# Morphology of immatures of *Aphodius* (*Neocalaphodius*) *moestus* (Fabricius, 1801) (Coleoptera: Scarabaeidae: Aphodinae)

**Abstract :**

Immatures of *Aphodius (Neocalaphodius) moestus* (Fabricius, 1801) were studied and compared with *A arenarius, A. nanus, A. hyxos* and *A. granaries*. The IIIrd Instar larva of *A. moestus* differs in presence of prominent slit on the ventral anal lobe, 1st antennal segment 2 times the length of 2nd antennal segment, presence of 36 to 41 setae on raster and mandible with 1st tooth blunt compared to *A. arenarius, A. nanus, A. hyxos* and *A. granaries*. Eggs are laid freely in dung. As the larval development gets completed, pupation occurs inside the pupal chamber. Pupal chamber is irregularly oblong with pupa on one side of the chamber. Pupa of male differs from that of female in presence of gonopore. The ratio of adult emergence during March and April 2017 was 2f#:1m#.

**Keyword :**

Coprophagous, beetles, white grubs, Maharashtra

**Author(s) :** Khadakkar, S. S., Tiple, A. D., Khurad, A. M.



**Published Issue :** 2018 Vol. 13 Number 2

# MORPHOLOGY OF IMMATURES OF *APHODIUS (NEOCALAPHODIUS) MOESTUS* (FABRICIUS, 1801) (COLEOPTERA: SCARABAEIDAE: APHODINAE)

**Suvarna S. Khadakkar*, Ashish D. Tiple** and Arun M. Khurad***

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**[Khadakkar, S. S., Tiple, A. D. & Khurad, A. M.** 2018. Morphology of immatures of *Aphodius (Neocalaphodius) moestus* (Fabricius, 1801) (Coleoptera: Scarabaeidae: Aphodinae). Munis Entomology & Zoology, 13 (2): 616-621]

ABSTRACT: Immatures of *Aphodius (Neocalaphodius) moestus* (Fabricius, 1801) were studied and compared with *A. arenarius, A. nanus, A. hyxos* and *A. granaries*. The IIIrd Instar larva of *A. moestus* differs in presence of prominent slit on the ventral anal lobe, 1st antennal segment 2 times the length of 2nd antennal segment, presence of 36 to 41 setae on raster and mandible with 1st tooth blunt compared to *A. arenarius, A. nanus, A. hyxos* and *A. granaries*. Eggs are laid freely in dung. As the larval development gets completed, pupation occurs inside the pupal chamber. Pupal chamber is irregularly oblong with pupa on one side of the chamber. Pupa of male differs from that of female in presence of gonopore. The ratio of adult emergence during March and April 2017 was 2f#:1m#.

KEY WORDS: Coprophagous, beetles, white grubs, Maharashtra

*Aphodius (Neocalaphodius) moestus* (Fabricius, 1801) is widely distributed in Afrotropical, Madagascan, Palaearctic, and Oriental region (Schoolmeesters, 2017).

Immature stages of dung beetle have been studied in temperate countries. But the studies from Asiatic region, Indian subcontinent are restricted to few species only. Adults of dung beetle are always in focus in taxonomy studies. However, immatures can play major role in taxonomy and identification of species. Literature survey lack any description on immature stages of genus *Aphodius* from Indian subcontinent. The endocoprid beetle *Aphodius moestus* is very common in central India but little is known about the immature stages of this species. Description of the immature stages of *Aphodius moestus* is unavailable. This study has been started with a view to study the immature stages of this species. However, *Aphodius hyxos* (Verdu et al., 1997), *Aphodius (Plagiogonus) nanus*, *Aphodius (Plagiogonus) arenarius* (Verdu & Galante, 2000) are some of the Aphodiines whose immatures were documented by earlier authors which were found to be morphologically related.

## MATERIAL AND METHODS

**Study site.** The study was done during March and April months of 2017 in Zilpi village of Wardha district of Maharashtra (India). Zilpi is situated at 21.0658° N, 78.8666° E and approximately 312 m above sea level. The study area is a typical village with ample cattle sheds. Usually, the villagers collect and deposit the cattle dung on pile near the cattle shed.

**Sampling.** Immatures of *Aphodius moestus* were collected from this area and reared in laboratory till adult to confirm the species identity. Beetles and larvae were removed from dung with blunt forceps.

International Journal of Researches In Biosciences &AgricultureTechnology
(ISSN No.2347-517X (Online))
(Open Acces, Online, Peer Reviewed Four Monthly Journal)
Published By VMS Research Foundation, Nagpur, M. S., India

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### BUTTERFLY DIVERSITY IN RELATION TO A RELATIVE ABUNDANCE AND STATUS IN SELOO CITY, WARDHA MAHARASHTRA, CENTRAL INDIA

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**Page Nos :** 1-5

ISSN No. 2347-517X (Online)

INTERNATIONAL JOURNAL OF RESEARCHES IN BIOSCIENCES, AGRICULTURE & TECHNOLOGY
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# BUTTERFLY DIVERSITY IN RELATION TO A RELATIVE ABUNDANCE AND STATUS IN SELOO CITY, WARDHA MAHARASHTRA, CENTRAL INDIA

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**ABSTRACT:-**

A survey was conducted to record the butterfly diversity and the status and occurrence of butterfly species in and around Seloo city, Central India from 2011 to 2018. A total of 91 species of butterflies belonging to Papilionidae (07 species), Pieridae (14 species), Nymphalidae (29 species), Lycaenidae (28 species), Hesperiidae (12 species) and 01 species was recorded from the Riodinidae. Of all the total 91 species, 29% were commonly occurring, 46% were very common, 9% were not rare, 13% were rare and 3% were very rarely occurring. About 06 species of the recorded ones come under the protection category of the Indian Wild Life protection Act 1972. The observations support the value of the Seloo city area in providing valuable resources for butterflies.

**Keywords:** India, Lepidoptera, diversity, Seloo city, Maharashtra

## INTRODUCTION

Butterflies are the most beautiful and colourful creatures on the earth and have a great aesthetic value. Butterflies have always been a subject of interest and they are probably next only to birds in their universal popularity evoking curiosity and fondness among children, naturalists and scientist alike. This is partly attributable to the great variety and beauty of their colour patterns and partly to their aromatic transformation during mimicry and migration (Kunte, 2000). They constitute one of the most important links in ecological pyramids of food chain i.e. a link between plants and other predators like birds, reptiles and spiders; transforming and transmitting energy from green plants to the animal. Amongst the invertebrates, butterflies are becoming sufficiently well studied for them to be used for general conservation planning in some parts of the tropics as a representative insect group (Thomas, 1992).

Butterflies are very sensitive biota to environment and are directly affected by changes in the habitats, atmospheric temperature and the weather conditions; they can be good indicators of environment changes (Tiple et al., 2006). Most of the butterflies are seasonal in their occurrence, they are abundant only from beginning of monsoon (June–July) till the early winter (August–November) and decline in species abundance from late winter (December–January) up to the end of summer (Tiple and Khurad 2009).

Butterflies have been studied systematically since the early 18th century and about 19,238 species are documented worldwide by 1998 (Heppner, 1998). This figure is not constant because of the continuous addition of new butterflies and also due to ongoing disagreements between taxonomists over the status of many species.

The Indian subcontinent a diverse terrain, climate and vegetation hosts about 1,504 species of butterflies (Tiple 2011) of which Peninsular India hosts 351, and the Western Ghats 336. In Central India, the butterfly diversity was reported earlier by Forsayeth, (1884); Swinhoe, (1886); Betham, (1890, 1891) & Witt, (1909). D'Abreeu, (1931) documented a total of 177 species occurring in the erstwhile Central Provinces (now Madhya Pradesh and Vidarbha). In the recent past, several workers have studied butterflies from urban, rural and protected areas of Vidarbha. 65 species belonging to 52 genera representing 7 families from Pench Tiger Reserve, (Maharashtra) (Sharma & Radhakrishnan, 2005); 68 species of butterflies of 50 genera were recorded from Tadoba Andhari Tiger Reserve (Sharma & Radhakrishnan, 2006) and 103 species of butterflies were recorded from Melghat Tiger Reserve (Wadatkar, 2008). Tiple & Khurad, (2009) reported 145 species of butterflies recorded, of which 62 species were new records

# Biodiversity Journal 2018, 9 (3): 169-312

*Biodiversity Journal*, 2018, 9 (3): 171–180 DOI: 10.31396/Biodiv.Jour.2018.9.3.171.180

# Butterflies (Lepidoptera Rhopalocera) of the Bor Wildlife Sanctuary, Wardha, Maharashtra, Central India

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**ABSTRACT** The diversity of butterfly species (Lepidoptera Rhopalocera) was studied in the Bor Wildlife Sanctuary, Wardha district area (Central India) of 138.12 km² from 2011 to 2017. A total of 114 species of butterflies belonging to 6 families were recorded. Most of the butterflies recorded belong to the family Nymphalidae (35 species). 34 Lycaenidae species were recorded. A total of 18 Hesperiidae and 18 Pieridae species were recorded, 8 species were recorded from the Papilionidae and 1 species from the Riodinidae family. Among the 114 butterflies recorded, 9 species come under the protection category of the Indian Wild Life (protection) Act 1972 (i.e., *Pachliopta hector*, *Appias albina*, *Appias libythea*, *Eurema andersonii*, *Euploea core*, *Hypolimnas misippus*, *Euchrysops cnejus*, *Lampides boeticus*, ***Ionolyce helicon***, ***Baoris farri***). The observations support the value of the National Park (Reserve forest) area in providing valuable resources for butterflies.

**KEY WORDS** Lepidoptera; diversity; Bor wild life Sanctuary; Wardha; Mahrashtra.

Received 16.03.2018; accepted 22.05.2018; printed 30.09.2018; published online 05.10.2018

## INTRODUCTION

Bor Wildlife Sanctuary was declared as a tiger reserve in July 2014. It is located near Hingani in Wardha District, Maharashtra. It is a home to a variety of wild animals. The reserve covers an area of 138.12 km² (53.33 sq. mile) at 20°57' N and 78°37' E altitude, which includes the drainage basin of the Bor Dam. Bor Wildlife Sanctuary is covered with southern mixed dry deciduous forest. Teak, ain, tendu, and bamboo are the main species of flora in this sanctuary. Tigers, panthers, bisons, blue bulls, chitals, sambars, peacocks, barking deers, chinkara, monkeys, wild boars, bears, and wild dogs are the important faunas of the sanctuary. It represents the floral and faunal wealth of Satpuda-Maikal Landscape. Satpuda runs along the Northern Boundary of Maharashtra from West to East and meets the Maikal Hill range which comes from Kanha (Figs. 1–3).

Among insect, butterflies are the most beautiful and colourful creatures on the earth, have a great aesthetic value and are called the flying jewels or winged jewels of nature. Butterflies are generally regarded as one of the best and most taxonomically studied groups of insects and well observed, not only by the lepidopterists and entomologists, but also by laymen. They are a very common and widespread species, but our understanding on their real biology and diversity may prove to be startlingly below common expectations (Willmott et al., 2001; Ackery, 1987; Tiple & Khurad, 2009).

The butterflies are a very important unit of ecosystem due to the inter-relationship with plants diversity (Kunte, 2000). Their caterpillars can be reared at home and the transformation from cater-

**Journal of Threatened Taxa**

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ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

**SHORT COMMUNICATION**

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26 December 2018 | Vol. 10 | No. 15 | Pages: 12990–12994
10.11609/jott.3935.10.15.12990-12994

Journal of Threatened Taxa | www.threatenedtaxa.org | 26 December 2018 | 10(15): 12990–12994

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ISSN 0974-7907 (Online)
ISSN 0974-7893 (Print)

OPEN ACCESS

# DESCRIPTION OF LIFE STAGES OF DUNG BEETLE *SCAPTODERA RHADAMISTUS* (FABRICIUS, 1775) (COLEOPTERA: SCARABAEIDAE: SCARABAEINAE) WITH NOTES ON NESTING AND BIOLOGY

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**Abstract:** Immature stages of *Scaptodera rhadamistus* (Fabricius) are described for the first time along with notes on nidification and biology. The larvae differ from other Scarabaeinae species in the structure of raster on tenth sternum with two irregular bunches of serrations ventrally one on either half. Pupae with pronotum transverse having rounded margins resemble adults, and consist of four lateral, single caudal and single pteronotal support projection. Adult males and females differ in coloration, structure of pronotum, presence of spine like process on mesosternum and, in the structure of male and female genitalia.

**Keywords:** Description, immatures, nesting, scarab beetle, *Scaptodera rhadamistus*.

Beetles belonging to family Scarabaeidae are commonly called as 'Scarabs' and their larvae are known as white grubs. Arrow (1931) provided detailed account of Indian Scarabaeidae. The monotypic *Scaptodera rhadamistus* (Fabricius, 1775), was previously cited as *Liatongus* (*Paraliatongus*) Reitter under tribe Oniticellini of subfamily Scarabaeinae (Hanski & Cambefort 1991; Philips 2016). Larvae of different stages and adults forage by clearing excrement (Arrow 1931). Adult males of *S. rhadamistus* are attractive owing to the coloration and structure of pronotum.

Much of the literature available relating to scarab beetles are on adult taxonomy. Information regarding their immature forms and nest-building behaviour is deficient (Ritcher 1966; Veeresh 1980; Sreedevi & Tyagi 2014). Studies on natural history of dung beetles of the subfamily Scarabaeinae lack the information on *S. rhadamistus* (Halffter & Matthews 1966). The objective of this study is to present an account of larval morphology and nest-building behavior of *S. rhadamistus*, a commonly found scarab in central Indian region, based on a study conducted in and around Nagpur-Wardha forest areas.

Species diagnosis: In life, adults are yellowish-orange with metallic green colored patches present on dorsal and lateral regions, elongate, oval; 13–15 mm in length and 6–8 mm in width. Males have a prominent pronotum with elevated margins forming deep cavity at

**DOI:** https://doi.org/10.11609/jott.3935.10.15.12990-12994 | **ZooBank:** urn:lsid:zoobank.org:pub:3C6C9BAF-F36F-493E-A2F6-FC68979D5426

**Editor:** B.K. Agarwala, Tripura University, West Tripura, India. **Date of publication:** 26 December 2018 (online & print)

**Manuscript details:** Ms # 3935 | Received 02 December 2017 | Final received 29 October 2018 | Finally accepted 05 December 2018

**Citation:** Khadakkar, S.S., A.D. Tiple & A.M. Khurad (2018). Description of life stages of dung beetle *Scaptodera rhadamistus* (Fabricius, 1775) (Coleoptera: Scarabaeidae: Scarabaeinae) with notes on nesting and biology. *Journal of Threatened Taxa* 10(15): 12990–12994; https://doi.org/10.11609/jott.3935.10.15.12990-12994



**Funding:** None.

**Competing interests:** The authors declare no competing interests.

**Acknowledgements:** We are thankful to Dr. M. M. Rai, Cordinator and Dr. M. K. Rathod, Scientist, Centre for Sericulture and Biological Pest Management Research, Nagpur for providing necessary facilities to conduct the following studies and encouragement. The authors are also thankful to State Biodiversity Board, Maharashtra for providing permission to collect scarab beetles. First author acknowledges the help of Dr Sandhya Kranthi, Head of Plant Protection division, and Dr. Vishlesh Nagrare, Principle Scientist, Central Institute for Cotton Research, Nagpur, MS for permitting use of Binoculor for morphometric studies.

**Volume 6, Issue 2 (II)**
**April - June 2019**

**ISSN 2394 - 7780**


Journal No.: 63571

# International Journal of
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# Journal - 63571

## UGC Journal Details

| | |
|---|---|
| **Name of the Journal :** | International Journal of Advance & Innovative Research |
| **ISSN Number :** | |
| **e-ISSN Number :** | 23947780 |
| **Source:** | UNIV |
| **Subject:** | Multidisciplinary |
| **Publisher:** | Indian Academicians and Researchers Association |
| **Country of Publication:** | India |
| **Broad Subject Category:** | Multidisciplinary |


PRINCIPAL
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**International Journal of Advance and Innovative Research**
Volume 6, Issue 2 (II): April - June, 2019
ISSN 2394 - 7780

# COMPARATIVE STUDY OF ECONOMIC PARAMETERS OF DIFFERENT SILKWORM RACES OF BOMBYX MORI L. AFTER DRUG TREATMENT

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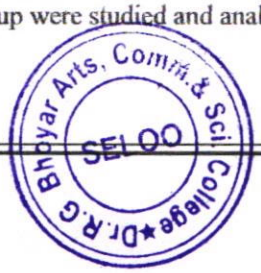
## ABSTRACT
*During large scale rearing of three commercial races, PM x CSR2, CSR2 x CSR4 and CSR4 x CSR2 of Bombyx mori the incidence of bacterial disease was observed mostly during rainy season. Various drugs such as Ampicillin, Chloramphenicol, Streptomycin and Penicillin and standard disinfectant Reshamkeet Aushadh were used against bacteria infected larvae and survival percent, various economic parameters compared and studied. The results obtained from present study showed that, out of the three hybrids, PM x CSR2 hybrid race is most suitable for Vidarbha region even at varied climatic conditions. During the adverse condition, the diseased larvae if treated with Chloramphenicol at early stages of infection, the menace due to disease could be controlled and cocoon crop yield may increase, which might attract more farmers to practice sericulture.*
*Keywords- Antibiotics, Chloramphenicol, Ampicillin, Streptomycin, Penicillin, Reshamkeet Aushadh.*

## INTRODUCTION
The newly evolved races CSR hybrids have been introduced in Vidarbha apart of Central India where temperature usually ranged higher as compared to other states. In the beginning of 2000 these hybrids PM x CSR2, CSR2 x CSR4 and CSR4 x CSR2 were introduced on a large scale to improve the cocoon production with less efforts, but these hybrids suffered crop loss at many occasions due to abiotic factors like temperature and biotic factors such as diseases caused by virus, bacteria and protozoa. The silkworm eggs received from National Silkworm Seed organization (NSSO), are screened only for the infection of protozoan pathogen, Nosema bombycis whereas no screening is done for BmNPV and bacterial infection. The transmission of BmNPV and Bacillus sp. was not known till recently, Khurad et al., (2004) reported the transmission of BmNPV virus and Rai et al., (2010) Bacillus sp. transmission from infected parent through embryo to the next generation.

Since the technique is still not known to detect the viral and bacterial infection at an early stage, these pathogens are constantly perpetuating in the silkworm seeds and the culture of onward generation. Hence the present study was undertaken on incidence of bacterial disease mostly during rainy season, control by treatment of drugs and comparative economic characters of hybrids of silkworm, B. mori has been observed. Thereby the most suitable hybrid for Vidarbha region is suggested.

## MATERIAL AND METHODS
During mass rearing of silkworm, the larvae with symptoms of bacterial infection were collected and haemolymph of the infected larvae was plated on agar and incubated at room temperature. The colonies of Bacillus sp. grown on the agar were observed, counted and used for further inoculation. A suspension of Bacillus sp. having concentration of about 5 x $10^7$particles/ml was prepared. The rearing of silkworm PM x CSR2, CSR2 x CSR4, CSR4 x CSR2 was undertaken and about 350 newly moulted healthy third instar larvae were selected from each hybrid. . All selected larvae were starved for about 10 - 12 hrs before the inoculation with B. sp. Out of selected larvae, 50 larvae from each hybrid kept as control group and fed with piece of mulberry leaf smeared with 2.5 µl of distilled water after air drying. Remaining 300 larvae of each hybrid were provided with mulberry leaf coated with 2.5 µl suspension of 5 x $10^7$ Baccilus spore/ml. The larvae, that consumed whole piece of mulberry leaf were separated and further reared by maintaining on fresh mulberry leaves up to cocoon formation. These inoculated larvae from each hybrid separated into six groups of 50 larvae and used for four antibiotic treatment, one group for Reshamkeet Aushadh treatment and one group reared separately as infected group.

Prior to the antibiotic treatment the larvae were screened with four different dosages such as 100, 50, 10 and 4 mg/ml of which 4 mg/ml dose of antibiotic was effective hence preferred. Commercial drugs such as Ampicillin, Chloramphenicol, Streptomycin and Penicillin and standard disinfectant Reshamkeet Aushadh were used against *Baccilus* inoculated larvae. During rearing, survival percent and various economic parameters of antibiotics treated, infected and control group were studied and analyzed.

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## RESULTS

### Survival percent of hybrids after antibiotics treatment

In PM x CSR2 at IV instar stage survival of control group was 96%, while infected group survived only 88%, whereas Chloramphenicol and Reshamkeet Aushadh treated groups showed 94%. At V instar stage the Chloramphenicol and Penicillin groups showed better survival than the other antibiotics treated groups. About 74% larvae went on spinning in control group while in infected only 10%. Streptomycin improved the survival to 40%, chloramphenicol 46%, more than the infected group. At the pupal stage better results obtained using the Chloramphenicol, then the Penicillin, Streptomycin, Reshamkeet Aushadh and Ampicillin (Table 1).

In CSR2 x CSR4 hybrid at IV instar Penicillin and Chloramphenicol showed good results and survival of larvae was close to control group, whereas at V instar stage survival reduced to 50% in Chloramphenicol and 48% in Penicillin treated groups. In Ampicillin and Streptomycin treated group 56% and 52% survival observed. At the spinning and pupal stages, Chloramphenicol and penicillin worked better and gave higher survival rate than the other treatments. Reshamkeet Aushadh did not perform well and lower survival was noticed however it was better than the infected groups (Table 1).

The IV instar stage of CSR4 x CSR2 larvae when treated with streptomycin the survival percent was similar as control group, which reduced to 66% during the V instar and only 32% larvae survived during spinning stage. By the time of spinning of the silkworm, the survival in penicillin and Chloramphenicol was 58% and 54%, similar to control, however it was reduced to 38 and 40% respectively when larvae reached pupal stage.

### Economic Characters

The results indicated that in PM x CSR2 hybrid race all the parameters such as; shell ratio, length and weight of filament and denier are higher than the treated groups. The result indicated that chloramphenicol treated group, improved the quality of cocoon produced. Thickness of the filament was 2.316 in control and the lowest was in infected 1.937. The other drug treated groups also improved the denier of the silk filament, however significantly lower than control (Table 2).

In CSR2 x CSR4 hybrid control group gave higher 1.26 g/cocoon having 0.254 shell weight and 20.15% shell ratio. Length of filament was also higher 680 m/cocoon with 2.276 denier, whereas cocoon from inoculated group showed weight of 0.837 g/cocoon, 0.148 g/shell, ratio 17.682%, length approximately 480 m/cocoon and1.687 denier. As observed earlier Chloramphenicol also improved all the characters as compared to infected larvae, however the improvement was comparatively lower than the control results. The use of Ampicillin, Streptomycin, Penicillin and Reshamkeet Aushadh lead to improvement in economic parameters of the cocoons but not up to the level of the control group (Table 3).

In CSR4 x CSR2 hybrid the cocoon weight was 1.252 and 0.568 g/cocoon in control and infected groups respectively. The application of Chloramphenicol although improved the cocoon and other economic characters, however it was still inferior to that of control group. The group received penicillin also showed improvement in overall characters of cocoon and filament. Reshamkeet Aushadh did not show any improvement as other antibiotic treated group; however the improvement was significantly better than the infected group (Table 4).

### Fecundity of females after antibiotics treatment (F1 fecundity)

Fecundity showed that female of control group laid eggs 723, 683 and 688 eggs whereas infected group laid 15%, 23% and 18% in PM x CSR2, CSR2 x CSR4 and CSR4 x CSR2 respectively. In PM x CSR2, after drug treatment, 69% eggs laid by the female over control, where as other groups showed the range of 24% – 49% over controls. In CSR2 x CSR4 hybrid the highest number of eggs, 59% laid against control, and the other groups showed 26% in Reshamkeet Aushadh up to 46% in Penicillin treated groups. Quite similar results have been observed in CSR4 x CSR2 groups where Chloramphenicol produced 415 eggs as compared to 688 eggs/female in control, which was about 60% of the number of eggs laid in controls. (Table 5)

## DISCUSSION

The fluctuation between day and night temperature and relative humidity prevailing in the rearing room are the important causes of infection in the silkworm larvae (Samson et al., 1990; Savanurmath et al., 1992). Rupasan and Gabriel (1976) reported that environmental factors especially temperature and humidity play a very important role during silkworm rearing in determining the cocoon characters and its existence in a particular zone. Watanabe (1919, 1928) and Kogure (1933) reported that, the quantitative characters of silkworm such as cocoon weight, shell weight, pupal weight, silk weight, filament length, filament thickness and survival rate of larvae in a known environment are of utmost importance in sericulture.

ISSN 2394 - 7780

The results of the present study showed that application of Chloramphenicol improved the larval characters, which was almost equivalent to the control larvae in all the hybrids. Percent survival of larval stages was also improved in the three races with the use of Chloramphenicol and Penicillin. The recovery from infection was highest in PM x CSR2 with Chloramphenicol and also overall characters of the silkworm such as cocoon weight, shell weight, denier and fecundity. Chloramphenicol improved the above parameters in other two hybrid races, CSR2 x CSR4 and CSR4 x CSR2. The oral administration of chemicals along with the feed (mulberry leaves) to silkworm, *Bombyx mori* is to increase the economical characters of the larvae/cocoons or to prevent the occurrence of the diseases. The studies conducted on these aspects have shown that use of chemicals can prevent loss of crop due to various diseases. Manchev et al. (1984), Rai and Devaiah (1988) and Sridhar et al. (2000) observed reduction in disease incidence due to use of antibiotics, drugs and vaccines.

**Table 1: - Survival % in infected and drug treated developmental stages in different races of silkworm, B. mori**

| Stage | Survival % (PM x CSR2) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Control | Infected | Ampicillin | Chloramphenicol | Streptomycin | Penicillin | Reshamket Aushadh |
| IV instar | 96 | 88 | 90 | 94 | 92 | 90 | 94 |
| V instar | 80 | 48 | 66 | 76 | 54 | 70 | 64 |
| Spinning | 74 | 10 | 30 | 46 | 40 | 42 | 22 |
| Pupa | 66 | 4 | 24 | 50 | 30 | 35 | 20 |
| | Survival % (CSR2 x CSR4) | | | | | | |
| IV instar | 92 | 80 | 85 | 86 | 82 | 90 | 84 |
| V instar | 74 | 30 | 56 | 50 | 52 | 48 | 42 |
| Spinning | 70 | 14 | 38 | 40 | 28 | 42 | 20 |
| Pupa | 56 | 5 | 36 | 42 | 24 | 39 | 15 |
| | Survival % (CSR4 x CSR2) | | | | | | |
| IV instar | 90 | 78 | 86 | 88 | 90 | 84 | 84 |
| V instar | 70 | 38 | 56 | 62 | 66 | 54 | 40 |
| Spinning | 58 | 12 | 32 | 54 | 32 | 58 | 19 |
| Pupa | 50 | 4 | 22 | 40 | 20 | 38 | 10 |

**Table 2:- Economic parameters recorded of infected and drug treated PM x CSR2 race of silkworm, B. mori**

| Group | Weight of Cocoon (gm) | Shell weight (gm) | Shell Ratio % | Length of filament (m) | Weight of filament(gm) | Denier | Fecundity | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Egg laying % | No.of eggs laid |
| Con. | 1.24 ± 0.0 | 0.27 ± 0.0 | 21.61 ± 0.2 | 715 ± 0.1 | 0.18 ± 0.1 | 2.32 ± 0.0 | - | 723 ± 23 |
| Ino. | 0.80 ± 0.0 | 0.12 ± 0.0 | 15.18 ± 0.3 | 432 ± 0.1 | 0.09 ± 0.1 | 1.94 ± 0.1 | 15 | 109 ± 26 |
| Amp. | 1.02 ± 0.0 | 0.20 ± 0.0 | 19.63 ± 0.3 | 474 ± 0.1 | 0.11 ± 0.0 | 2.18 ± 0.1 | 47 | 341 ± 20 |
| Chlor. | 1.10 ± | 0.24 ± | 21.41 ± | 672 ± 0.1 | 0.17 ± 0.0 | 2.28 ± | 69 | 499 ± |

ISSN 2394 - 7780

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0.0 | 0.0 | 0.2 | | | 0.1 | | 20 |
| Strep. | 1.09 ± 0.0 | 0.18 ± 0.0 | 17.03 ± 0.4 | 603 ± 0.1 | 0.15 ± 0.0 | 2.19 ± 0.2 | 43 | 310 ± 19 |
| Peni. | 1.11 ± 0.0 | 0.22 ± 0.0 | 19.78 ± 0.4 | 649 ± 0.1 | 0.16 ± 0.0 | 2.25 ± 0.1 | 29 | 209 ± 20 |
| R.K.O. | 0.99 ± 0.0 | 0.17 ± 0.0 | 17.00 ± 0.2 | 488 ± 0.1 | 0.11 ± 0.1 | 1.97 ± 0.9 | 24 | 170 ± 23 |

**Table 3:- Economic parameters recorded in infected and drug treated CSR2xCSR4 race of silkworm, B. mori**

| Group | Weight of Cocoon (gm) | Shell weight (gm) | Shell Ratio % | Length of filament (m) | Weight of filament (gm) | Denier | Fecundity | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Egg laying % | No. of eggs laid |
| Con. | 1.26 ± 0.0 | 0.25 ± 0.0 | 20.16 ± 0.2 | 680 ± 0. | 0.172 ± 0.0 | 2.276 ± 0.1 | - | 683 ± 21 |
| Ino. | 0.84 ± 0.0 | 0.15 ± 0.0 | 17.68 ± 0.3 | 480 ± 0.1 | 0.090 ± 0.0 | 1.687 ± 0.1 | 23 | 159 ± 24 |
| Amp. | 1.18 ± 0.0 | 0.22 ± 0.0 | 18.71 ± 0.4 | 651 ± 0.0 | 0.152 ± 0.0 | 2.095 ± 0.1 | 35 | 244 ± 21 |
| Chlor. | 1.21 ± 0.0 | 0.24 ± 0.0 | 19.83 ± 0.2 | 640 ± 0.0 | 0.158 ± 0.0 | 2.221 ± 0.1 | 59 | 405 ± 25 |
| Strep. | 1.12 ± 0.0 | 0.21 ± 0.0 | 18.72 ± 0.2 | 539 ± 0.1 | 0.116 ±0 .0 | 2.061 ± 0.1 | 34 | 238 ± 21 |
| Peni. | 1.16 ± 0.0 | 0.23 ± 0.0 | 19.53 ± 0.3 | 620 ± 0.0 | 0.140 ± 0.0 | 2.032 ± 0.1 | 45 | 311 ± 22 |
| R.K.O. | 1.11 ± 0.0 | 0.19 ± 0.0 | 17.05 ± 0.2 | 554 ± 0.1 | 0.122 ± 0.0 | 1.981 ± 0.1 | 26 | 180 ± 26 |

**Table 4: Economic parameters recorded in infected and drug treated CSR4 x CSR2 race of silkworm, B. mori**

| Group | Weight of Cocoon (gm) | Shell weight (gm) | Shell Ratio % | Length of filament (m) | Weight of filament (gm) | Denier | Fecundity | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Egg laying % | No. of eggs laid |
| Con. | 1.25 ± 0.0 | 0.26 ± 0.0 | 20.45 ± 0.2 | 655 ± 0.1 | 0.17 ± 0.0 | 2.28 ± 0.0 | - | 688 ± 23 |
| Ino. | 0.57 ± 0.0 | 0.10 ± 0.0 | 16.90 ± 0.4 | 400 ± 0.1 | 0.08 ± 0.1 | 1.84 ± 0.1 | 17 | 118 ± 23 |
| Amp. | 0.88 ± 0.0 | 0.17 ± 0.0 | 18.91 ± 0.3 | 649 ± 0.1 | 0.15 ± 0.0 | 2.10 ± 0.1 | 41 | 283 ± 22 |
| Chlor. | 1.11 ± 0.0 | 0.22 ± 0.0 | 19.80 ± 0.2 | 614 ± 0.1 | 0.15 ± 0.0 | 2.20 ± 0.1 | 60 | 415 ± 23 |
| Strep. | 0.95 ± 0.0 | 0.18 ± 0.0 | 19.16 ± 0.4 | 474 ± 0.1 | 0.10 ± 0.0 | 1.97 ± 0.0 | 38 | 260 ± 21 |
| Penicillin | 1.16 ± 0.0 | 0.23 ± 0.0 | 19.57 ± 0.4 | 618 ± 0.1 | 0.14 ± 0.0 | 2.04 ± 0.0 | 57 | 396 ± 20 |
| R.K.O | 0.84 ± 0.0 | 0.15 ± 0.0 | 17.72 ± 0.3 | 583 ± 0.0 | 0.13 ± 0.1 | 1.97 ± 0.1 | 24 | 166 ± 24 |

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ISSN 2394 - 7780


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ISSN 2394-5303

Issue-52, Vol-01 April- 2019

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Peer Reviewed International Refereed Research Journal

Editor

Dr.Bapu G.Gholap

www.vidyawarta.com

ISSN: 2394 5303 | Impact Factor 6.039(IIJIF) | Printing Area International Research journal | April 2019 Issue-52, Vol-01 | 01

आंतरराष्ट्रीय बहुभाषिक शोध पत्रिका

# प्रिंटिंग एरिया

Printing Area International Interdisciplinary Research Journal in Marathi, Hindi & English Languages

April 2019, Issue-52, Vol-01

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"Printed by: **Harshwardhan Publication Pvt.Ltd.** Published by **Ghodke Archana Rajendra** & Printed & published at Harshwardhan Publication Pvt.Ltd.,At.Post. Limbaganesh Dist,Beed -431122 (Maharashtra) and Editor **Dr. Gholap Bapu Ganpat.**"

Reg.No.U74120 MH2013 PTC 251205

**Harshwardhan Publication Pvt.Ltd.**
At.Post.Limbaganesh,Tq.Dist.Beed
Pin-431126 (Maharashtra) Cell:07588057695,09850203295
harshwardhanpubli@gmail.com, vidyawarta@gmail.com

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# Rural Marketing in India –A chronological study

**Prof. Dr. Parag R. Kawley**
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Lecturer
Vidyabharti College Ta. Seloo, Dist. Wardha

**ABSTRACT**

Rural markets of India have acquired consequence, as the taken as a whole development of the Indian nation has resulted into significant raise in the purchasing power of the rural community. It is the known detail that India's 75 per cent of the population reside in rural areas and 58 per cent of the in particular spending come from here. Rural Indians are capable to generate consequential command to the country's urban division. There are Increase in incomes, growing non-farm employment opportunities; higher aspirations and the Government's hub on rural sustainability schemes are main factors that have been dynamic the rural markets' development.

**Key words:** Rural market, Marketing Practices.

**INTRODUCTION**

It is the known fact that India's 75 per cent of the population resides in rural areas and 58 per cent of the in general consumption comes from there. Rural Indians are capable to generate important demand to the country's urban division. There are Increase in incomes, increasing non-farm employment opportunities, higher aspirations and the Government's hub on rural sustainability schemes are most important factors that have been dynamic the rural markets' expansion. Rural expenses was considerably higher at Rs 4,73,000 crores than urban consumption at Rs 3,98,600 crores between 2010-11 and 2012-13; in which rural using up per person outpaced its urban equivalent by 3 per cent, according to a study by CRISIL and preliminary data released for 2012-13 by the National Sample Survey Organization (NSSO).

The authentic income of rural households is expected to increase from 3.8% in the past two decades to 4.6% in the next two. Higher incomes and revelation to urban lifestyles have also raised the aspirations of the rural laypeople, as they endeavor to advance their worth of life by gaining entrance to new technologies, products and services.

**Rural Markets in India :**

The conception of Rural Marketing in India financial system has played a significant role in the lives of people. The rural market in India is not a split article in itself and it is extremely partial by the sociological and behavioral factors in use in the country. Rural marketing determines the moving out of business behavior bringing in the stream of goods from urban sectors to the rural regions of the country as well as the advertising of diverse products manufactured by the non-agricultural human resources from rural to urban areas. The rural market in India is enormous, speckled and offers a plethora of opportunities in evaluation to the urban sector. It covers the highest population and regions and by this means, the highest number of consumers.

**Objectives:**

To study the scenery of Indian rural marketing

To consider the rural marketing in India

**RURAL MARKETING CIRCUMSTANCES IN INDIA:**

**1. FAST MOVING CONSUMER GOODS:** FMCG companies have realized a considerable fraction of their sales from rural markets. They account

Peer Reviewed Referred and UGC
Listed Journal (Journal No. 40776)
ISSN 2277 - 5730

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QUARTERLY RESEARCH JOURNAL

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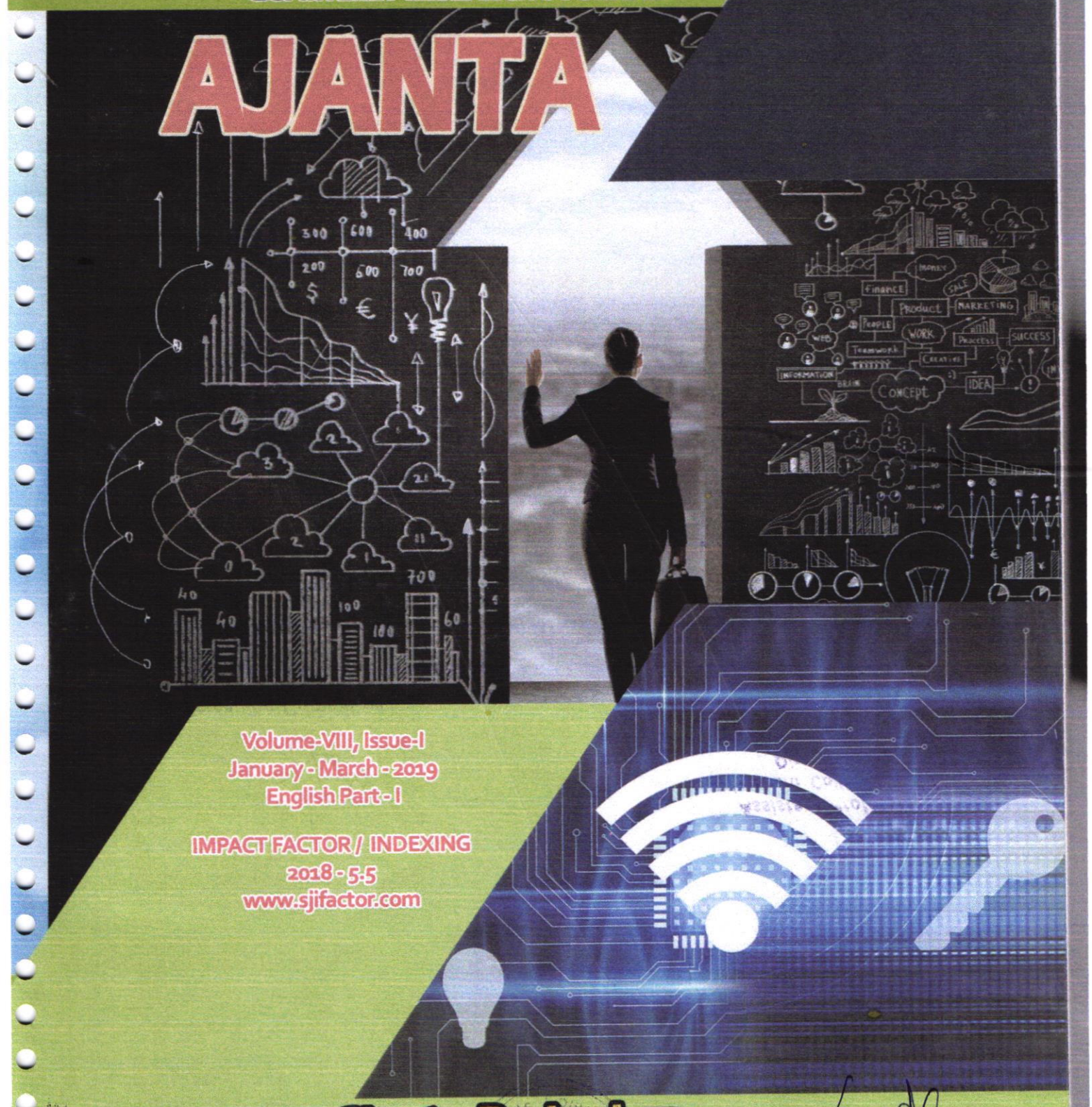


Volume-VIII, Issue-I
January - March - 2019
English Part - I

IMPACT FACTOR / INDEXING
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ISSN 2277 - 5730

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Volume - VIII Issue - I English Part - I January - March - 2019

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ज्ञान-विज्ञान विमुक्तये

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VOLUME - VIII, ISSUE - I - JANUARY - MARCH - 2019
**AJANTA - ISSN 2277 - 5730 - IMPACT FACTOR - 5.5 (www.sjifactor.com)**

# 15. Planning for Climate Change in Urban Areas : A Conceptual Framework

**Dr. Parag R. Kawley**
Asst. Professor, Vidyabharti College, Seloo, Ta. Seloo, Dist. Wardha.

**Abstract**

Climate change poses a serious threat to sustainable urban development, placing many cities at risk. Consequently, city authorities face the challenge of finding ways to include adaptation strategies into their work, although related knowledge and competence is still scarce and fragmented. With the aim of contributing to knowledge development and organizational learning, the objective of this paper is to critically review and compare current theoretical and practical approaches to adaptation planning in cities. First the conceptual characteristics and features of a climate-resilient city are identified. Second, the reciprocal linkages between climate-related disasters, urban form and city planning processes are analysed – by taking into account the life cycle of disasters from causes, to short- and long-term impacts, and post-disaster response and recovery. Finally, urban adaptation measures proposed for both developed and so-called developing countries are assessed. On the basis of the differences, gaps and synergies identified between theoretical and practical approaches to adaptation planning, the implications for improving sustainable urban transformation are discussed.

**Keywords:** Adaptation, Climate Change, Disaster, Risk Reduction, Urban Planning, Urban Resilience.

## Introduction

Climate change poses a serious threat to sustainable urban development, placing many cities at risk. The worldwide rate of so-called natural disasters has almost quadrupled in the last 35 years, resulting in escalating human and economic losses. Despite many uncertainties concerning the magnitude and frequency of hazards, and their specific impacts, climate change will inevitably increase the susceptibility of urban societies if no effective adaptation takes place. Historically, cities have been and often still are perceived as providing refuge from disasters and as buffers against environmental change. Today, however, they are better described as risk and disaster hotspots. The environmental changes humanity faces are deeply intertwined with complex urbanization processes and happen at a previously unseen rate and magnitude.

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ISSN 2277 - 5730

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QUARTERLY RESEARCH JOURNAL

# AJANTA

Volume-VIII, Issue-I
January - March - 2019
English Part - I

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ISSN 2277 - 5730

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Volume - VIII Issue - I English Part - I January - March - 2019

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Journal No. 40776

ज्ञान-विज्ञान विमुक्तये

IMPACT FACTOR / INDEXING
2018 - 5.5
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# CONTENTS OF ENGLISH PART - I

# 8. Investment or Insurance: A Common Man's Perspective in India

**Prof. Dr. Parag R. Kawley**
Asst. Professor, Vidyabharti College, Seloo, Ta. Seloo, Dist. Wardha.

**Abstract**

One big question in common man's life is: Which one you should prioritize: Insurance or Investment? Some people are either inclined to both of them. Some of them are so eager about any types of financial investments that could give them good reward and security in the long run. Example of these investments is stocks, gold, etc; while some are so concerned about having insurance in life. Some people claim insurance is an investment. Yes in some cases like for example a life insurance. Technically investment means:

Putting money into an asset and then grabbing the rewards later. A good example is when you buy a certain piece of real estate for a certain amount; when the price increase in the long run, if you sell it; you can reap profits or rewards. Remember that you have control when to liquidate or sell your investments. On the other hand, insurance means: 1.) Putting money into in the hope that when there is an emergency you will never run out of cash or your dependents. A good example is that if someone is hospitalized you will only pay a little and the insurance will pay the entire amount. Hence they are vice, but not versa.

**Key Words:** Insurance Sector, Investment, Bonds, Stocks, Mutual funds, Risks involved in insurance.

**Introduction**

Any well designed personal financial plan should include life insurance, savings and investments. Sometimes the lines that separate these three distinct financial products get blurred, because certain types of life insurance include saving and investing components. When it comes to planning your budget, examine all three of these categories separately for best results.

**Identification**

Savings is money that you set aside for emergencies or for big ticket items. These funds should be kept in a safe account that is readily accessible, such as a bank savings or money market account. Investments involve risk, but are also expected to produce a higher rate of return than savings. Investments may include stocks, mutual funds and real estate.

# A DESIGN OF NOVEL SYNTHESIS OF P- PHENYL ISONITROSO ACETOPHENONE AND THEIR ANTIMICROBIAL ACTIVITY

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**ABSTRACT**

**p-phenyl- isonitroso -acetophenone was synthesized. The Co(II), Ni(II) and Cu(II) complexes of ligand p-Phenyl- isonitroso-acetophenone (p-PINAP) have been synthesized and characterized on the basis of elemental analysis, conductivity, magnetic measurement, IR and electronic spectral studies. The conductivity data of the complexes suggests their nonelectrolyte nature. On the basis of these studies complexes of formula $Co(P\text{-}PINAP)_2$, $Ni(P\text{-}PINAP)_2$, and $Cu(P\text{-}PINAP)_2$ have octahedral geometry**

**Keywords: $Cu(P\text{-}PINAP)_2$, p-phenyl-isonitroso- actophenone , metal, complexes, spectroscopy, antimicrobial activity**

## 1 Introduction

The inclusion of biologically active ligand into organometallic complexes offers much scope for the design of novel drug with enhanced targeted activity.

Isonitroso ketones are of great interest since it has the ability to chelate metal ion through nitrogen and or oxygen donor centers. The interaction of metal ion with ligand containing oxygen and nitrogen as donor atom were undertaken by many chemist. Studies on such complexes indicate that new mechanism of action are possible when combining the bioactivity of the ligand with the properties inherent to the metal by Tomar et al.[1]. With significant development in the field of biological activity of metal chelates plays important role in treatment of biological disorder shown by Mahajan and Patil [2] .

The ligand p-bromo-isonitroso-acetophenone (p-BrINAP) and p-chloro-isonitroso-acetophenone (P-ClINAP) have also been studied by Bhandrakar [3] for few transition metals . Many researchers have screened Pd complexes for anticancer by Ali et al. [4] and antitumor by Malik et al, [5] activities with more or less success. Versatility of Schiff base ligands and biological, analytical and industrial applications of their complexes make further investigations in this area highly desirable. It was also established that the biological activity of Schiff bases is altered many folds on coordination with metal ions shown by Saraf et al. [6]. Keeping the above fact in our mind and in continuation of work on transition metal complexes with Schiff bases.

However, structural studies of the complexes of transition metals with p-phenyl-isonitroso-acetophenone have not been reported yet. The present paper describes the synthesis and characterization of complexes of transition metals Co(II), Ni(II) and Cu(II) with isonitroso p-phenyl-acetophenone on the basis of elemental analysis, IR Spectra, NMR Spectra, Magnetic properties and Antimicrobial activity.

### 1.1 Material and methods

All chemical used were of analytical grade and of highest purity available and used without further purification. Metal (II) chlorides and acetate salts were also obtained from Merck. Solvents used were distilled and purified before used.

**1.1.1: Preparation of Cu (p-PINAP) $_2$ :** Copper acetate solution was prepared by dissolving 0.199 g. in a minimum quantity of alcohol and equal volume of water was added. Similarly 0.450 g. of p-PINAP was dissolved in a minimum quantity of alcohol. The copper solution was added to the reagent solution drop by drop with constant stirring in conical flask.

PRINCIPAL

# SILICA-BORIC ACID ($Sio_2$-$H_3BO_3$): A MILD, EFFICIENT AND REUSABLE HETEROGENEOUS CATALYST FOR BOC PROTECTION OF AMINES

S. M. Thorat[a] ,Wasim. A. Khan[b] , M. T. Sangole[a,b,*]
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**ABSTRACT**
**An efficient method for *N-tert*-butoxy carbonylation of amines using silica-boric acid ($SiO_2$-$H_3BO_3$) as a new catalyst is described. The catalyst is air stable and can be readily separated from the reaction products and recovered for direct reuse.**
**Keywords: Silica-Boric Acid Catalyst, Protection of amines**

## 1.Introduction

Protection and deprotection plays a pivotal role for the synthesis of complex organic molecules. Amine is one of the most important functional group present in plethora of biologically active compounds. So, its protection plays a crucial role while designing the syntheses of bioactive molecules. Till now, many protective groups have been developed for the amine functionality. Out of these, *N-tert*-butyloxycarbonyl (Boc) has emerged as the most commonly used strategies due to the ease of protection as well as deprotection. This group is stable for various base-catalyzed nucleophilic substitutions and catalytic hydrogenation reactions.[1] Various methods are available for the *N-tert*-butyloxycarbonylation (Boc) under basic as well as Lewis acidic conditions using di-*tert*-butyl-dicarbonate ($Boc_2O$) that includes $I_2$,[2] $ZrCl_4$,[3] $HClO_4$-$SiO_2$,[4] $Zn(ClO_4)_2.6H_2O$,[5] ionic liquid,[6] Amberlyst-15,[7] sulfamic acid,[8] etc. However, most of the methods suffer from one or more drawbacks like highly basic conditions, elevated temperatures, long reaction times and high toxicity. To overcome these drawbacks still there is a need to develop a new catalyst system that can minimise these limitations. Recently, solid supported catalysts have attracted great deal of attention for carrying out important organic transformations. Supported reagents have good thermal and mechanical stabilities. These are more advantageous over homogeneous catalysts as they can be easily recovered from reaction mixture by simple filtration and can be reused several times, making the process more economically and environmentally viable.[9, 10]

One of the few solid supported catalysts is silica supported boric acid ($SiO_2$-$H_3BO_3$) as it is a simple, inexpensive reagent recently gaining momentum as a green catalyst in various organic transformations. It possesses environmentally benign properties such as non-toxicity, biocompatibility, recyclability, inexpensive and thermal stability. As an example, Parveen[11] *et al* utilized $SiO_2$-$H_3BO_3$ as an efficient solid supported recyclable catalyst for the synthesis of tetrazoles in high yields. Next, this elegant catalyst have been successfully utilized for the synthesis of bis(indolyl)methane derivatives,[12] β-amino carbonyl compounds,[13] etc.

Encouraged by these advantages, we herein report for the first time use of silica-boric acid ($SiO_2$-$H_3BO_3$) for *N*-Boc protection of amines. $SiO_2$-$H_3BO_3$ catalyst was prepared using standard procedure[14] and the structure was confirmed using IR spectroscopy.

## 2. Experimental

**Preparation of silica supported boric acid:** Boric acid (3.0 g) was taken in a 250 ml round bottom flask with 60 mL water and heated to 60-80$^0$C. Silica gel (60-120 mesh, 27.0 g) was added gradually with constant stirring and refluxed for 5 hrs. Water was evaporated under reduced pressure and the residue was stirred at 100°C for 6-7 hrs under vacuum to give free

Research Article | Published: 22 October 2018

# Scarab Beetles (Coleoptera: Scarabaeoidea: Scarabaeidae) of Vidarbha, India, with Notes on Distribution

Suvarna S. Khadakkar, Ashish D. Tiple & Arun M. Khurad

*Proceedings of the National Academy of Sciences, India ection B: Biological Sciences* **89**, 1239–1249 (2019)



## Abstract

Surveys for collection of scarab beetles of different habitats of the Vidarbha region of Central India were conducted during 2013–2018. A total of 97 species of 39 genera belonging to 07 subfamilies were identified, where 10 species were newly recorded. Subfamily Scarabaeinae is dominant with 57 species under 18 genera, followed by Melolonthinae with 13 species under 05 genera. Third abundant subfamily in terms of species richness is Rutelinae with 10 species under 04 genera. Cetoniinae contributed 09 species under 08 genera. Aphodiinae and Dynastinae contributed 04 and 02 species, respectively, whereas Orphinae added only 02 species. The most dominating subfamily Scarabaeinae can be further categorized into tunnelers, dwellers and rollers according to their functional group. Tunnelers contribute about 77.19% of the species composition of Scarabaeinae followed

Proc. Natl. Acad. Sci., India, Sect. B Biol. Sci.
https://doi.org/10.1007/s40011-018-1035-4

RESEARCH ARTICLE

# Scarab Beetles (Coleoptera: Scarabaeoidea: Scarabaeidae) of Vidarbha, India, with Notes on Distribution

Suvarna S. Khadakkar[1] · Ashish D. Tiple[2] · Arun M. Khurad[1]

Received: 7 May 2018 / Revised: 4 September 2018 / Accepted: 15 September 2018


**Abstract** Surveys for collection of scarab beetles of different habitats of the Vidarbha region of Central India were conducted during 2013–2018. A total of 97 species of 39 genera belonging to 07 subfamilies were identified, where 10 species were newly recorded. Subfamily Scarabaeinae is dominant with 57 species under 18 genera, followed by Melolonthinae with 13 species under 05 genera. Third abundant subfamily in terms of species richness is Rutelinae with 10 species under 04 genera. Cetoniinae contributed 09 species under 08 genera. Aphodiinae and Dynastinae contributed 04 and 02 species, respectively, whereas Orphinae added only 02 species. The most dominating subfamily Scarabaeinae can be further categorized into tunnelers, dwellers and rollers according to their functional group. Tunnelers contribute about 77.19% of the species composition of Scarabaeinae followed by rollers 14.04% and dwellers 8.77%. This study also provides the location-specific occurrence data of beetles from the investigated sites. The presented comprehensive checklist is unique in compiling economically and ecologically important scarab faunal diversity of Vidarbha region of Central India.

**Keywords** Scarabaeoidea · Scarabaeidae · Scarabs · Vidarbha · Dung beetles

**Significance statement** Considering the economical and ecological importance of scarabs, location-specific species occurrence data of this study prove to be a significant contribution for understanding the diversity and distribution pattern of various species of scarabs.

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Published online: 22 October 2018

## Introduction

Insects constitute the largest of all groups in the animal kingdom. Among them, coleopterans typically characterized by a pair of elytra comprise about 40% of all known species of living organisms with approximately 3,60,000 described species [1]. The superfamily, Scarabaeoidea of class Insecta, is a large, diverse and cosmopolitan group of robust-bodied, large-sized beetles. They are frequently brightly colored, and many bear charismatic horns and adornments. They are known as 'dung beetles' due to their coprophagous nature, whereas some are famous as 'rose chafers.' Due to the presence of lamellate antennae, they are also called as 'lamellicorn beetles.'

'White grubs' is the common name applied to the larvae belonging to Scarabaeidae, in particular to those of economic importance to agricultural crops [2]. Grubs of subfamily Melolonthinae, Rutelinae, Cetoniinae and Dynastinae are known to be pests of various agricultural crops such as sugarcane, groundnut and cotton.

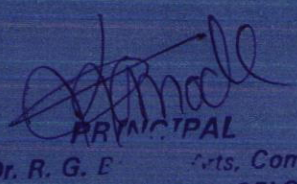
Understanding the ecology and documentation of occurrence data of scarabs is of utmost necessity due to their economic and ecological importance. Apart from their economic importance as pests, beetles of the family Scarabaeidae are indicators of environmental change [3]. Activity of beetles positively influences hydrological

Volume 6, Issue 2 (II)
April - June 2019

ISSN 2394 - 7780


Journal No.: 63571

# International Journal of Advance and Innovative Research


Indian Academicians and Researchers Association
www.iaraedu.com

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (II): April - June, 2019
ISSN 2394 - 7780

# DIVERSITY, SEASONAL DISTRUBUTION AND STATUS OF BUTTERFLIES IN SATPUDA BOTANICAL GARDEN, NAGPUR, CENTRAL INDIA

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**Abstract**
*A study was conducted to record the butterfly diversity and the status and occurrence of butterfly species in the Satpuda botanical garden within the Nagpur city, Central India, from 2006 to 2019. A total of 96 species of butterflies belonging to Papilionidae (06 species), Pieridae (13 species), Nymphalidae (35 species), Lycaenidae (30 species) and Hesperiidae (12 species) were recorded. Most species were observed from the monsoon (hot/wet season) to early winter (cool/wet season) but thereafter declined in early summer (March). Among the butterflies recorded, 15 species come under the protection category as per the Indian Wild Life Protection Act 1972. The observations support the high value of this city garden for conservation of butterflies and research on their biology.*

*Keywords: India, Butterflies, Satpuda botanical garden, Nagpur City, Status, Occurrence, Diversity*

## Introduction

Amongst the invertebrates, butterflies are becoming sufficiently well studied for them to be used for general conservation planning in some parts of the tropics as a representative insect group (Thomas, 1992). Butterflies are most beautiful and colourful creature on the earth and have a great aesthetic value, which make them very attractive. The butterflies are the very important unit of ecosystem due to the inter–relationship with plants diversity. Butterflies are very much important for the pollination as they visit to different flowers for the nectar feeding, which make them important unit of environment. Butterflies are also good indicators of environment changes as they are sensitive and are directly affected by changes in the habitats, atmospheric temperature and the weather conditions (Kunte, 2000; Tiple et al., 2006).

The Indian sub-region hosts about 1,504 species of butterflies (Tiple, 2011) of which Peninsular India hosts 351, and the Western Ghats 334. In Central India, the butterfly diversity was reported earlier by Forsayeth (1884), Swinhoe (1886), Betham (1890, 1891) and Witt (1909). D'Abreeu (1931) documented a total of 177 species occurring in the erstwhile Central Provinces (now Madhya Pradesh, Chhattisgarh and Vidarbha). Tiple and Khurad (2009) reported 145 species of butterflies recorded, of which 62 species were new records for Nagpur city.

The present study was started to examine the diversity; population across seasons and habitats of butterflies, since there was no known published checklist of butterflies in the Satpuda botanical garden and hence, the present work was initiated.

## Materials and Methods

The findings presented here are based on a field survey and investigation carried on a daily basis from 2006 to 2019 on the Satpuda Botanical Garden, Nagpur. The observations were made from 08.00hr to 11.00hr, which is a peak time for butterfly activity and they were found to do basking.

### *Identification of Butterfly Species*

Identification of the butterflies was primarily made directly in the field. In critical condition specimens were collected only with handheld aerial sweep nets and subsequently released without harm and identification with the help of field guides (Wynter–Blyth, 1957; Kunte, 2000). The observed butterflies were grouped in five categories on the basis of number of sighting in the field. The butterflies were categorized as VC- Very common (> 100 sightings), C- Common (51–100 sightings), NR- Not rare (16–50 sightings), R- Rare (2–15 sightings), VR- Very rare (< 2 sightings) (Tiple et al. 2006; 2007).

### *Study Area*

Nagpur city is the second capital of Maharashtra state and located in the center of India at 20° 9' N and 79° 9' E altitude. It has tropical dry equable climate having three main seasons: June/July wet Monson and its aftermath from June till October, the cool dry winter from October/November to February /March and the hot dry season from April till the onset of rains. Temperature of city ranges from minimum of 12-25°C to maximum 30-45°C with a relative humidity 10-15% to 60-95%. Annual precipitation is 1138.5 mm. Ninety percent of the precipitation takes place within four months, i.e., from June to September, July being the rainiest month. Satpuda botanical garden is located at west side of Nagpur spreading over 25 ha. Hill and Lake County (Futala)