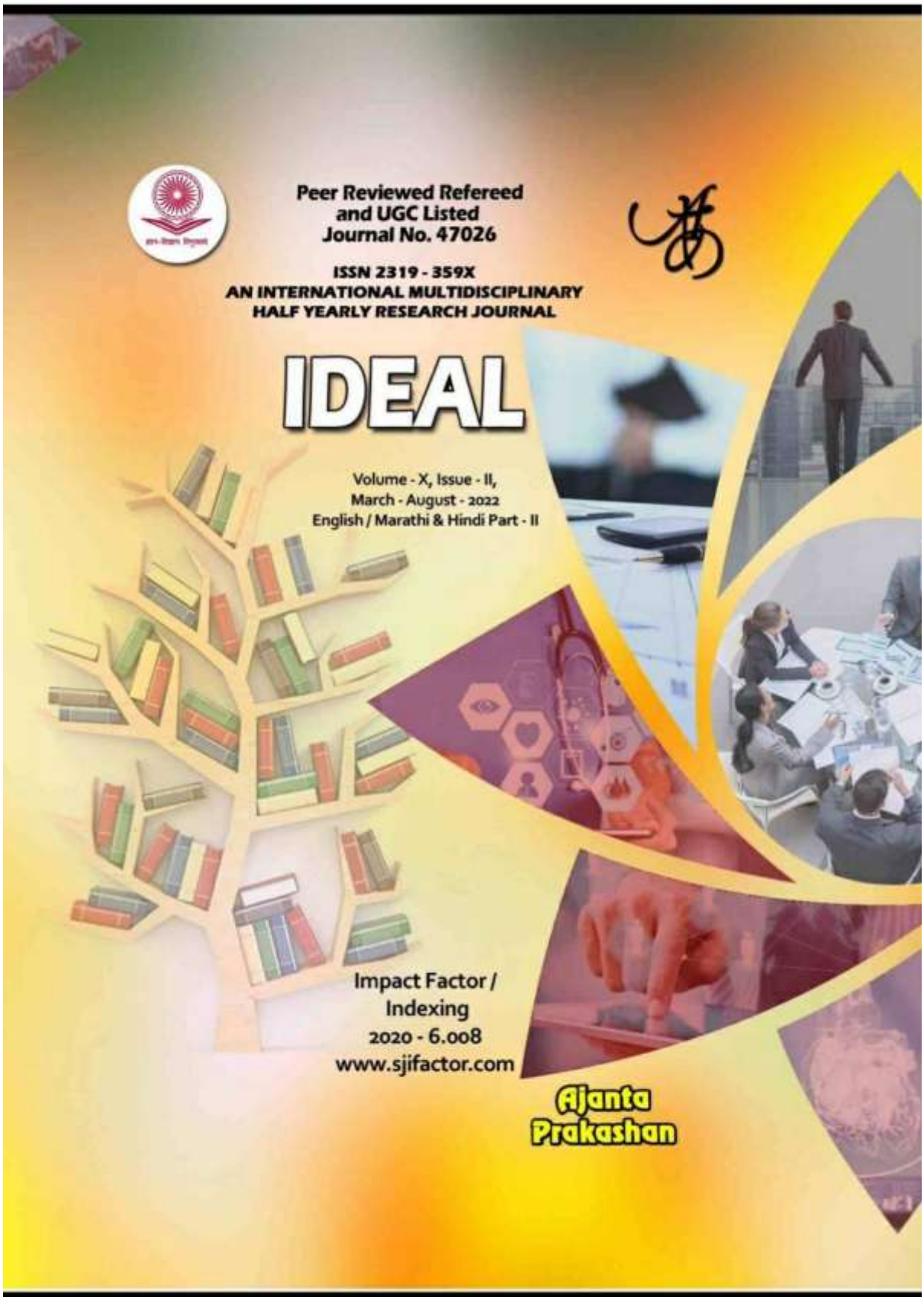
3.3 Research Publication and Awards

3.3.2 Number of research papers per teachers in the Journals notified on UGC website during the year

Research papers per teachers in the Journals notified on UGC website during the year

Title of paper	Name of the author/s	Department of the teacher	Name of journal	Year of publication	ISSN number	Link to the recognition in UGC enlistment of the Journal
Bhartiya Sangitamadhil Thumriche Vartamankalat Sthan ani Vikas	Mrs.Aruna C.Harley	Music	IDEAL	2022-23	ISSN 2319 – 359X	www.sjifactor.com
Role Of Home Economics In Collaborative Learning And Community Partnership	Dr. Pratibha Katkar	Home economics	Sanshodhak UGC CARE LISTED	2022-23	ISSN No. 2394-5990	https://ugccare.unipune.ac.in/Apps1/User/WebA/ ViewDetails?JournalId=101051359&flag=Search
EFFECT OF CYTHION ON BEHAVIOURAL PATTERN OF SOME AQUATIC ORGANISMS	Dr.Kalpana C.Kulkarni	Home Science	PARIPEX - INDIAN JOURNAL OF RESEARCH	2022-23	ISSN No. 2250 - 1991	https://www.worldwidejournals.com/paripex/

EFFECT OF ENDOSULFAN ON FREE AMINO ACIDS OF CRAB,FISH AND SNAIL	Dr.Kalpana C.Kulkarni	Home Science	INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH	2022-23	ISSN No. 2277 - 8179	https://www.worldwidejournals.com/international-journal-of-scientific-research-(IJSR)/


Peer Reviewed Refereed
and UGC Listed
Journal No. 47026
ISSN 2319 - 359X
AN INTERNATIONAL MULTIDISCIPLINARY
HALF YEARLY RESEARCH JOURNAL
IDEAL
Volume - X, Issue - II,
March - August - 2022
English / Marathi & Hindi Part - II
Impact Factor /
Indexing
2020 - 6.008
www.sjifactor.com
Ajanta
Prakashan

ISSN 2319 - 359X
AN INTERNATIONAL MULTIDISCIPLINARY
HALF YEARLY RESEARCH JOURNAL

IDEAL

Volume - X | Issue - II | March - August - 2022

English / Marathi & Hindi Part - II

Peer Reviewed Refereed
and UGC Listed Journal No. 47026

IMPACT FACTOR / INDEXING
2020 - 6.008
www.sjifactor.com

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❖ PUBLISHED BY ❖
Ajanta Prakashan
Aurangabad. (M.S.)

VOLUME - X, ISSUE - II - MARCH - AUGUST - 2022
IDEAL - ISSN - 2319 - 359X - IMPACT FACTOR - 6.008 (www.sjifactor.com)

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५. भारतीय संगीतामध्ये ठुमरीचे स्थान आणि वर्तमानात ठुमरीची स्थिती

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प्रस्तावना

संगीताचा मुख्य हेतू श्रोत्यांच्या मनाला रिझविणे हा आहे. संगीत श्रवणाच्या योगे श्रोत्यांच्या मनात विविध भावभावनांचा उद्भव होत असेल तर ते गायन वादन यशस्वी झाले असे म्हणता येईल. श्रोत्यांना काही काळ आपल्या कौटुंबिक विवंचनांचा विसर पडून त्यांचे मन गायनाशी एकरूप करून घेणे हेच खऱ्या कलावंताचे ध्येय असले पाहिजे. अभिजात शास्त्रीय संगीतातील ख्यालाच्या तुलनेने जरा हलक्या फुलक्या पण मैफिलीत एकदम रंगत आणणाऱ्या गायनशैलीची बात काही औरच असते नाही का? उपशास्त्रीय किंवा सेमी क्लासिकल संगीत म्हणून ओळखले जाणारे संगीतातील हे प्रकार म्हणजे ठुमरी, दादरा व तत्सम इतरप्रकार होत. अलीकडच्या काळात याप्रकारांना विशेष प्रतिष्ठा प्राप्त झाली आहे. गंभीर व भारदस्त अशा ख्याल-गायनानंतर बहुतेक गायक आपल्या मैफिलीची सांगता एखाद्या भावपूर्ण ठुमरीने किंवा दादऱ्याने करताना दिसतात. भक्ती भावनेने किंवा नर्म शृंगाराने नटलेल्या ठुमरीचे गायन गायकाप्रमाणेच श्रोत्यांनाही आनंददायक ठरते व त्या ललित्यपूर्ण स्वरविष्कारात श्रोते तल्लीन होऊन जातात.

ठुमरीची प्रारंभीक स्थिती

पूर्वी शास्त्रीय संगीताच्या मैफिलीत नजाकतदार ठुमरीला खास स्थान नव्हते उलट ती हलक्या प्रतीची समजली जात असे,केवळ घंटेवाईक गणीकांच्या कोठीवर ठुमरी गायली जात असे.भावनांच्या प्रकटीकरणासाठी योग्य मानल्या जाणाऱ्या ठुमरीच्या नावातच तिचे वैशिष्ट्य सामावलेले आहे. ठुमरी किंवा ठुंबरी म्हणजे जणू काही ठुमकत येणारी, आपल्या ललित्यपूर्ण पदन्यासाने रसिकांचे चित आकर्षून घेणारी घेणारी लावण्यवती नृत्यांगनाच अतिशय डौलदारपणे ठुमकत ठुमकत चालणाऱ्या त्या नृत्यांगनेचे किती मोहक दृश्य टिपावे। कत्थक नृत्यामध्ये तर कलाकाराच्या अभिनयाला ठुमरी गायनाची जोड असावीच लागते,त्याशिवाय नृत्याला उठावदारपणा येणार नाही. कत्थकसाठी बिंदादीन महाराजांच्या रचना अत्यंत लोकप्रिय आहेत. उत्तर भारतात ठुमरीगायन विशेष प्रचारात असून लखनऊ व बनारस ही शहरे ठुमरीसाठी प्रसिद्ध आहेत. मुस्लिम शासनकाळात म्हणजेच अठराव्या शतकापासून ठुमरी शैली प्रथमतः प्रचारात आली आणि नंतर ती सर्व भारतभर प्रसिद्ध झाली. सर्वप्रथम लखनऊच्या नवाबांनी ठुमरी गायनशैलीला भरपूर उत्तेजन दिले. लखनऊचा शेवटचा नवाब वाजिद अली शाह (१८२२-१८८७) याने ठुमरीला सर्व स्तरात लोकप्रिय करण्याचे महत्त्वाचे काम केले. नवाब वाजिद आली शाह हा स्वतः एक उत्तम गायक होता तसेच

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तसेच त्याने तर, 'अख्तरपिया' या टोपणनावाने अनेक ठुमरीच्या रचना रचल्या.अठराव्या शतकापासून बनारस हे ठिकाणही ठुमरी गायनाचे एक महत्त्वाचे केंद्र म्हणून ओळखले जाऊ लागले. त्याकाळी बनारस मधील कथ्थक नर्तक नृत्याबरोबरच ठुमरीगायनही करीत असत. प्रचलित लोकगीतांमधून विकसित झालेला ठुमरी गितप्रकार सुरुवातीला लोकगीतांना जवळच्या अशा केहरवा, दादरा इत्यादी तालामध्ये व काही मोजक्याच रागांमध्ये गायिला जात असे. ठुमरीचे प्राचीन नाव वेगळेच काही असण्याची शक्यता आहे जसे महाकवी कालिदास यांच्या 'मालविकाग्निमित्र 'नाटकातील एका वाक्यावरून असे दिसून येते की, "मालविक तत्र उपगानं कृत्वा यथा रसम् अभिनयति नृत्यतिच।" यावरून असे म्हणता येईल की,ठुमरीचे प्राचीन नाव 'उपगान' राहिले असेल. उपशास्त्रीय शब्दापासून ऊपगान शब्द जवळचा वाटतो. ठुमरीचे प्रारंभिक रूप लय आणि तालामध्ये निबद्ध भावपोषक स्वररचना असे होते. ठुमरीच्या प्रारंभिक स्वरूपाने ठुमरीला बंदिशीची ठुमरी, बोलबांटची ठुमरी आणि कथ्थकची ठुमरी अशा तीन प्रकारांमध्ये विभाजित केलेले दिसते.

ठुमरीच्या बाबतीत विद्वानांचे असे मत आहे की,भारतीय संगीतामध्ये ठुमरी गीतप्रकार शेकडो वर्षांपासून प्रचलित होता, असे असतानासुद्धा अठराव्या शतकामध्ये लखनऊचा नवाब वाजिद अली शाह यांच्या दरबारामध्ये ठुमरी गायकीला अत्याधिक लोकप्रियता मिळाली त्याचबरोबर तेव्हापासूनच ठुमरीचा विकास होण्यास सुरुवात झाली. तेव्हापर्यंत कथ्थकचे कलाकार अभिनयासह गाऊन ठुमरी सादर करीत असत.कथ्थकचे कलाकार,नृत्यांगना आणि देवदासी यांच्यापर्यंतच ठुमरी गायन सिमित होते.पुष्टीमार्गीय, हवेली संगीत आणि किर्तन संगीत यामध्ये ठुमरी शब्द दिसून येतो. ठुमरी हा एक शृंगार रस प्रधान काव्यप्रकार आहे. यातील स्वररचना मधुर असते त्याच बरोबर काव्यरचना सुलभ,सोपी,शृंगारिक व सहज मनोहर असते. धृपद गाण्यासाठी जोरकस आवाज, ख्याल गाण्यासाठी भरदार आवाजाची आवश्यकता असते पण ठुमरी गाण्यासाठी पातळ, लवचिक आणि मधुर असा आवाज जास्त उपयुक्त ठरतो.ख्यालगायनाप्रमाणे ठुमरी गायनाचीही वेगवेगळी घराणी आहेत.यांनाच शैली,ढंग किंवा बाज असेही म्हटले जाते.उदाहरणार्थ लखनवी ढंग, पूरब किंवा बनारसी ढंग,पंजाबी ढंग इत्यादी. अनेक गायक-गायिकांनी या वेगवेगळ्या शैली, ढंग विकसित करण्यात मोलाचा हातभार लावला आहे. लखनऊ दरबारात विकसित झालेली ठुमरी दिलखेचक आणि विलासी अदाकारीमुळे ठुमरीचा लखनऊ बाज काहीसा उतान,शृंगारिक व मनमोहक वाटतो.यात स्वर लावण्याची पद्धत नाजूक व तरल असून कणस्पर्श, मुरकी यांनी गायन नटविले जाते. भावनांच्या प्रगटीकरणाला अधिक वाव देणारी, नृत्याला अधिक जवळची,गझलगायकीशी अधिक साम्य दाखविणारी अशीही ठुमरीची लखनवी शैली प्रि
पिया,अख्तर पिया, बिंदादीन महाराज इत्यादी गायकांनी लखनऊ अंगाची ठुमरी गाऊन
विकसित केले. गौहरजान, जोहराबाई, मलकाजान यांच्यासारख्या अनेक गायिकांनी
वैभवशाली व विलासी रंग भरले. ठुमरीसम्राज्ञी असे ज्यांना सार्थपणे म्हटले जाते त्या बेगम अख्तर यांच्या

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गायनातही ठुमरीचा हा बाज दिसून येतो. पूरब किंवा बनारसी अंगाची ठुमरी गाणाऱ्या गायिकांमध्ये सिद्धेश्वरीदेवी, रसूलनबाई, गिरिजादेवी, सवितादेवीया प्रसिद्ध आहेत. स्पष्ट शब्दोच्चार, भारदस्त स्वरलगाव व व भावनांचे संयमपूर्वक प्रकटीकरण ही या शैलीची वैशिष्ट्ये आहेत.लखनऊ ठुमरीतील विलासी छाप बनारसी ठुमरी मध्ये दिसत नाही. याउलट बनारसी ठुमरीच्या श्रवणातून एक प्रकारचे धीरगंभीर व उदात्त वातावरण निर्माण होते. पंजाबी बाजाची ठुमरी पंजाब प्रांतातच वाढली आणि विकसित झाली.पंजाबी राहणीतील ऐसपैस, चैनदार, रसिला व रंगीला ढंग पंजाबी ठुमरीनेही आत्मसात केला. उस्ताद बडे गुलाम अली खाँ यांनी पंजाबी अंगाची ठुमरी गाण्याचा खास लौकिक मिळविला होता. त्यांच्या ठुमरीत विरह, कारुण्य, आर्तता, आर्जव या सर्व भावनांचे उत्तम दर्शन घडवते. उस्ताद बडे गुलाम अली खाँ यांचे पाकटे बंधू उस्ताद बरकत अली खान हे सुद्धा पंजाबी अंगाची ठुमरी समर्थपणे गात असत.

ठुमरीची आधुनिककाळात स्थिती

अभिजात ख्यालगायन करणाऱ्या गायकांनी ख्यालअंगाची ठुमरी किंवा ख्याली ठुमरी विकसित केली. किराणा घराण्याचे जेष्ठ गायक खाँसाहेब अब्दुल करीम खाँ यांची ख्याली ठुमरीबद्दल विशेष ख्याती होती. ख्याली ठुमरी गाणाऱ्यांमध्ये हिराबाई बडोदेकर, माणिक वर्मा, भीमसेन जोशी, प्रभा अत्रे, किशोरी आमोणकर, परवीन सुलताना इत्यादींचा निर्देश करता येतो. यासर्व ख्याल गायकांनी ठुमरी गायनाचे दालनही समृद्ध केले आहे. राजस्थानी अंगाची ठुमरी असाही एक ढंग हनुमान प्रसाद या गायकाने प्रचारात व प्रसिद्धीस आणला. चित्रपटाने तर ठुमरीचे मूळ स्वरूप जसेच्या तसे घेऊन किंवा कधीकधी त्यात किंचितसे परिवर्तन करून ठुमरीला आपलेसे केले आणि नाट्यसंगीतात ठुमरीच्याच बंदिशीला नाट्यसंगीताचा साज चढवून ठुमरीचा गौरव केलेला आहे. दादरा, कजरी, मिर्जापुरी कजरी, बनारसी कजरी, सावनी, झुला, होरी, पक्कीहोरी, कच्चीहोरी, चैती, भोजपुरीचैती, घाटोचैती, निर्गुणचैती, साधारणचैती, झलकुटिया, खंजरीया चैती हे सर्व गीतप्रकार लोकसंगीतातून निर्मित आहेत. मात्र या सर्व गीतप्रकारांच्या गायकीचा अंदाज ठुमरीचाच असल्याने लयीच्या चापल्यामुळे त्यांचे वेगळेपण खुलून दिसते. सर्वांच्या मनाची पकड घेणारी ठुमरी आणि तिचे वरील सर्व गीतप्रकार श्रेष्ठच समजायला हवेत. आज-काल कोणत्याही घराण्याचा कलाकार आपल्या मैफिलीत उपशास्त्रीय संगीतातील प्रकारांना प्रस्तुत केल्याशिवाय आपल्या मैफिलीची

सांगता करीतच नाही. हल्लीच्या ख्याल गायकीवर ठुमरी अंगाचा, ठुमरी गीत शैलीचा खूपच प्रभाव पडल्याचे दिसते. ठुमरी गाताना पदाच्या मधे-मधे दोह्यांचा प्रयोग केला जातो. विदुषी सवितादेवी या बनारसशैलीच्या गायिका असल्याने काव्याच्या आंतरिक सौंदर्याकडे ओढा जास्त प्रमाणात असल्याचे दिसते. बनारसशैलीत ठुमरी गाताना बोल बनाव करतेवेळी बोल कहन आणि पुकार ढंगाने केल्या जातात. बनारस शैलीचे ठुमरी गायन ख्याल गायनाच्या अंगाने केले जाते. लखनऊ शैलीतील ठुमरीत उर्दूचा प्रभाव दिसून येतो, कारण उर्दू भाषेतील पोषक शेर त्यात गुंफलेले दिसतात. ठुमरीमध्ये सरगमचा प्रयोग सुद्धा आज-काल

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दिसून येतो. हल्ली गायनाच्या बरोबरीने ठुमरीची लोकप्रियता दिवसेंदिवस आधिक वाढलेली दिसते. ज्यामध्ये सर्व कलाकार म्हणजेच गायक, वादक, नर्तक, आपल्या कार्यक्रमाच्या प्रस्तुतीकरणात मुख्यत्वे ठुमरीला आनंद देऊन सादर करतात.

सुर से बात पैदा करना, बोल से बात पैदा करना, बात से बात पैदा करना, या तीन ठुमरीच्या कसोट्या आहेत आणि याला दृष्टीसमोर ठेवूनच ठुमरीचे गायन मनमोहक पद्धतीने रसिकांच्या मनात उतरविले जाते. छोट्याख्यालाच्या बंदिशी यासुद्धा ठुमरी अंगाने गायिल्या जातात, त्याच बरोबर शिकविल्या जातात.ठुमरीचा प्रचार बनारस, लखनऊ, पंजाब, राजस्थान इत्यादी ठिकाणी झालेला तर आहेच परंतु महाराष्ट्रामध्ये सुद्धा मेनकाबाई शिरोडकर, केसरबाई केरकर, सुंदराबाई, निर्मला देवी, इ. गायिकांनी ठुमरी गायन समृद्ध केले. त्याचबरोबर आधुनिक काळातील रसिकांना, विद्यार्थ्यांना ठुमरी, दादरा इत्यादी उपशास्त्रीय गीतप्रकार समर्थपणे गाणाऱ्या गायिकामध्ये शोभा गुर्टू, सवितादेवी, शोभामुद्गल, आरती अंकलिकर, कौशिकी चक्रवर्ती इत्यादी नावे चांगलीच परिचित आहेत. या गायिकांच्या ठुमरीत खानदानी तोरा दिसून येतो. अवधी, ब्रज, भोजपुरी, उर्दू याभाषेच्या शब्दातून शृंगाररसाबरोबरच भक्ति,करुण रसाचा समावेश दिसतो. बिहारी, पहाडी, गारा, मांड, बरवा, झिंझोटी, काफी, खमाज, तिलंग, तिलककामोद, भैरवी ठुमरीसाठी नियोजिलेल्या रागांशिवाय परज, यमन, सोहनी, कालिंगडा, बिहाग, मारवा यासारख्या ख्याल गायकीच्या रागांमध्येसुद्धा ठुमरी प्रस्तुत केली जाते.

आधुनिक काळामध्ये कलावंत कुठल्याही एका विशिष्ट शैलीची बांधीलकी दूर करून रुचेल ती शैली घेऊन नियम सांभाळून सुचलेले, भावलेले, रुचलेले वैशिष्ट्यपूर्ण भाग घेऊन आपल्या ठुमरीमध्ये कलात्मकता व नाविन्यता आणून परिणामकारक रीतीने ठुमरीचे सादरीकरण करतात. गायनाचे ठुमरी गायन सुरू असताना पदातील सर्व ओळी विषयानुकुल भावाभिव्यक्तिसह प्रस्तुत करीत असतांना त्यानंतर मूळ तालाला सोडून केहरवा तालात तबलावादक लग्गी लावतो, लयीच्या बरोबरीने वेगवेगळ्या हरकतींसह बोलबनाव केला जातो.संथ लयीत ठुमरी गायल्यानंतर लग्गी लावणे महत्वाचे ठरते.जलदगतीत शब्द स्वरांना विविधतेने चपखलपणे गुंफून ठुमरी गायनातील परमोच्च बिंदू साधण्याचा प्रयत्न लग्गीद्वारा होऊ लागलेला आहे आणि ठुमरीत लग्गी हे एक प्रधान अंग ठरलेले आहे, अशा पद्धतीने कलात्मकरीत्या ठुमरी सादर केली जाते. ठुमरीचा प्रभाव नाट्यगीतावर सुद्धा पडल्याशिवाय राहिलेला नाही कळत नकळत संगीत नाटकातील पदांवर ठुमरी, दादरा यांचा रंग चढलेला दिसून येते. नाट्यपदातील प्रत्येक ओळ ठुमरीप्रमाणेच रसात्मकतेने,भावपूर्ण आणि विविध अंगांनी फुलवणे हेच नाट्यपदांचे मर्म ठरले. नाट्यसंगीतात 'सुर से बात' आणि 'बोल से बात' या तत्वांचा सुंदर मेळ साधलेला दिसतो आणि त्यामुळे नाट्यसंगीत हे अधिकाधिक ठुमरीच्या जवळचे आहे असे दिसून येते. अजूनही गायक कलाकारांना आपली मैफल रंगविण्यासाठी पूरब अंग मिश्रित गंधर्व गायकीच्या नाट्यपदांचा समावेश करण्याचा मोह आवरत नाही जोकी रसिकांनाही प्रिय आहे.

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चित्रपटाच्या आरंभीच्या काळापासून तर आजतागायत चित्रपट निर्मात्यांवर आणि संगीत दिग्दर्शकांवर रागदारी संगीताचा त्याचबरोबर ठुमरी, दादरा यासारख्या उपशास्त्रीय संगीताचा जबरदस्त प्रभाव पडलेला दिसून येतो. हिंदी बोलपटात तर ठुमरीचा वापर होतोच त्याचबरोबर मराठी आणि इतरही भाषिक चलचित्रात,चित्रपटातसुद्धा ठुमरीचा समावेश झालेला दिसतो यावरून ठुमरीने आपले विशेष असे स्थान प्राप्त केलेले आहे असे लक्षात येते. ज्याप्रमाणे नाट्यगीतात,चित्रपटगीतात ठुमरी सहजरित्या एकरुप झाली तशीच कीर्तनात सुद्धा ती रममाण झाली असे दिसते. हार्मोनियम, सतार, सरोद, शहनाई, बासरी, व्हायलीन, संतूर, गिटार या वाद्यांवर स्वतंत्र वादन शैलीमध्ये ठुमरीचेही घून स्वरूपात सादरीकरण होताना आपण बघतोच. असामान्य अशा वादन शैलीने ठुमरी घून जनमनात रुजविण्याचे श्रेय प्रतिष्ठीत नामवंत वादकांना द्यावे लागेल.

सारांश

ठुमरी ही फक्त गायक कलाकारांच्या कलेचा आविष्कार राहिलेली नसून नृत्य,नाट्यसंगीत, चित्रपटसंगीत, किर्तन, वादन यासर्व कलाविष्कारांवर ठुमरीने आपले वर्चस्व कायम केलेले आहे. नृत्यातील चापल्य व लालित्य यांचा आविष्कार घडविणारी ठुमरी अलीकडच्याकाळात शास्त्रीय संगीताच्या मैफिलीतील एक अविभाज्य अंगच झाली आहे. ठुमरीची स्थिती बदलू लागली आहे आणि आज शास्त्रीय संगीताच्या मैफिलीत ठुमरीला मानाचे स्थान मिळाले आहे हाच काय तो काळाचा महिमा ! वर्तमान काळामध्ये ठुमरीला ख्यालाच्या बरोबरीने स्थान मिळालेले दिसून येते, याचे पूर्ण श्रेय आजतागायत ज्यांनी ठुमरी गीतशैलीला,ठुमरीच्या गायकीला प्राधान्यक्रम देऊन प्रचार-प्रसार आपल्या कलेच्या माध्यमातून केला त्या सर्वच कलाकारांना देणे क्रमप्राप्त ठरते.

संदर्भग्रंथ सूची

१. ठुमरी की उत्पति,विकास और शैलियाँ,डॉ.शत्रुघ्न शुक्ल,प्रथम संस्करण-१९८३, हिंदी माध्यम कार्यान्वय निदेशालय,दिल्ली विश्वविद्यालय
२. ठुमरी एक गान विधा, डॉ. चित्रा मोडक,प्रथम आवृत्ती-२००९, प्रकाशक:विजय प्रकाशन, हनुमान गल्ली, सिताबर्डी, नागपूर.
३. ठुमरी परिचय, आमुख, लीला कारवाल,द्वितीय आवृत्ती-१९९५, प्रकाशक:संगीत सदन प्रकाशन, साठय मलाका, इलाहाबाद.
४. नादचिंतन, पं. वि.रा. आठवले, प्रथम आवृत्ती-२००८, प्रकाशक:संस्कार प्रकाशन, अभ्युदय नगर, काळाचौकी, मुंबई.
५. रागदारी संगीतातील सौंदर्यस्थळे, रचना भडकमकर,प्रथमावृत्ती २००४, प्रकाशक: प्रतिमा प्रकाशन, सदाशिव पेठ, पुणे.

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श्री. संजय मुंदडा

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दूरध्वनी (०२५६२) २३३८४८, ९४०४५७७०२०

कार्यालयीन वेळ

सकाळी ९.३० ते १.००, सायंकाळी ४.३० ते ८.०० (रविवारी सुट्टी)

मूल्य रु. १००/-

वार्षिक वर्गणी रु. ५००/-, आजीव वर्गणी रु. ५०००/- (१४ वर्षे)

विशेष सूचना : संशोधक त्रैमासिकाची वर्गणी चेक/ड्राफ्टने 'संशोधक त्रैमासिक राजवाडे मंडळ, धुळे' या नावाने पाठवावी.

अक्षरजुळणी : सौ. सीमा शिंत्रे, वारजे-माळवाडी, पुणे ५८.

महाराष्ट्र राज्य साहित्य आणि संस्कृती मंडळाने या नियतकालिकेच्या प्रकाशनार्थ अनुदान दिले आहे. या नियतकालिकेतील लेखकांच्या विचारांशी मंडळ व शासन सहमत असेलच असे नाही.

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संशोधक
ISSN No. 2394-5990

ROLE OF HOME ECONOMICS IN COLLABORATIVE LEARNING AND COMMUNITY PARTNERSHIP

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Abstract :

Home economics as an educational situation has comparable well known aims. The International Federation for Home Economics (IFHE) states that domestic economics as a curriculum area "allows college students to find out and similarly broaden their very own sources and skills for use of their private life, via way of means of directing their expert selections and moves or getting ready them for life" (IFHE Position Statement - Home Economics with inside the twenty first Century, 2008). The all-encompassing expression "getting ready for life" recollects the query of what know-how and competencies are wanted with inside the twenty first century. This paper reviews a year longitudinal take a look at of the results of cooperative studying on technology attainment, attitudes closer to technology and social connectedness in the course of transition from number one to excessive college. The implications enhancing the effectiveness of college transition via way of means of the use of cooperative studying projects are explored. Possibilities for destiny studies and the results for exercise and coverage are discussed.

Key words - Home- economics, collaborative learning, community partnership.

Introduction :

Home economics strongly integrates the theoretical content material found out at college into realistic know-how implemented at domestic (Beinert et al., 2021) and to different college topics, as an instance mathematics (Granberg et al., 2017). The studying duties in domestic economics instructions are instead particular, given that they may be rooted to student's ordinary stories and frequently encompass realistic studying activities (together with meals preparation). Therefore, the cognitive demanding situations that scholars revel in in domestic economics instructions are just like the ones in ordinary situations (Palojoki, 2003), wherein the decision-making technique is strongly stimulated via way of means of social and cultural context (Lave, 1988). It is probably that the trouble embedded with inside the studying challenge is ill-structured (e.g., put together a meal); it may additionally alternate in the course of the trouble-fixing technique (e.g., availability of substances or flavor preferences) or it may be deserted within side the mild of latest records or stories (e.g., nutritional restrictions). An extra venture with inside the context of the given instance is that on the stop of the lesson college students collectively devour the meal they've prepared. As Rendahl (2018) illustrates, this could be a game-changer. Planning a meal and thinking

about numerous components is one thing; understanding that you may additionally devour it as soon as it is prepared is even greater challenging. These sort of safe to eat studying assignments make domestic economics particular in contrast to different college topics and lift questions which can be nonetheless unknown. Our preceding observations of institution paintings assignments from domestic economics instructions have led us to trust that troubles in domestic economics instructions are solved via numerous steps (in addition as in ordinary situations), called the gap-ultimate technique (Lave, 1988). Students revel in numerous cognitive demanding situations and important moments even as operating with the cognitive or realistic assignment, and thereby they want to talk about and suppose collectively so one can get in the direction of the answer of a challenge. Group work and cooperative studying in technology training are already included into the pedagogical practices in lots of countries (Howe et al, 2007).

Group work in technology frequently bureaucracy a part of practitioner guides (e.g. Harlen & Qualter, 2004; Sharp, Peacock, Johnsey, Simon & Smith, 2007; Topping & Thurston, 2005). Within Scotland group work has reached the extent of country wide coverage within side the new 'Curriculum for Excellence' technology consequences which mainly discover the want for institution dialogue in powerful studying (Scottish Government, 2008). The effectiveness of group work and cooperative studying techniques in technology had been broadly suggested over some of years. Basili and Sanford (1991) suggested that during a pattern of sixty two college students reading in a network college, use of cooperative group work in chemistry ended in college students retaining fewer misconceptions than the ones taught via way of means of direct tuition. Howe et al (2007) suggested that during a pattern of number one college scholars drawn from 24 instructions that group work, and the dialogue it facilitated, performed a important function in improving the studying of scholars in technology subjects in rural and concrete settings with inside the UK. However, there may be a lack of literature concerning the durability of such profits, and no preceding literature that appears at whether or not such profits live on transition after a alternate of college.

Cooperative learning :

The Group Work Transition (GWT) assignment constructed on and prolonged on a preceding studies assignment subsidized beneath Neath the Economic and Social Research Council (ESRC) Teaching and Learning Research Project (TLRP). It become designed as a longitudinal follow-as much as the Scottish extension assignment: "Supporting Group Work in Scottish Schools: Age and Urban/Rural Divide" (SCOTSPRING). The unique assignment observed proof of profits in technology attainment and social connectedness due to the intervention. Therefore, the assignment explored the results of transitions (shifting from one college context to another) and transfers (the cap potential of scholars to apply preceding studying, attitudes and competencies with inside the new instructional context) because the unique take a look at institution moved college in city and rural geographical locations. Both transition and switch are suggested as being important affects on a child's improvement and schooling.

Transition between schools :

It has lengthy been acknowledged that motion from simple/number one to center/excessive faculty can bring about reduced educational attainment and motivation after transition (e.g. Finger & Silverman, 1966). In a pattern of 933 scholars, reduced attainment ratings and reduced tiers of motivation had been discovered at transitions from simple to center and center to school in a pattern drawn from Ogden Utah City School District, , USA (Barber & Olsen, 2004).

ISSN No. 2394-5990

Significant declines in technology attainment ratings had been obtrusive after transition for a pattern of 225 twelve-12 months-antique college students drawn from an city faculty in Chicago, Illinois, USA (Petersen & Crockett, 1985). The falls in educational overall performance had been associated with reduced self-idea as a learner, reduced self idea in man or woman topics and a mismatch among the improvement desires of younger kids on the give up of simple faculty and the surroundings of the center faculty (Mullins & Irvin, 2000).

At a time whilst friendships and the peer institution are getting more and more crucial with inside the improvement of the adolescent, the transition among faculties regularly serves to disrupt, regulate or sever them (Mizelle & Irvin, 2000). Barber and Olsen (2004) said extended loneliness and melancholy and reduced projects with friends after transition to center faculty for a pattern of 933 twelve-12 months-antique scholars. Similar findings had been said in a 12 months longitudinal observe of 143 ten-eleven-12 months-antique scholars from a faculty district with an related populace of 100,000 human beings in Midwestern USA (Hirsch & DuBois, 1992). Peer help previous to transition turned into inversely correlated to extended mental symptomatology at some point of the duration of faculty transition from simple to junior excessive (despite the fact that consequences lessened through the years).

Transfer or generalization of studying can arise through the years and space. Transfer may be implicit or explicit. This latter difference has been termed 'low road' (relying on vast and sundry exercise of a ability in order that it's far automatic) and 'excessive road' (depending on the learner's deliberate "aware abstraction" and next utility of well-known principles) switch (Perkins & Salomon, 1987). The latter is corresponding to what many term 'meta-cognition' - know-how approximately one's very own cognition and the law of that cognition (Simons, 1994). Meta-cognition consists of reflection, self-know-how of strengths and weaknesses, studying techniques and tracking studying. Opinions are divided on problems of switch of studying. In the sector of grownup studying, strict adherents of theories of "located studying" (Lave & Wenger, 1991; Resnick & Collins, 1994) contend that abilities are pretty use-precise and are obtained and located in positive contexts. A greater slight view is that there are precise necessities for switch to arise - the shape of the interest required within side the scenario that's the goal for switch have to be much like that with inside the authentic scenario. Much training virtually proceeds on the belief of switch (e.g. one problem into another, three hundred and sixty five days into another, or transition among faculties).

Conclusion :

This studies shows that the use of co-operative studying techniques in technology might also additionally permit switch of know-how and abilities obtained to new contexts. We have supplied bridges among domestic economics training and all 4 competences (communication, collaboration, crucial wondering and creativity) which can be named within side the Partnership for 21st-century studying (2007). This observe is the primary within side the context of domestic economics training wherein it's been established that inter thinking is mainly beneficial within side the gap-final technique because it enlarges novices capacity in undertaking overall performance, as an example via way of means of supplying them greater know-how to govern whilst locating a appropriate option to the problems.

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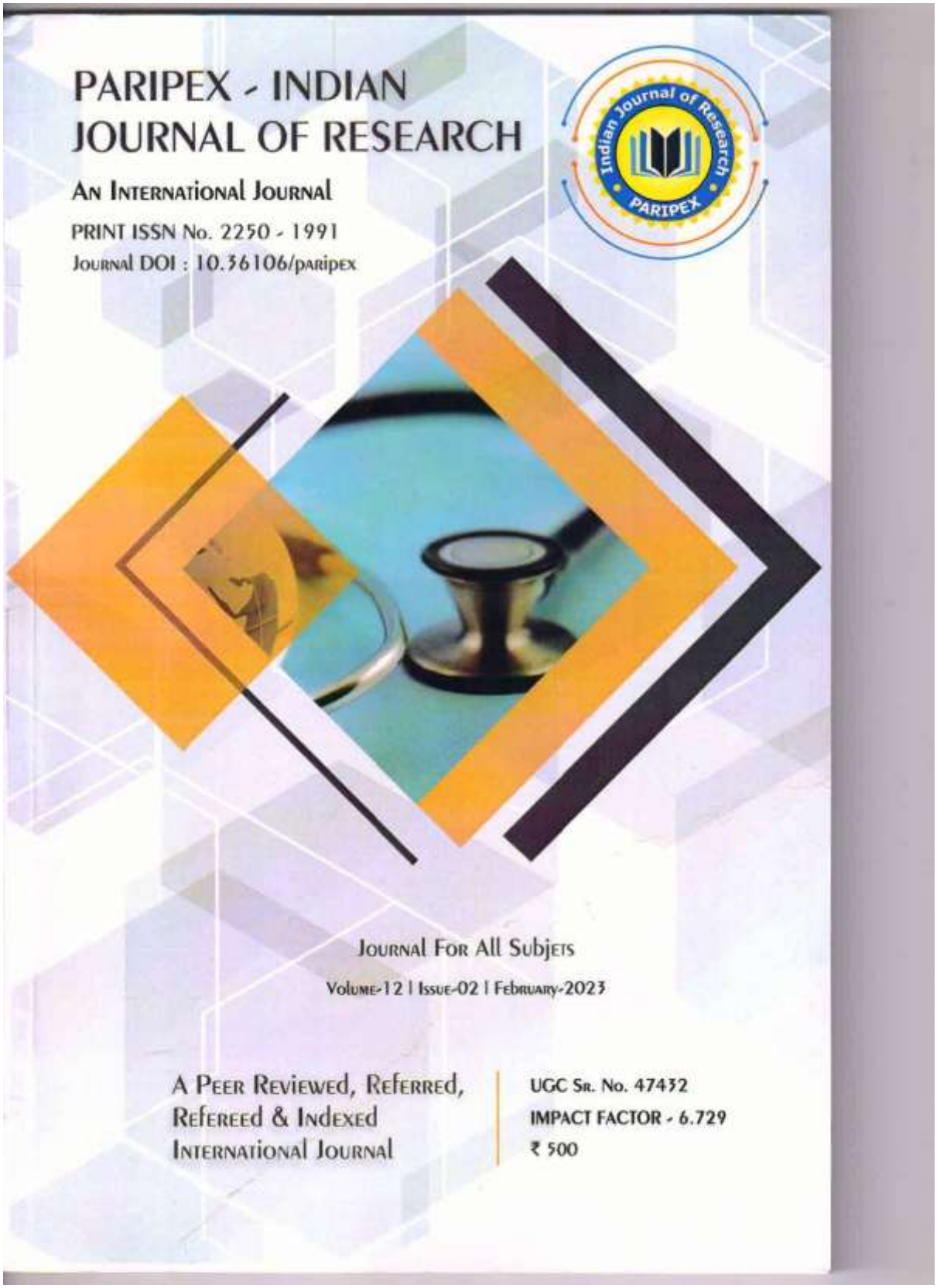
PARIPEX - INDIAN JOURNAL OF RESEARCH
AN INTERNATIONAL JOURNAL
PRINT ISSN No. 2250 - 1991
JOURNAL DOI : 10.36106/paripex
Indian Journal of Research
PARIPEX
JOURNAL FOR ALL SUBJETS
VOLUME-12 | ISSUE-02 | FEBRUARY-2023
A PEER REVIEWED, REFERRED, REFEREED & INDEXED INTERNATIONAL JOURNAL
UGC SR. No. 47432
IMPACT FACTOR - 6.729
₹ 500

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PARIPEX - INDIAN JOURNAL OF RESEARCH | Volume - 12 | Issue - 02 |February - 2023 | PRINT ISSN No. 2250 - 1991 | DOI : 10.36106/paripex

ORIGINAL RESEARCH PAPER

Zoology

EFFECT OF CYTHION ON BEHAVIOURAL PATTERN OF SOME AQUATIC ORGANISMS

KEY WORDS: Organophosphate, Toxicity, Lethal, Behavioural change

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ABSTRACT

Different types of pesticides like organophosphate,organochlorine are known to produce several behavioural changes in aquatic organisms. Exposure to pesticide is known to affect both the central and peripheral nervous system.Pollution stresses on behavioral pattern includes a wide range of effects an predator avoidance, migratory behaviour, learning ability habitat selection, feeding behaviour, changed movements and attitude loss of sensation .Study showed that the crab, fish and snail were more sensitive to cythion .The 24 h LC50 values obtained were the highest in all cases followed by 48, 72 and lowest for 96 h among all exposure periods. It showed that the toxicity of pesticide is directly proportional to exposure time. The LC50 values decreased as the exposure period increased and mortality rate increased with increasing concentrations.These toxicity studies are important because of their economic importance and vital position in the food chain and food web of the aquatic ecosystem.

INTRODUCTION

Exposure of large quantities of pollutants might be an immediate effect as measured by mortality suddenly in larges scale aquaculture, for example, fish mortality caused by pollution of waterways with agricultural insecticides. A small quantity of pollution discharge may result in the accumulation of pollutants in fish species and also by aquatic organisms. Furthermore pesticides carried through food chains are very harmful to the aquatic animals and a potential danger to man when he consumes. herbicides can also trim down the reproductive success of fish species and other aquatic flora and fauna [1],[2],[3] The inhibitory effect was observed in Lepomis macrochirus, Labeo rohita, Danio rerio, *and* Jenynsia multidentata exposed to endosulfan [4] .Entry of these pesticides into water bodies through industrial effluents, run off of direct applications affects many aquatic organisms [5],[6] Pesticides not only affect the farmer health but can also affect on consumer's health through residues of pesticide present in the food [7].

The pest controllers and weed-killers are moderately to highly toxic to aquatic invertebrates such as crab, shellfish and fish species[8] .The aquatic environment has become a store house for chemical pollutants which Infiltrate in to aquatic environment by several ways .Behavioural pattern includes a wide range of effects an predator avoidance, migratory behaviour, learning ability habitat selection, feeding behaviour, changed movements and attitude loss of sensation and other behavioural responses may easily be up set, if altered by environmental stresses associated with pollution.

The crab P. jacquemontii, fish C. orientalis, B. bengalensis are exposed to lethal and sublethal concentrations of organophosphate cythion at 24, 48, 72 and 96 h treatment period and are observed for the behavioural changes. Pollutant affects behaviour of organisms.

The behaviour of animal has been correlated to the metabolic changes in different crustaceans, [9],[10].

The toxic effects begins with the change of behaviour followed by the death of organisms. Physiological and behavioural effects of sublethal exposures to pesticides has been closely studied.Experimental animals when exposed to lethal concentrations of organophosphate cythion resulted in severe behavioural lesions and at last resulted in death. Excitability, irritability and restless movements were the prominent features of cythion exposed animals. In sub lethal exposures the behavioural changes were same but with lesser intensity. The high excitability shown by vigorous movements, cleaning movements. Loss of equilibrium and co-ordination was observed.

MATERIAL AND METHODS

The species which has been selected for the present study are of economic value and readily available through out the year and it stands captivity well.

The species represents the natural population i the river or water bodies of the Amravati (Lattitude 20- N,Longitude 77-45 E) and are resistant to handling a transportation.

Procurement And Maintenance

ALL the animals used were of same size and weight. Crab of size 6.5x5.3 and weight 55-65 g; Fishes of size 13-15 cm and weight 20-32 g and Snails of size 3-5 cm with weight 5-6 g.The animals were purchased from the market as well as collected at spot. The animals were brought in to the laboratory, transferred to the glass aquarium and were inspected for any possible injury or infection Only the healthy animals were selected and washed with dilute solution of potassium permangnate ($KMnO_4$, 1.0 mg/1) t remove dermal infection if any.

The animals were acclimatized for 10 days according to APHA/AWWA/WPCE (1975) standard methods [11]. The mortality was less than 5 per cent within 4 days of preceding test. The Test animals were fed adlibitum diet of boiled eggs,dried prawn, fish food and goat liver. Excess food ant faecal matter were removed from aquaria once in a day or twice at least in a week .The renewal technique bioassay method (Committee on methods for toxicity test with aquatic organisms, 1975) was used. It is an Improved static test in the sense that an attempt was made to maintain the water quality. The test solutions were periodically (usually once every 24 h) replaced with fresh test solution of the same composition. This was achieved by transferring the test organisms from one test chamber to another or some time by replacing the test solution in the same chamber periodically. The animals were starved for 24 hours before using for experimentation: The quality of water used in terms of physical and chemical characters is given in **Table 1.1** For toxicity evaluation organophosphate cythion pesticides was selected. Dilution medium was well water.

Procedure For Toxicity Evaluation Experiment The toxicity evaluation of cythion to the crab, fish and snail was conducted in static aquatic medium as per the method of Doudoroff et al, (1955)[12].

Exploratory Tests

i Different concentrations of cythion (organophosphate) were prepared from stock solutions.

ii The crab, fish and snail in batches of 10 were taken in six plastic troughs. The five troughs as experimental and the

PARIPEX - INDIAN JOURNAL OF RESEARCH | Volume - 12 | Issue - 02 |February - 2023 | PRINT ISSN No. 2250 - 1991 | DOI : 10.36106/paripex

sixth one as a control.

iii. The crabs, fishes and snails in the 6 troughs were exposed to the above selected pesticide concentration for 48 hours.

iv. The animals were exposed to pesticide at 8 O'clock in the morning to avoid chronotoxicological alterations in the toxicity evaluation as per the method of Utham et al, (1979).[13]

v. After 48 hours of exposure, the number animals killed in each concentration were recorded.

vi. To reach precise value in each concentration, the experiment was repeated and concurrent values obtained.

vii. To determine the precise dosage level of LC_{50} value, the probit method was followed (Finney, 1964) [14].

Table 1.1 Means and ranges of various physio chemical characteristics of dilution water.

Characteristics*	Mean	Range
Temperature (%)	28.3 _ +2.3	25.30-30.50
pH	7.30	6-80-7,50
Total solids	13.60	12.50-18.25
Dissolved solid	4.38	3.23.5.80
Suspended solids	9.45	9.23-11.20
Alkalinity as CO3	55.00	37.00-88.00
Alkalinity as OH7	5.22	3.50 8.22
Dissolved oxygen (D.O.)	4.42	3.56- 6 80
Biochemical oxygen demand	1.70	0.83 3.53
Phosphate as C	0.82	0.22 1.61

*Values except pH and temperature have been expressed in mg/1.

Cythion was found to be a toxic pesticide. The LC_{50} values (lethal concentration) at which 50 percent mortality occurred in test animals were calculated by Finny et. al; (1981) method,

Paratelphusa Jacquemontii

The values of probit analysis of LC_{50} for Cythion were 3.981 at 24 h, 3.467 at 48 h, 3,888 at 72 h and 3.235 at 96 h (Table 1.9.).

Channa Orientalis

LC_{50} values were 1.941, 1.819, 1 737 and 1.513 at 24, 48, 72 and 96 hours respectively (Table 1.9)

Bellamya Bengalensis

Respective values of LC_{50} at 24, 48 72 and 96 h. were 0.930,0.870.0.800,0.790 **(Table 1.4)**

Probit analysis LC50 values for the crab P. Jacquemontii fish C. orientalis and snail B.begalensis F.typica exposed to Cythion at different time intervals (ml/1).

Treatment periodh	Paratelphusa Jacquemonti	Channa orientalis	Bellamya bengalens
24	3.981	1.949	0.930
48	3.467	1.819	0.870
72	3.888	1.737	0.800
96	3.235	1.513	0.790

OBSERVATION

The freshwater crab P. jacquemontii is an important common member of freshwater ecosystem, The maladaptive behaviour of this crab following exposure to pollutants would increase in it's predation which might enhance the changes of bio accumulation in the food chain.

Paratelphusa Jacquemontii

The crab P. jacquemontii a fresh water crab showed little different organophosphate. behaviour when exposed to organophosphate.The crabs showed no notable response, normally calm and quite. Little movements of mouth parts and chlae in normal position, preferred to sit at bottom. Locomotion unaffected. After 48 hour became sluggish, and sat at one place. If touch by rod reacted quickly in attacking way. Loss of balance was prominent and crab did not turn or ventral side immediately after keeping on glass.

In sublethal concentration crab were, calm and quite indifferent for short and long span exposure. No observable changes in mouth parts and chelae during experimental period were observed with slowed movements. Crabs preferred to remain at one place and became sluggished or rather slow in action if touched by rod. Non-responsive to predatory action.

Channa Orientalis

Fish is very sensitive indicator to pollutants The behavioural responses of the fish C. orientalis varied in accordance to the test concentrations.Decreased opercular movement during early exposure period was noticed. It showed excitability, restless movements and Irritability, but the intensity was less than the organo chlorine insecticide. Increased erratic movement,. Jerky body and opercular movements, There was balance impairment in exposed fishes, Overall fish movements were slowed down as compared to the fish introduced in higher pesticide, Mucus secretion was found directly proportional to the concentration of pesticide, Secretion Increases with increase in pesticide concentration

Bellanya Bengalensis F.Typica

In toxicological experiments carriedout on B. bengalensis F. typica; disturbed behaviour prior to death was observed, After cythion exposure body retracted within shell and operculum was closed. The operculum was opened slowly with little foot protruded. Adherence to substratum (Wall of bowl) with partially protruded proboscis, epipodial lobe and tentacles was recorded.

The body remain outside and snails did not respond to stimulus, foot margin and other parts were seen swollen. The snail appeared to edematous with their swollen body outside the shell and flattened foot. Large secretion of mucus was noticed in early hours of treatment but the quantity of mucus secretion decreased with exposure period

RESULT AND DISCUSSION

Now a days due to tremendous development in chemicals for crop production and pest control, the problem of aquatic pollution is increased. The pollutants used in agriculture and industry dump in aquatic medium, ultimately affects the organisms of aquatic medium.

Singh and Srivastava (1982) [15] worked out the toxic concentrations of various insecticides on air breathing fish, Heteropneuses fossilis. Results exhibited the LC $_{50}$ concentrations for malathion 9.9-7.0 mg/1, aldrin 0.242-0.175 mg/1 and mixture of aldrin and for malthion 0.198-0.142 mg/1 to this fish.

Abidi. (1983)[16] recorded the relative toxicity of 8 popular insecticides to carp fingerlings and found organochlorine more toxic than other types. Sharma et al., (1983)[17] observed the effect of malathion on the mortality of Clarias batrachus at 0.25, 0.5, 0.75, 1.0, 1.25, 1.5, 1.75 and 2.00 ppm. Singh and Sahai, (1984a) tested the malathion toxicity on two freshwater species. Rasbora daniconius (6 ppm) and Puntius ficto (4 ppm).

Ruperelia et al (1984)[18] recorded LC50 of thiodon for Cyprinus carpio as 0.00092 mg/1 of chlorodane to be 0.0029 mg/1 and 0.0031 g/1 of aldrin and the value of dieldrin was 0.60 mg/1. di-eldrin was 0.60 mg/1. Rao et al (1981) [19] reported 96 h LC_{50} values as 3.5 0.2 ppb.

In Oxiotelphusa senex senex 3 mg/1 BHC was found to be the LC_{50} 24 h while in case of P. Jacquemontii LC_{50} was found to be 84.1 mg/1 [20].. Rao (1984)[21] suggested that the marine edible crab, Scylla serrata were most sensitive to DDT, less sensitive to malathion and least sensitive to sevimol.

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Molluscs have received less attention of researchers to carryout toxicity studies, using different pollutants even in India, several references may mentioned that deal with the study of cytochemistry, biochemical composition, physiology, ecology, growth and reproduction of molluscs by[22],[23],[24],[25],[26].

The organophosphate (cythion) exposed animals showed prominent loss of balance in all organisms with erratic movements and irritability. Mucus secretion was observed in snails after cythion exposure. In present study the initial reaction to pesticide exposure might be disturbing some enzyme system and acetylcholinesterase metabolism. The action of low concentration of pesticides might be at a sensory cell, then stimulate the C.N. synapse and finally influence the motor neurons, while in high concentration of pesticide must have acted on directly on motor neurons or motor nerves. In fishes anti acetylcholinestesase activity of pesticides was studied with reference to the inhibition of brain and serum choline-esterase activity[27]and suggested the paralytic action. Similar might be true in all above tested animal of present study.

SUMMARY AND CONCLUSION

In nature, pesticides like organochlorine and organophosphate compounds were reported to be toxic to several non target organisms like fish, crab, snail and aquatic fauna. These pesticides enter the aquatic ecosystem through various routes and cause much disaster. The animals fish crab and snail are important as they are sensitive to a wide variety of toxicants in water and hence were profitably used as pollution Indicators in water quality management.

In the present research work the efforts were made to investigate the effect of pesticides Cythion (organophosphate) behavioural aspects in the crab Paratelphusa jacquesonti fish C. orientalis, snail B. bengalensis f. typlea at different time intervals. on

The LC50 values of cythion for crab were 0.34 at 24 0.25 at 48 h, 0.17 at 72 h and 0.12 at 96. For fish LC, 50 values were 0.16, 0.15, 0.14 and 0.13 and for snail 0.112. 0.06, 0.06, 0.04 at 24, 48, 72 and 96 h respectively.

Above data showed that the toxicity of pesticide is directly proportional to exposure time. The LC50 values decreased as the exposure period increased and mortality rate increased with increasing concentrations.

The freshwater crab P. Jacquemontii is an important common member of fresh water ecosystem. The maladaptive behaviour of the crab following exposure to pollutants would increase it's predation which might enhance the death rate with increasing pesticide deposition in the body tissues.

The crab P. jacquemontii exposed to cythion exposure showed prominent loss of balance, did not turn on vertical side, became sluggish and sat at one place.

Fish C. orientalis after the treatment of Cythion showed loss of co-ordination and nervous balance. Increased erratic movements and pescular movements were observed. Overall movements were slowed down.

After cythion treatment bengalensis did not respond to stimulus, foot margin and other parts were seen swollen and appeared to edematose.

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Print ISSN No. 2277 – 8179
Journal DOI : 10.36106/ijsr
International Journal of Scientific Research
An International Journal
Journal For All Subjects
Volume-12 | Issue-05 | May-2023
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH
A Peer Reviewed, Referred, Refereed & Indexed International Journal
UGC Sr. No. 49217
Impact Factor : 5.862
₹ 500

ORIGINAL RESEARCH PAPER
Volume - 12 | Issue - 05 | May - 2023 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

EFFECT OF ENDOSULFAN ON FREE AMINO ACIDS OF CRAB,FISH AND SNAIL

Zoology

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ABSTRACT

Aquatic animals are often exposed to insecticides.Knowledge about the mode of action of toxicants is better understood from biochemical investigations . These effects can be studied by lethal and sublethal effects. Aminoacid and nitrogen metabolism are of the utmost importance in animals, since amino acids are essential intermediates in protein synthesis Furthermore amino acids are known to play an important part in several phenomenon occuring in the lifetime of animals during osmotic stress. The variations in the amino acids after exposure to endosulfan in crab P. Jacquemontii, Fish C. orientalis and snail B. bengalensis at 24, 48, 72 and 96 h were studied in present investigation. Free amino acid content o showed general increasing trend in all tissues at 24, 48, 78 and 96 h after endosulfan exposure. Except fish, in which the free amino acid level was slightly decreased at 24 h of treatment period.

KEYWORDS

insecticide,sub lethal,toxicants,osmotic pressure

Introduction

Aquatic animals are often exposed to insecticides as a result of treated areas as well as from direct application to the water. Knowledge about the mode of action of toxicants and causes of death in poisoned aquatic animals is better understood from biochemical investigations besides mortality studies. These effects can be studied by lethal and sublethal effects which can be shown by apparent external signs toxicity and by internal disturbances.

Environmental pollutants brings about the damage to different organs or disturb the physiological and biochemical processes with the organism following exposure to pollutant. Effect of different pesticides, heavy metals and other chemicals on biochemical constituent in aquatic animals is the current topic of interest because of threatening of the natural resources from industrial effluents (Everall, 1989; Giudici, 1981; Danota Szerow and Anna Milian, 1987).[1][2][3]

Endosulfan remains in the environment for longer periods and bio-accumulates in plants and animals which leads to contamination of food consumed by humans [4]. It affects mainly the central nervous system and was found to have higher acute inhalation toxicity than dermal toxicity. Gastrointestinal absorption of endosulfan is very high [5].Many workers attempted to evaluate these hazards on biota (Maria and Quasin, 1983; Tankar, 1985; Sherekar, 1986; Kabra, 1988; Malu, 1989;[6][7][8][9][10]

Biochemical investigations constitute an excellent evidence for the accumulation of pesticides in the tissues of animals which showed a wise degree of fluctuations in their organic components. Exposure to chemical pollutants elicit many molecular and biochemical changes in fish which precide cellular and systematic disfunction so that it appropriate parameters are early inconsistent signs of distress may be detected. To encounter stress, metabolic cycles involved in the interchange of organic constituents, that are responsible for production of energy, production. undergo change for energy production.

The organochlorine and organophosphate pesticide used in the present study occur in persistant nonpersistant state in the aquatic medium. Ramaswmy (1987) investigated effect of sevin on free amino acid in fish Sarotherodon mossambicus.[11] Gautam (1988), Bhale et al., (1988) also studied the effect of pesticide on physiological and biochemical aspects of fish and crab. [12][13] Patil et al., (1991) discussed some physiological and biochemical aspects of Paratelphusa jacquemontii exposed to organochlorine pesticides (BHC and DDT)[14].Since the stress conditions caused alterations in the metabolic cycles such as ionic composition, enzyme system etc. It is necessary to understand the significance of these variations in the organic compounds of the tissues. Under such conditions,these variations in turn can have an impact on food web relation and energy cycles and therefore is an important aspect for study. Hence present study was undertaken to account for the changes involved in protein nitrogen metabolism in the tissues like liver, muscle, gill, foot of crab, Paratelphusa jacquemontii; fish, Channa orientalis and snail, Bellamya bengalensis f. typica exposed to organochlorine pesticide Endosulfan .

Since the physiological characteristics and energy functions of the fish are known to alter during pesticide treatment (Holden, 1973). [15]These changes would certainly have an impact on the free amino acid level. In such altered physiological conditions, the free amino acid certainly play a vital role in maintaining the intracellular osmotic balance and also act as precursors for the synthesis of enzymes, hormones and other constituents of the metabolic machinery (Lenhinger , 1978).[16]

Anino acid and nitrogen metabolism are of the utmost importance in animals, since amino acids are essential intermediates in protein synthesis and the catabolise products of these prime constituents appear in the form of different nitrogen substances. Furthermore amino acids and certain other nitrogenous compounds are known to play an important part in several phenomenon occurring in the lifetime of animals and more specifically, during osmotic stress.

A large proportion of the dry matter of molluscan bodies is made up of amino acids, either free or combined to form macro molecules, among which proteins are constant. The pattern of the amino acid composition of the bulk of the proteins of molluscan tissues is similar to the pattern generally observed in animal tissues.

Increase or decrease in free amino acid content may be considered as the operation of the stress phenomenon at the tissue level. Very little information is available concerning the physiological or biochemical effects of pesticides on nucleic acid levels and protein content.

Amiared et al (1986), observed changes in amino acid content in haemolymph of crab after exposure to cobalt chlonde.[17] Krishaja et al (1987) mentioned the effects of heavy metals (mercury cadmium, lead, arsenic and selenium) on amino acid content of industrial crab Scylla serrata.[18] Hushanam (1987), studied alteration in free amino acids in freshwater prawn Macrobrachium kistnensis exposed to napthalene.[19] Srinivasulu Reddy et al (1989), reported alteration in amino acid content of peaneld prnun Metapenaeus sonmceros exposed to phosphamidon.[20] Regulation of free amino acid in the tissues of teleost Tilapia mossambica exposed to sublethal concentration of malathion was reported by Kabeer Ahmand Sahib (1979)[21].Seshagiri et al (1987) reported changes in amino acid level due to toxicity of benthiocarb in fresh water teleost Sarotherodon mossambicus [22].

Kabeer Ahmad et al(1978) reported changes in amino acid levels in the snail Pila globosa (Swainson) exposed to malathion [23]. Decrease in free amino acid level in body fluid of the snail Pila globosa was reported by Satyaprasad (1982)[24] when exposed to methyl parathion. Rajeshwara Rao (1983) studied elevation in amino acids in snail Pila globosa exposed to phenothoate [25]. Decrease in levels of free amino acid in fresh water mussel Lamellides marginalis under dichlorovas exposure was reported by Srinivas Moorthy (1983)[26]

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Graney et al, (1986) studied effect of long ters exposure to pentachlorophenol on the free amino acid pool and energy reserves of the freshwater amphipod, Gasarus pseudol Linnaeus [27].

In present work, changes in free amino acid contents were studied in freshwater crab, P. jacquemontii, fish C. orientalis and snail, B. bengalensis after endosulfan exposure.

MATERIAL AND METHOD

The test crab, P. Jacquemontii, the fish, C. orientalis and the snail B. bengalensis were procured from around Amravati fish market and local ponds. Maintenance, acclimation, selection of specimens size, weight, cleaning and treatment of pesticide was as per norms. Pesticide concentration was prepared as per procedure for experimentation.

Estimation of free amino acids (Danilson and Harold, 1958) Homogenated tissue in 10 ml folin fungstic acid. filter and take 5 ml of this filtrate, add a drop of phenolphthaline, add 0.1 M NaOH drop by drop till permanent pink colour was produced. Similarly for blank, add 5 al o water and treat as above (For blank test tube). 1 al o Borax solution and 1 ml freshly prepared Napthoquinon solution (0.5 %) was added. Keep in boiling water for 1 minute. After cooling, dilute it to 13 ml. To that add ml of farmaldehyde reagent and 1 ml of 0.05 N thiosulphat Make up to 15 ml by water. Read at 470 to 480 u

RESULT AND OBSERVATION

Animals were treated with organochlorine pesticide-endosulfan. The crab P. Jacquemontii, fish C. orientalis and snall B. bengalensis exposed to endosulfan showed variations in free amino acid content at 24, 48, 72 and 96 h treatment period in the tissues Hepatopancreas, Muscle and Gills. Hepatopancrease (Table 1.1) P. jacquemontii: Free amino acids were found be elevated at all treatment periods. Regarding values lethal and sublethal concentrations were 19.78, 23. 25.90, 27.27 and 19.24, 22.69, 24.46, 26.98 after endosulfan exposure.

C. orientalis: At 24 h exposure period free amino acid contents were observed less, which later on showed an ascending trend up to the end of experiment. Percent changes for lethal and sublethal concentrations were -6.28, 46.81, 63.28. 75.79 an -5.31, 44.29, 61.11, 72.86 after endosulfan effect.

B. bengalensis: Enhancement in free amino acid was recorded at all exposure periods. Values for lethal concentration Increased from 13.50 to 17.68 and from 13.22 to 17.40 for sublethal concentration.

Table 1.1 a & 1.1 b Changes in hepatopancreas /liver free amino acid content of some aquatic organisms exposed to endosulfan lethal and sublethal concentrations at different exposure period. (mg /gm wet wt.tissue)

	Lethal (mg/l) (1.1 a)		
Concentration	0.121	0.13	0.048
Exposure period (h)	P.jacquemontii	C. ori-entalis	B. bengalensis f. typica
Control	16.13	30.51	0.97
	± 4.91	± 9.19	± 3.01
24	19.78***	28.59*	13.50**
	± 3.33	± 4.91	± 3.91
	-22.68	(-6.28)	-17.29
48	23.16*	44.81*	15.38**
	± 1.73	± 4.24	± 3.80
	-43.67	-46.89	-33.7
72	25.90NS	49.81**	16.72**
	± 2.01	± 3.30	± 2.71
	-60.62	-63.28	-45.29
96	27.27NS	53.63*	17.68**
	± 1.67	± 1.73	± 2.82
	69-09)	-75.79	-53.68

Parenthesis fig.( ) percent change *P=0.01, **P=0.001, ***P=0.05, NS = Not Significant

	sublethal(mg/l) (1.1. b)		
Concentration	0.04	0.043	0.162
Exposure period (h)	P.jacquemontii	C. ori-entalis	B. bengalensis f. typica
Control	9.81	16.28	7.89
	± 1.73	± 2.01	± 3.33
24	11.19NS	15.78***	8.68*
	± 4.91	± 1.81	± 1.73
	-14.09	(-5.31)	-10.11
48	13.00***	22.77NS	9.82**
	± 3.33	± 6.49	± 0.01
	-32.52	-39.87	-24.57
72	13.71*	25.46**	10.48NS
	± 1.73	± 4.91	± 2.30
	-39.79	-56.39	-32.89
96	14.61**	26.74***	11.401*
	± 0.01	±3.33	± 0.81
	-49.02	-64.27	-39.6

Parenthesis fig.( ) percent change *P=0.01, **P=0.001, ***P=0.05, NS = Not Significant Muscle (Table 1.2)

P. jacquemontii: Ever increasing trend was seen at 24, 48, 72 and 96 h treatment period. Amount of percent change was from 20.52 to 41.67, 58.19, 67.09 for lethal and from 17.39 to 38.60, 55.89, 64.76 for sublethal concentration of endosulfan.

C. orientalis: Free aminoacid level was found to be less at 24 h, which later on showed remarkable increase up to 96 doir exposure period. For lethal concentratie freeamino acid values were 19.87, 31.78, 35.05, 37.75 and 20.14, 31.03, 34.63, 37.01 for sublethal concentration after endosulfan exposure. In muscle slightly higher values were seen as compared to hepatopancrease.

B. bengalensis: Endosulfan influenced animals reflected increase in freeamino acid level through out the experimental course. The corresponding values for lethil and sublethal concentrations were 15.10, 31.69, 43.60, $1.63 and 13.29, 28.43, 40.09, 49.27.

Table 1.2 a & 1.1 b Changes in muscle free amino acid content of some aquatic organisms exposed to endosulfan lethal and sublethal concentrations at different exposure period. (mg /gm wet wt.tissue)

	Lethal (mg/l) (1.2 a)		
Concentration	0.121	0.13	0.048
Exposure period (h)	P.jacquemontii	C. ori-entalis	B. bengalensis f. typica
Control	10.56	21.23	8.21
	± 4.91	± 2.92	± 3.33
24	12.72***	19.87**	9.44*
	± 3.33	± 3.80	± 1.73
	-20.52	(-6.37)	-15.1
48	19.40*	31.78**	10.81*
	± 1.73	± 1.73	± 1.40
	-41.67	-47.72	-31.69
72	14.96**	35.05**	11.78*
	± 0.01	± 0.01	± 1.04
	-58.19	-65.13	-43.6
96	17.64NS	37.75NS	12.45**
	± 5.37	± 5.20	± 0.01
	(67-09)	-77.83	-51.65

Paranthesis fig.( ) percent change *P=0.01, **P=0.001, ***P=0.05, NS = Not Significant

	sublethal(mg/l) (1.2 b)		
Concentration	0.04	0.043	0.162
Exposure period (h)	P.jacquemontii	C. ori-entalis	B. bengalensis f. typica
Control	10.56	21.23	8.21
	± 4.94	± 2.62	± 3.24
24	12.39***	20.14**	9.30**
	± 3.33	± 2.71	± 1.37
	-17.39	(-5.11)	-13.29

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48	14.63*	31.05**	10.54**
	± 1.73	± 2.23	± 2.28
	-38.6	-46.29	-28.43
72	16.46**	34.63**	11.50**
	± 0.01	± 3.20	± 3.04
	-55.89	-31.13	-40.09
96	17.39NS	37.01**	12.25**
	± 5.28	± 2.51	± 4.62
	-64.76	-74.37	-49.27

Parenthesis fig.( ) percent change *P<0.01, **P<0.001, ***P<0.05, NS = Not Significant

Gills (Table 1.3)

P. jacquemontii: Ever increasing trend was obtained in endosulfan exposed crab. Exposure in lethal concentration showed increase from 11.43 to 14.83 and from 11.19 to 14.61 for sublethal concentration at 24, 48, 72 and 96 h treatment period.

C. orientalis Enhanced free amino acid level was marked at 24 h which further went on decreasing up to 96 h treatment, Variations in percent values were -4.12, 43-29, 57.37, 69.37 and -3.07, 39.87, 56.39), 64.27 for lethal and sublethal concentrations respectively.

B. bengalensis: Free amino acid was seen to be Increased from 24 to 96 h exposure period. Increased for lethal concentration, was from 8.88 to 11.21 and from 8.68 to 11 al for sublethal concentration after endosulfan effect

Table 1.3 a& b Changes in gill free amino acid content of some aquatic organisms exposed to endosulfan lethal and sublethal concentrations at different exposure period. (mg /gm wet wt.tissue) Paranthesis fig.( ) percent change *P<0.01, **P<0.001, ***P<0.05, NS = Not Significant

	sublethal(mg/l) (1.3 b)		
Concentration	0.04	0.043	0.162
Exposure period (h)	P.jacquemontii	C. ori-entalis	B. bengalensis f. typica
Control	9.81	16.28	7.89
	± 1.73	± 2.01	± 3.33
24	11.19NS	15.78***	8.68*
	± 4.91	± 1.81	± 1.73
	-14.09	(-5.31)	-10.11
48	13.00***	22.77NS	9.82**
	± 3.33	± 6.49	± 0.01
	-32.52	-39.87	-24.57
72	13.71*	25.46**	10.48NS
	± 1.73	± 4.91	± 2.30
	-39.79	-56.39	-32.89
96	14.61**	26.74***	11.401*
	± 0.01	±3.33	± 0.81
	-49.02	-64.27	-39.6

Parenthesis fig.( ) percent change *P<0.01, **P<0.001, ***P<0.05, NS = Not Significant

	Lethal (mg/l) (1.3 a)		
Concentration	0.121	0.13	0.048
Exposure period (h)	P.jacquemontii	C. ori-entalis	B. bengalensis f. typica
Control	9.81	16.28	7.89
	± 2.62	± 4.91	± 0.56
24	11.43***	15.60**	8.88**
	± 2.71	± 3.33	± 0.38
	-16.59	(-4.12)	-12.58
48	13.21**	23.32*	9.97**
	± 2.23	± 1.73	± 0.22
	-34.67	-43.29	-26.37
72	13.99**	25.61**	10.70**
	± 3.20	± 0.01	± 0.92
	-42.69	-57.37	-35.62
96	14.83**	27.57NS	11.21**
	± 2.51	± 5.23	± 0.86
	69-09)	-69.37	-42.19

Discussion

Amino acid is utilized for protein synthesis and to which the products of protein degradation are returned. The variations in the amino acids after exposure to endosulfan in crab P. Jacquemontii, Fish C. orientalis and snail B. bengalensis at 24, 48, 72 and 96 h were studied in present investigation. values of freeamino acidand the comparative analysis of the acid recorded following facts.

Free amino acid content of above selected species showed general increasing trend in all tissues at 24, 48, 78 and 96 h after endosulfan exposure. Except fish, in which the free amino acid level was slightly decreased at 24 h of treatment period.

In crab P. jacquemontii increase in free amino acid may be due to degradation of protein synthesis or/and may be due to diminished utilization of amino acids In the tissue or their enhanced synthesis From other sources like glucose and fatty acids. Such Increase was also noticed in different animals like crab (Bhale et al., 1988)[28]and in army worm (Lomte and Patil, 1987 [29]).

These free amino acids might be fed in to TCA cycle as keto acids by way of transsination. Since in present study transaminase activity is known to elevate during pesticide exposure (Chapter IV). The Increased level of amino acid might also be due to increase synthetic potentiality. The Increased free amino acid may be partly utilized for the protein synthesis and partly for glyconeogenesis, through the transamination and transdeamination reactions to supply the necessary keto acids to act as a precursors for the maintenance of carbohydrate metabolism, to meet the energy demand during stress condition (Natarajan 1983)[30]Decreased free amino acid levels in fisl C. orientalis at early exposure period may be due to protein synthesis. This result was in agreement with Choudhary (1987)[31]. The free amino acid increased with increasing exposure time. The increased after 24 hour, may be due to enhanced proteolysis or synthesis of free amino acid, when there was deficit of glycogen content, these amino acids might be source of energy. The level of free amino acid say indicate the condition of the tissue. Increase or decrease in free amino acid content may be considered as the operation of the stress phenomenon at the tissue level. Mehrle et al. (1974)[32], Shkoori et al, (1976) [33]observed similar results in fishes exposed to toxicants.

The increased free amino acid pool suggested the increased protein brakedown, the related protein degradation and thus free amino acid pool was found to be enhanced, during pesticide exposure. The Increased free amino acid content might be due to the higher synthesis of free amino acid to full till the demand. However the increased synthesis of free amino acid can not be attributed to all types of amino acids, but to those which can be synthesized in fish tissues. Thus, amino acid pool might be contributed through two ways- viz. by the degration of proteins and by the enhanced synthesis of amino acids in the tissues and this might have resulted in consistent rise in free amino acid pool.

The increased free amino acid pool besides contributing to proteinsynthesis and energetic requirements may also be useful to the fish in the maintenance of the osmotic and acid base balance as reported for other animals during altered physiological states of the fish consequence to pesticide exposure. Analogus results were observed in teleost Sartherodon mossambicus exposed to benthicarb by Seshagiri Rao (1987)[20], Kabeer et al. (1981)[34] and Malla Reddy (1987)[35] observed in free amino acid level in fish Tilapia mossambicus to sublethal malathion exposure. Higher free amino acid content may also be attributed to decreased utilization of amino acids in glyconeogenesis as consequence of pesticiee exposure (Sreenivasulu Moorthy, 1983[24]; Sherekar, 1986[6]).

Increase in free amino acid content of snail B. bengalensis might be because of different turn over between amino acid synthesis and amino acid degradation to TCA cycle, as the proteolytic activity increased (as -Chapter IV).

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Proteins are degraded in to amino acids showed their increased level of free amino acid (Chapter 111). This increased free amino acid level later on was comparatively less, because these amino acids might have been used for energy purposes through TCA cycle, which was clear from the ammonia formation as This might be because of the short span of experiments selected rather than longer duration as the gastropod animals respond to the stress of pesticide slowly by projecting foot or opening operculum.

Conclusion

But in case of crab P. jacquemonti and snail B. bengalensis, pesticide can not be easily entered directly as small have effective dosing of operculum and crab can reduce the pestiedal entry by behavioral changes and so have less effect than fish C. orientalis.

Amino acids are representative of proteolysis. Amino acids are utilized for protein synthesis, to which the products of protein degradation are returned. There was increased free amino acid content upto end of the experimental period in the hepatopancreas /liver, muscle and gill in crab, fish and snail after endosulfan and cythion exposure. Only in fish free amino acid decrease was observed at 24 h of treatment period.

Increased proteolysis leads to increased free amino acid levels. Increased free amino acid may be partly utilized for glyconeogensis the protein synthesis and partly for through the transamination and transdeamination reactions to supply the necessary keto acids to act as precursors for the maintenance of carbohydrate metabolism to meet energy demand during stress conditions. Increased proteolysis may be due to breakdown of proteins leading to the formation of free amino acids.

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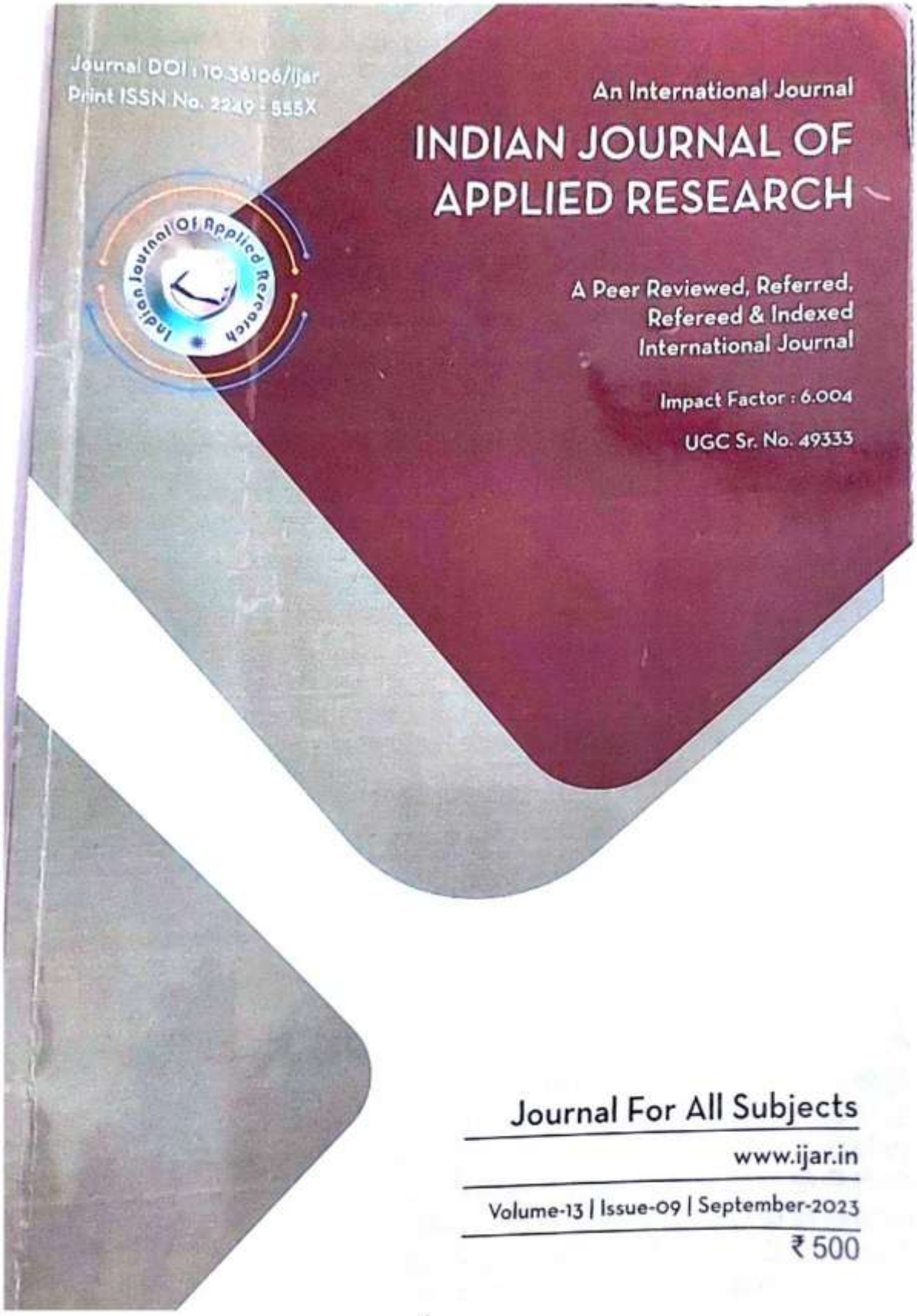
Journal DOI : 10.36106/ijar
Print ISSN No. 2249 - 555X
An International Journal
INDIAN JOURNAL OF APPLIED RESEARCH
A Peer Reviewed, Referred, Refereed & Indexed International Journal
Impact Factor : 6.004
UGC Sr. No. 49333
Journal For All Subjects
www.ijar.in
Volume-13 | Issue-09 | September-2023
₹ 500

Original Research Paper
Volume - 13 | Issue - 09 | September - 2023 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar
Zoology

EFFECT OF ENDOSULFAN ON BEHAVIOURAL PATTERN OF SOME AQUATIC ORGANISMS

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ABSTRACT The pesticides are known to produce behavioral pathology at toxic levels lower than LC 50 and the effects have been found to differ at different concentrations. Exposure to pesticide is known to affect both the central and peripheral nervous system.pollution stresses on behavioral pattern includes a wide range of effects an predator avoidance, migratory behaviour, learning ability habitat selection, feeding behaviour, changed movements and attitude loss of sensation and other behavioural responses .The crab P. jacquemontii, fish C. orientalis, B. bengalensis are exposed to lethal and sublethal concentrations of organochlorineendosulfan at 24, 48, 72 and 96 htreatment periodand are observedfor the behavioural changes Excitability, irritability and restless movements were the prominent features ofendosulfan exposed animals. In sub lethal exposures the behavioural changes were same butwith lesser intensity. Study showedthat the crab, fish and snail were more sensitive toendosulfan.

KEYWORDS : Behavioural change, Lethal, Organochlorine, Toxicity

INTRODUCTION

Pesticides released into the environment has imbalanced the biology of ecosystem [1]. Furthermore pesticides carried through food chains are very harmful to the aquatic animals and a potential danger to man when he consumes. herbicides can also trim down the reproductive success of fish species and other aquatic flora and fauna [2], [3], [4]. The inhibitory effect was observed in Lepomis macrochirus, Labeo rohita, Danio rerio, *and* Jenynsia multidentata exposed to endosulfan [5], [6]. Entry of these pesticides into water bodies through industrial effluents, run off of direct applications affects many aquatic organisms[7],[8]. Pesticides not only affect the farmer health but can also affect on consumer's health through residues of pesticide present in the food [9] The pest controllers and weed-killers are moderately to highly toxic to aquatic invertebrates such as crab, shellfish and fish species[10].

The aquatic environment has become a store house for chemical pollutants which Infiltrate in to aquatic environment by several ways .Behavioural pattern includes a wide range of effects an predator avoidance, migratory behaviour, learning ability habitat selection, feeding behaviour, changed movements and attitude loss of sensation and other behavioural responses may easily be up set, if altered by environmental stresses associated with pollution.

The crab P. jacquemontii, fish C. orientalis, B. bengalensis are exposed to lethal and sublethal concentrations of organochlorine endosulfan at 24, 48, 72 and 96 htreatment period and are observed for the behavioural changes.Pollutant affects behaviour of organisms. The behaviour of animal has been correlated to the metabolic changes in different crustaceans, [11],[12].

The toxic effects begins with the change of behaviour followed by the death of organisms. Physiological and behavioural effects of sublethal exposures to pesticides has been closely studied.Experimental animals when exposed to lethal concentrations of endosulfan resulted in severe behavioural lesions and at last resulted in death. Excitability, irritability and restless movements were the prominent features of endosulfan exposed animals. In sub lethal exposures the behavioural changes were same but with lesser intensity. The high excitability shown by vigorous movements, cleaning movements. Loss of equilibrium and co-ordination was observed.

MATERIALAND METHODS

The species which has been selected for the present study are of economic value and readily available through out the year and it stands captivity well. The species represents the natural population i the river or water bodies of the Amravati (Lattitude 20- N, Longitude 77-45 E) and are resistant to handling a transportation.

Procurement and Maintenance

ALL the animals used were of same size and weight. Crab of size 6.5x5.3 and weight 55-65 g; Fishes of size 13-15 cm and weight 20-32 g and Snails of size 3-5 cm with weight 5-6 g. The animals were purchased from the market as well as collected at spot. The animals were brought in to the laboratory, transferred to the glass aquarium and were inspected for any possible injury or infection Only the healthy animals were selected and washed with dilute solution of potassium permangnate ($KMnO_4$ 1.0 mg/1) remove dermal infection if any.

The animals were acclimatized for 10 days according to APHA/AWWA/WPCE (1975) standard methods[13]. The mortality was less than 5 per cent within 4 days of preceding test. The Test animals were fed adlibitum diet of boiled eggs,dried prawn, fish food and goat liver. Excess food ant faecal matter were removed from aquaria once in a day or twice at least in a week .The renewal technique bioassay method (Committee on methods for toxicity test with aquatic organisms, 1975) was used. It is an Improved static test in the sense that an attempt was made to maintain the water quality. The test solutions were periodically (usually once every 24 h) replaced with fresh test solution of the same composition. This was achieved by transferring the test organisms from one test chamber to another or some time by replacing the test solution in the same chamber periodically. The animals were starved for 24 hours before using for experimentation: The quality of water used in terms of physical and chemical characters is given in Table 1.1 For toxicity evaluation Endosulfan pesticides was selected. Dilution medium was well water.

Procedure For Toxicity Evaluation Experiment

The toxicity evaluation of endosulfan to the crab, fish and snail was conducted in static aquatic medium as per the method of [14].

Exploratory tests Different concentrations of endosulfan (organochlorine) were prepared from stock solutions.

ii The crab, fish and snail in batches of 10 were taken in six plastic troughs. The five troughs as experimental and the sixth one as a control.

iii. The crabs, fishes and snails in the 6 troughs were exposed to the above selected pesticide concentration for 48 hours.

iv. The animals were exposed to pesticide at 8 O'clock in the morning to avoid chronotoxicological alterations in the toxicity evaluation as per the method of[15] . After 48 hours of exposure, the number animals killed in each concentration were recorded.

vi. To reach precise value in each concentration,the experiment was repeated and concurrent values obtained.

vii. To determine the precise dosage level of LC_{50} value, the probit method was followed [16]

Means and ranges of various physio chemical characteristics of dilution water was as per table(Table 1)

Table 1 Means and ranges of various physio chemical characteristics of dilution water.

Characteristics*	Mean	Range
Temperature (%)	28.3 +2.3	25.30-30.50
pH	7.30	6-80-7,50
Total solids	13.60	12.50-18.25
Dissolved solid	4.38	3.23.5.80
Suspended solids	9.45	9.23-11.20
Alkalinity as CO	55.00	37.00-88.00
Alkalinity as OH7	5.22	3.50 8.22

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Dissolved oxygen (D.O.)	4.42	3.56- 6 80
Biochemical oxygen demand	1.70	0.83 3.53
Phosphate as C	0.82	0.22 1.61

*Values except pH and temperature have been expressed in mg/1.

Endosulfan is a toxic pesticide, by using the LC_{50} values lethal which 50 percent mortality occurred in test animals were calculated. Paratelphusa jacquemontiiProbit analysis LC_{50} values were 0.3449 at 24 h, 0.2594 at 48 h 0.1740 at 72 h and 1219 at 96 h, Channaorientalis LC_{50} values were 0.160, 0.150, 0.140 and 0-130 for24, 48, 72 and 96 h respectively, Bellamyabengalensis Respective values of LC_{50} at 24, 48 72 and 96 h. were 0.1120, 0:636, 0-0629, 0-0488, (Table 2)

Table 2: Probit analysis LC50 values for the crab P.Jacquemontii fish C. orientalis and snail B.begalensis F.typica exposed to endosulfan at different time intervals (ml/1).

Treatment period h	Paratelphusa Jacquemonti	Channa orientalis	Bellamya bengalens
24	0.3449	0.160	0.1120
48	0.2594	0.150	0.0636
72	0.1740	0.140	0.0629
96	0.1219	0.130	0.0488

OBSERVATION

The freshwater crab **P. jacquemontii** is an important common member of freshwater ecosystem, The maladaptive behaviour of this crab following exposure to pollutants would increase in it's predation which might enhance the changes of bioaccumulation in the food chain.The crab P. Jacquimontii showed change in their behaviour when exposed to organochlorine (endosulfan) pesticide. The crabs showed restless excited irritated and uneasy movements in container, Mouth parts showed continuous movements. At start chelae erected up and after 48 hrs were drawn wide. After 24 hrs crawled flat, walked on tips, movements were slow in highest concentration exposure. Crabs got imbalanced lost co-ordination about 35 hrs. then lost balance and fell upside down. Because of irritation, became offensive and attack if touched. After 48 hrs crab showed no response, almost set for death. These observations were observed in endosulfan lethal concentration exposure,When exposed to sublethal concentration they became excited, irritated, if kept In group hold tightly with each other in short span exposure there after become chelae drawn wide forward with constant movements. In normal position got on leg tips, with slow movements. Equilibrium was found to be disturbed with uncoordinated activities. Crabs became furious but could not attack with force with quickness indifferent to predatory actions.

Channa Orientalis;

Fishes showed behavioural changes after exposure to pollutants[17], [18]. In present study on C. orientalis the behavioural response of the fish varied in accordance to the test concentrations. The exposure to endosulfan lethal concentration resulted in severe behavioural lesions. Fishes showed excitability, restless movements and more irritability. Exposed fishes showed irratic swimming pattern, rapid opercular movements, heavy mucous secretion. The impairmentment of sense of balance was noticed in endosulfan exposed animals. Fish lost their balance in due course slowly turning upside down In sublethal exposure the in behavioural changes were similar but with lesser intensity.

Bellamya bengalensis F.typica

In present study on the snail, B. bengalensis F typica, the closing and opening of shell by the operculum with partial protrusion of foot along with it's swelling and mucus secretions were taken in to consideration, The pesticide endosulfan caused behavioural changes in the snail.

At lower concentration of endosulfan snails did not show fast reactions. Exposure to lethal concentration caused severe behavioural lesions and lastly resulted in slow movement and a death. The early stage of poisoning was usually manifested by considerable action on the part of the snail, but subsequently activity was decreased and snail became inert with occasional movement till death. The general reaction of B bengalensis F.typica was partly withdrawal in to their shell and secretion of copious mucus. Large secretion of mucus was noticed in early hours of treatment but the quality of mucus secretion decreased with exposure period.

RESULT AND DISCUSSION

The aquatic environment has become a store house for chemical pollutants which Infiltrate in to aquatic environment by several ways .Considerable literature is available on the toxic potentialities of selected organochloride Insecticides with reference to aquatic biota like fish. pollutants like insecticides may effect on various physiological and biochemical processes that types of insecticides can cause a serious threat to the health status of fishes[19]

Sing and Srivastava worked out the toxic concentrations of various insecticides on air breathing fish, Heteropneustes fossilis [20] Murthy et al reported LC_{50} values of lindane as 0.15 pps for fish Tilapiamossambica. [21] Gopal et al. Indicated that the long persistant chlorinated hydrocarbon DDT was highly toxic as compared to the short persistant organophosphate insecticide metaacid[22].

Along with the fish similar studies have been conducted with marine Invertebrates too, the crustaceans crabs, prawns and molluses like clams, mussells are also being subjected to these toxicity studies because of their economic Importance and their vital position in the food chain and food web of the aquatic ecosystem.

The results in the present piece of work are in confirmatory with those of earlier workers. Pollutant affects behaviour of organisms. The toxic effects begins with the change of behaviour followed by the death of organisms. Physiological and behavioural effects of sublethal exposures to pesticides has been closely studied[23]. The fishes and various aquatic organises showed behavioural changes after exposure to pollutants [24],[25]. The present results showed that the exposure to endosulfan caused behavioural changes in the crabs, fishes and snails.

Experimental animals when exposed to lethal concentrations of endosulfan resulted in severe behavioural lesions and at last resulted in death. Exitability, irritability and restless movements were the prominent features of endosulfan exposed animals. In sublethal exposures the behavioural changes were same but with lesser intensity. The high excitability shown by vigorous movements, cleaning movements. Loss of equilibrium and co-ordination was observed

The observations for lethal and sublethal exposure instincted us to suggest that endosulfan acts on nervous system and crab reacts to the poisoning by excitation, this types of reaction could be an early Indication of poisoning. This type of external symptoms are similar to those reported for BHC poisoning in crab [26]. Similar results were recorded for zinc poisoning in fish[27].

SUMMARY AND CONCLUSION

The pollutants used in agriculture and industry dump in aquatic medium, ultimately affects the organisms of aquatic medium. The aquatic fauna was adversely affected by the pollutants both directly and indirectly in various ways the pesticide not only produce biological and pathological changes but also cause significant biochemical alterations in the living system.In nature, pesticides like organochlorine and organophosphate compounds were reported to be toxic co several non target organisms like fish, crab, snail and aquatic fauna. These pesticides enter the aquatic ecosystem through various routes and cause much disaster. The animals fish crab and small are important as they are sensitive to a wide variety of toxicants in water and hence were profitably used as pollution Indicators in water quality management.

In the present research work the efforts were made to investigate the effect of pesticides endosulfan (organochlorine)) biochemical aspects in the crab Paratelphusa jacquesonti fish C. orientalis, snail B. bengalensis f. typlea at different time intervals. The probit analysis revealed that the LC50 values of endosulfan in crab P. Jacquemontii, were 3.98. 3.46. 3.88 and 3.23 at 24, 48, 72 and 96 h respectively. For fish C. orientalis, 1.94, 1.81, 1.73 and 1.51 were corresponding values at 24, 48, 72 and 96 h exposure period; while for snail B. bengalensis LC50 values were 0.93, 0.87, 0.80, 0.79 at 24, 48, 72 and 96 h respectively.

Above data showed that the crab, fish and small were more sensitive to endosulfan. The 24 C50 values obtained were the highest in all cases followed by 48, 72 and lowest for 46 h among all exposure periods. It showed that the toxicity of pesticide 1 directly proportional to exposure time. The LC50 values decreased as the exposure period increased and mortality rate increased with increasing concentrations.

The freshwater crab P. Jacquemontii is an important common member of fresh water ecosystem. The maladaptive behaviour of the crab

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following exposure to pollutants would increase it's predation which might enhance the death rate with increasing pesticide deposition in the body tissues.The crab P. jacquemontii exposed to endosulfan showed excited, irritated, uneasy movement, got imbalanced, lost co-ordination and almost set for death.Fish C. orientalis after the treatment of endosulfan showed excitability, restless movements, rapid operculuy movements, heavy mucus secretion and impairment of the sense Balance.B. bengalensis showed decreased activity, secretion of copious suscus; the body parts were not seen inside the shell after death when exposed to endosulfan.

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