



Food and Supplies Department, Govt. of West Bengal



DIRECTORATE OF INSPECTION AND QUALITY CONTROL

Inspection of a Food Storage Godown



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Topic: Storage of foodgrains

- ▶ Sub-topic (a): Matters related to Hiring/de-hiring of Pvt. godowns



Hiring/de-hiring of Pvt. godowns

- ▶ Proposals/requisitions for hiring/de-hiring or retention of Private godowns are received from DDPS, Food & Supplies Department in accordance with the requirements of the concerned DCF&S,
- ▶ As per **2713/FS/P/Sectt./GE&EM/4M-46/2015** dt.29-08-2017, Tender(s) are floated online/offline for hiring of Private godowns with specific requirement by the WBSWC,
- ▶ The offered godowns are first inspected by the DCF&S and the team of DDPS+WBSWC,
- ▶ If found suitable, the **L1 Bidder** of that suitable private godown are hired by the WBSWC and offered to DCF&S for storage of CMR,
- ▶ Agreement with the concerned private owner of the hired godown is done on KMS basis.
- ▶ Rents are paid to the owner on the discovered L1 rate or the LA Collector assessed rate, whichever is lower, along with electricity bills,



Hiring/de-hiring of Pvt. godowns

- ▶ Handling Contractors of the near most WBSWC godowns are tagged with the private godowns,
- ▶ Staffs/ security guards are employed by the WBSWC from its pool or from the pool of DCF&S,
- ▶ WBSWC shall not store any hazardous/inflammable material in such godowns,
- ▶ Repairing, day to day maintenance are the responsibility of the godown owner, so the payment of taxes and maintenance of weighbridge,
- ▶ Foodgrains damaged due to rainwater due to constructional defects is the liability of the godown owner,
- ▶ De-hiring notices are served one month ago and at the same time the godown owner may also request to vacate the godown at least three months ago
- ▶ Prior to de-hiring, stock must be exhausted and online records shall be updated



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Topic: Storage of foodgrains

- ▶ Sub-topic (b): Engagement of Handling Contractors



Duties of Handling Contractors - 1

- Engagement of competent and adequate staffs and labours in the godown having the job cards,
- Unloading/Loading of Food grains bags from/into the trucks/ vehicles/ carts etc.
- Stacking/ de-stacking, bagging , re-bagging, weighment, standardization, cleaning of rice wherever/whenever necessary,
- Preservation and Quality Control Management (Except PEG),
- Furnishing correct and upto date position/information/ progress of work statement and accounts,



Duties of Handling Contractors - 2

- Contractor shall be responsible for the good conduct of their employees and shall compensate the corporation for losses arising from neglect, carelessness, want of skill or misconduct of themselves, their servants or agents or representatives,
- Contractor shall be solely responsible for compliance of all applicable laws and the statutory provisions enshrined therein and shall specifically ensure compliance of all such various Laws, Acts etc., including but not limited to the following:
 1. Contract Labour (Regulation & Abolition) Act 1970 and Rules made there under.
 2. The Employees (Provident Fund & Miscellaneous Provisions) Act 1952.
 3. The Employees State Insurance Act 1948 wherever applicable (in case ESI Act is not applicable the Workmen Compensation Act 1923 and Maternity Benefit Act 1961 will be applicable).
 4. The Minimum Wages Act 1948.
 5. The Payment of Bonus Act 1965.
 6. The Payment of Gratuity Act 1972.
 7. The Payment of Wages Act 1936.
 8. The Motor Vehicle Act 1988.



Duties of Handling Contractors – 3

- Liable for any loss which the Corporation/DCF&S may suffer on account of the bags not being properly handled,
- Ensure that their workers do not use large hooks for handling of foodgrains at any stage,
- Shall strictly abide by all rules and regulations of Police, Municipal authorities and other local bodies,
- Under no circumstances, the contractor or labourers engaged by him in any godown shall collect any money for the aforesaid works from any third party, like, MR Distributors/ Wholesellers/ Rice Millers/ FPS Dealers etc. for unloading/ loading of the bags of foodgrains from/to the vehicle or any other activities



Procedures followed for engagement of Handling Contractors

- ▶ Through e-Tender in the Govt. portal
(<https://wbtenders.gov.in>)
- ▶ All necessary requirements/ qualifications/ dis-qualifications/ documents that are required to be uploaded shall be specified clearly in a standard format,
- ▶ Duties, responsibilities, liabilities, penalties etc. shall be clearly mentioned in the Tender,
- ▶ Evaluation and acceptance of bids shall also be mentioned in the bid document



Procedures followed for giving payments to the Handling Contractors

- ▶ Following the terms and conditions of the Tender, SOP, Orders,
- ▶ Stock handled (in and out) in a month shall be tallied with online records as well as certificates given by the Godown In-charges,
- ▶ Stack heights following the standard norms and calculations shall be checked,
- ▶ Deductions shall be made as and where applicable,
- ▶ Bills shall be cleared within a month after receiving the same following the SOP



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Topic: Storage of foodgrains

► Sub-topic (c): Up-keeping of godowns



Up-keeping of godowns

- Maintenance of cleanliness of godown inside & surroundings,
- Arrangement of proper security,
- Arrangement of proper lighting, drainage, washroom etc.,
- Arrangement of Fire fighting systems,
- Arrangement of other necessary infrastructures like weighbridge, computer with internet, QC equipment and chemicals, chair, table, required registers etc.
- Receiving, maintenance and delivery of stocks maintaining quality, quantity etc.
- Regular inspection, Physical Verification (P.V.) etc.



Maintenance of cleanliness and hygienic conditions

- ✓ Cleaning of entire godown premises, removal of all waste materials from the complex and cleaning of Alleyways & Gangways inside the godown chambers by sweeping on regular basis to avoid cross-infestation,
- ✓ Arrangement of lighting, ventilation etc. inside the chamber,
- ✓ Bagging of spillage rice on daily basis in Empty Gunny Bags (palla bags),
- ✓ Filling of rat holes with stones, muds and cements with prescribed pest-control medicines,
- ✓ Informing the District Authority or WBSWC on any minor or major structural defects of roof, floors, ventilators and walls of the godown for undertaking repairing/renovations works as soon as possible to keep it storage worthy



Receiving of stocks

- ✓ Disinfestation of godowns following the latest G.O./ SOP,
- ✓ Programme for receiving CMR should be given as per RRO validity dates issued to concerned Rice Millers,
- ✓ CMR should be received from authorized representatives of the Rice Mill on production of valid RRO and necessary entries in the portal,
- ✓ Sample should be drawn from each truck by the concerned Quality Control Trained Inspectorate staff for quality analysis so that only FAQ rice are received and the same should be recorded in relevant physical Registers and WQSC and Stack Cards,
- ✓ Stacks should be built according to stack plans. In case of deviations, necessary permission should be taken from District Authority,
- ✓ All necessary entries shall be done with utmost care in the godown management portal and shall be verified on regular interval



Maintenance of stocks

- ✓ All chambers of godown should be opened on all days,
- ✓ Surface of the bags and the floor of the godown should be cleaned regularly,
- ✓ Purchase of all required medicines/ chemicals,
- ✓ QC treatment of the stock on a regular interval, as per prescribed G.O./ SOP,
- ✓ Categorization of the stock following the G.O.,
- ✓ Fumigation of stock as and when required,



Delivery of stocks

- ✓ Delivery of CMR should be scheduled in accordance with DO dates,
- ✓ Stocks of rice should only be delivered to the authorized representatives of MR Distributors accordingly on production of valid DO,
- ✓ Sampling of delivered rice should be done in presence of authorized representatives of concerned MR Distributors or lifting agents by the QC Inspector during delivery operation,
- ✓ All necessary entries shall be done with utmost care in the godown management portal and shall be verified on regular interval,
- ✓ Requisition for Empty gunny Bags to be used as Palla Bags for at other godown which are not managed by WBSWC should be given in advance before starting of new KMS.



Regular inspection

- ▶ Inspections shall be done in regular interval following the SOP,
- ▶ DCF&S in at least one godown in each week, ADCF&S/SCF&Ss in at least two godowns in a week or following the SOP/G.O. in this respect,
- ▶ Noting shall be done through mobile App/ written report/ in registers lying in the godowns,
- ▶ Minor corrective measures shall be taken at the time of inspection itself



Physical Verification (P.V.)

- ▶ PV is mandatorily to be done twice in a year, if not more,
- ▶ All other operations like receipt/ delivery of stocks shall be stopped at the time of PV,
- ▶ Presence of all staffs/ officials in connection with PV/ godown officials/ Handling Contractor/ Labours shall be ensured,
- ▶ Opening/Closing balance as well as all stocks that has been received and delivered from the godown shall be verified from the date of last PV and talied with that PV report,
- ▶ PV report of all godowns shall be verified and finalized and updated with online records,
- ▶ In case of any mismatch, in online and physical stock, the DCFS shall immediately intervene and bring it to the notice of ITR Cell, if there is any technical glitch



Godown Inspection

- ▶ Selection of site
 1. Pucca Approach road
 2. Not present in low-lying areas
 3. Away from residential locality
 4. Not affected by big trees
 5. Must have connection with high-road
 6. Proper drainage facilities must be there
 7. Surrounded by boundary walls
 8. Away from chemical industries & crushing mills



Plinth Height



➤ The height of the finished floor of the lowest floor level (base) above the ground level.

➤ It is needed for controlling rodent pest (rat, mouse, etc), water logging situation, seepage of water as well as facilitating loading and unloading.



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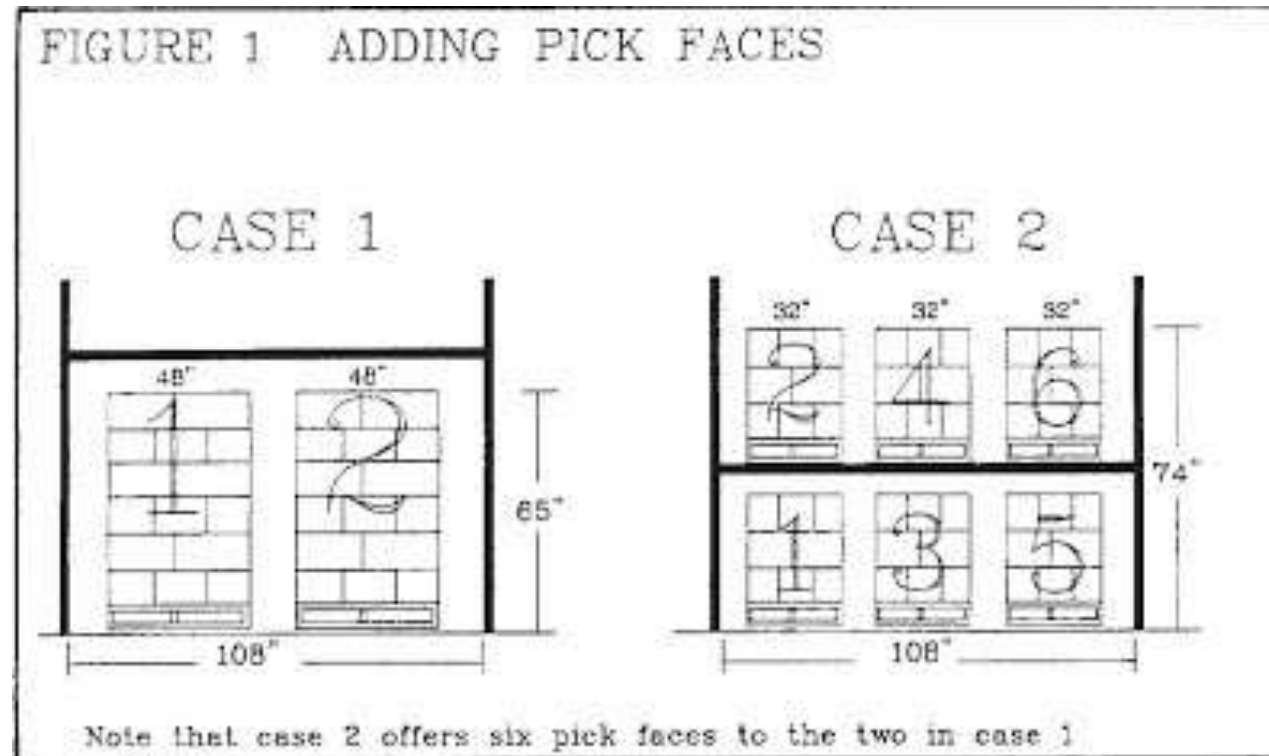
Doors, Ventilators and Aeration



Use: Maintains equilibrium in moisture level, temperature and proper entry of light.



Stack Plan



Stack Size 30'x20'

A model stack plan should be marked neatly in bold on the floor as well as on the nearby wall also.



Wooden crate

Dunnage

Used to check migration of moisture from the floor to the foodgrains



Polythene sheet

Bamboo mats





Types of stacking



Thappi stacking/ Bangla stacking:
Used in transit storage or storage for small time, having less strength, height also less and may break down easily.



Types of stacking



Cross stacking:
Used in scientific godowns for long storage, having good strength, less risk for break down, **but cannot be delivered partly.**

The total stack should be delivered at a time.



Types of stacking

Block stacking:

Used in scientific godowns for long storage, having good strength, less risk for break down, easy to count and can be delivered partly or full.



Stack Card

- Each stack must have a separate stack card. Quantity of receipt and delivery of stock is given on front side of the card.
- On the reverse, the condition of the grain, classification and categorization of stock and disinfestation treatments given to the stocks from time to time are recorded.
- The stack card shall be preserved till stack account is settled or till the period prescribed for its preservation, whichever is later.



Maintenance of Godown

The godown shall conduct fortnightly inspection of all the deposited food grains to ensure:

1. Hygienic condition
2. Keeping the stock clean
3. Free from insects, pests and rodents so that quality of food grain is maintained.

The stored food grains should be physically counted and tested periodically and quantities tallied with the records; should physically be verified by an employee independent of the storage.



Maintenance of Godown

- The godown shall have adequate facilities for undertaking periodic disinfection treatments and to perform fumigation of the commodities.
- The godown shall have adequate number of equipment and accessories including personal protection equipment (PPE) and recommended pesticides, rodenticides and fumigants for insect and rodent control.
- The Inspectorate cadre staff shall have detailed knowledge for fumigation of goods that require fumigation along with the process and periodicity of fumigation.



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Maintenance of Godown



- Good Hygiene and sanitation shall be maintained in and around the godown and for this, areas surrounding the godown also should be cleared of shrubs/bushes etc. and drainage maintained clean.



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Maintenance of Godown



- Check the godown regularly for any leakage in the roof, gaps in the walls / window / ventilation pans allowing entry of rain water or entry of birds.



Maintenance of Godown



The floor / walls shall also be checked for cracks / crevices and necessary repairs shall be carried out before accepting stock in the godown. The wall surfaces, wall roof joints, roof trusses, ventilators, doors, pillars etc. should be swept/brushed.



Maintenance of Godown



Stocks requiring **aeration** shall be given aeration during dry and cool days (not on rainy days). This shall be accomplished by keeping doors and ventilators open for natural flow of air through the godown or by using exhaust fans.



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SAMPLING OF FOODGRAINS



Sampling

Drawing a representative sample is an important and essential part of quality assessment of grain at various stages. If the sample obtained is not representative, no amount of care in further analysis will establish true quality of grain.

The sampling is to be done as per BIS method for sampling of Cereals and Pulses IS: 14818-2000 as amended from time to time.





Sampling Instruments from bags



Parkhi: Used for collecting of small quantity of sample from bags.



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Sampling Instrument from bulks



Multi-slot hand Spear: Used for collecting of sample from bulks.



Steps of sampling:

Primary sample: Samples are collected from each bag to identify homogeneity of the bags and are used to make a composite sample.





Steps of sampling:

Composit sample: A mixture of Primary sample which are collected from individual bags.





Steps of sampling:

Representative Sample: A representative sample is a sample which represents the whole characteristics of a stock and was formed by dividing the composite sample.





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Sampling from Bag Storage





Sampling from Bulk Storage





Preparation of Representative Sample by using Sample Divider

A “Composite Sample” of about 2500 g shall be drawn

- ▶ The composite sample shall be reduced to about 500 g by dividing on a sample divider.



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Sample Divider (Boerner Type)

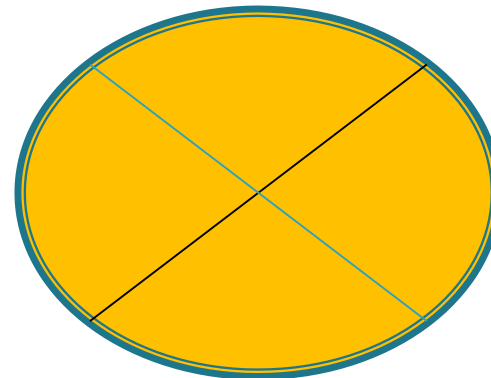




In case sample divider is not available

Coning and Quartering Method

- ▶ Mix the sample thoroughly on a clear non-absorbent surface.
- ▶ Draw the grain into a conical heap.
- ▶ Flatten the top of heap and divide into quarters.
- ▶ Reject the two diagonally opposite quarters and mix the remaining two.
- ▶ Repeat the complete process until the required laboratory sample is obtained.





Coning and Quartering Method





Coning and Quartering Method





Coning and Quartering Method





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Sample Slip

Camp:

Stack / Truck number: 1/2/6 Or WB 1234

Name of the commodity & Variety:

KMS year:

Date of receipt:

Source of receipt:

Number of bags:

Quantity:

Date of sampling:

Designation & signature of
the Representative

Designation & signature
of Sampler



Quality Control related Issues of Godown

The godown shall conduct fortnightly inspection of all the stored foodgrains to ensure:

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INSECT PEST OF STORED FOODGRAINS AND THEIR CONTROL



IMPORTANT SOURCES OF PEST INFESTATION

- ▶ Field infestation
- ▶ Infested godowns
- ▶ Infested stocks
- ▶ Infested gunny bags / containers
- ▶ Infested transport
- ▶ Natural source of infestation
- ▶ Machinery used in harvesting and post harvesting operations / processing of food grains and grain products



COMMON INSECT PEST IN STORAGE GRAIN PRODUCTS



Groundnut beetle
Caryedon serratus



Rice weevil
Sitophilus oryzae



Lesser grain borer
Rhyzopertha dominica



Red flour beetle
Tribolium castaneum



Khapra beetle
Trogoderma granarium



Cigarette beetle
Lasioderma serricorne



Indian meal moth
Plodia interpunctella



Potato tuber moth
Phthorimaea operculella



Angoumois grain moth
Sitotroga cerealella



Rice moth
Corcyra cephalonica



DETECTION OF VISIBLE INFESTATION

- ▶ Sieving
- ▶ Agitation of sacks
- ▶ Disturbance of stack or bulk surface
- ▶ The feel of grain in bulk
- ▶ Traps: (a) tube traps, (b) sticky traps
- ▶ Artificial crevices
- ▶ Dead insects
- ▶ Spray to stimulate insect activity
- ▶ Grain temperature and moisture content
- ▶ White spots



Rice Weevil : *Sitophilus oryzae*

Adult live for 3-6mths,
2.5- 4 mm long,

Egg: 150/F

Hatch

Larval period 4-10 wks,
legless

Life cycle: 4-12months

Temp: Max 15-34°C

RH: >40%



Male: short
Snout
irregular
pits;

Female:
long Snout
regular pits



Female lays the egg within grain and hole is plugged with waxy secretion; larva concealed within grain; cosmopolitan; cannibalistic behavior





Lesser grain borer, *Rhizopertha dominica*

Order : Coleoptera

Family: Bostrychidae



Stages of development



(1) Egg



(2) Larva



(3) Pupa



- Body is cylindrical; 2 – 3 mm long
- Head invisible (concealed) from above; pronotum has rows of teeth
- Antennae with large, loose 3-segmented club
- Wings have rows of punctures





KHAPRA BEETLE TROGODERMA GRANARIUM



LARVA



ADULT



Khapra Beetle larva and adult





Red flour beetle (RFB)

Tribolium castaneum

Identification:

- Head is visible from above
- Adult beetles very active, strong flyers
- Antennae abruptly enlarged at the terminal segments
- Eyes close to each other
- Side of thorax curved
- Long-lived (3 yr) adult female, ~1000 eggs
- Sticky eggs laid on sacks, in cracks or on food
- 3 to 4 months per generation





Red Flour Beetle: *Tribolium castaneum*

Adult live for 4-10 months, 3-4mm long, strong flier,
Egg: 450-500/F
Hatch in 5-6 days
Larval period 4-10 wks
Life cycle: 4-12 months
Temp: Max 40°C Min 20°C RH: >1%



Secretes methyl and ethyl Benzoquinones (which are Cancer-causing) and volatile compounds from Thoracic and Abdomen glands



Secondary Pest, Cannibalistic Behavior, Abrupt Antenna-3 Terminal Segments; Cosmopolitan





Oryzaephilus surinamensis

Order: Coleoptera
Family: Silvanidae



Stages of development



(1) Egg



(2) Larva



(3) Pupa



Sawtooth vs. Merchant grain beetles

- Sawtoothed grain beetle: *Oryzaephilus surinamensis*
- Merchant grain beetle: *O. mercator*

Important characters:

- Flattened beetles & larvae (mouthparts directed forward)
- Prothorax with saw-like projections
- Forewings with ridges
- Females can lay 250 eggs on grain
- Pupation in grain by binding damaged seeds
- Saw-T beetle is flightless





Grain moth damage

- First reported from France in 1736
- Most destructive insect of grain in USA, esp. corn
- May also attack developing wheat grain in field
- Adult moths do not feed on grain
- Eggs laid in clusters on grain>>produces larvae that feed in masses
- Larvae feed on starchy portions of seed, adult escapes from a circular exit hole
- There could be 6 generation





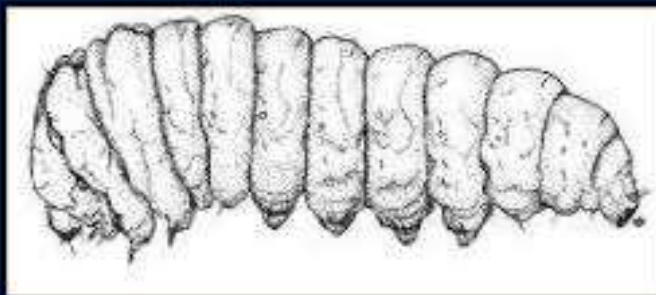
Angoumis grain moth

Sitotroga cerealella

- First site of infestation in USA was North Carolina

Identification:

- Adult moth is small (2/3 inch), brownish gray with long fringes of hair on wings
- Hindwings extended at the apical angle (arrow)
- Larval and pupal stages remain inside seed





1. Angoumois grain moth:

Sitotroga cerealella
(Gelechiidae: Lepidoptera)





PULSE BEETLE *Callosobruchus chinensis*



Order : Coleoptera
Family : Bruchidae

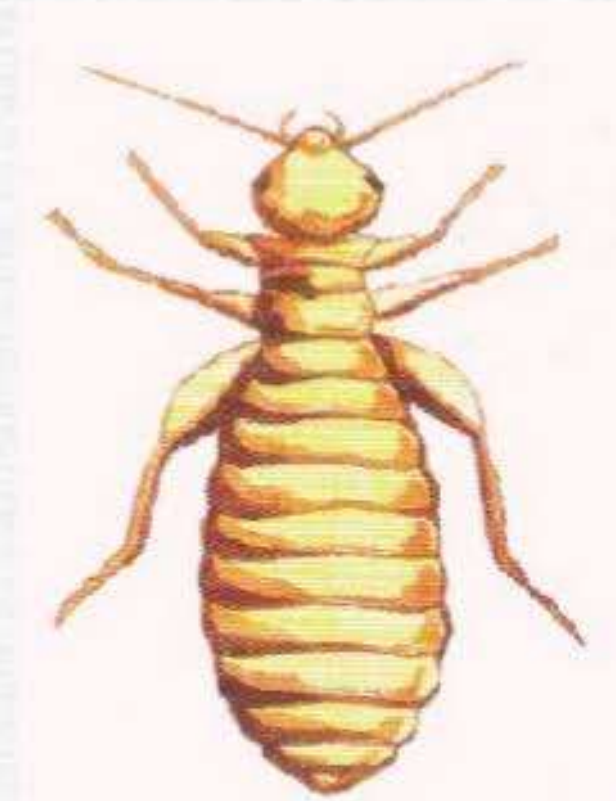
Stages of development





LIPOSCECELIS SP. GRAIN LICE / PSOCIDS

- **Appearance:** Adult is 1 mm long; white to grey in colour.
- **Life Cycle:** The life cycle from egg to adult takes about 21 days at 30 ° C and 70% R.H..
- **Damage:** Being scavenger, affects germ portion of whole grains having high moisture contents.





Insect Attacking Stored Grain

Key pest types:

Beetles & weevils

Moths

Insects: hard exoskeleton,
three part body (head thorax,
abdomen), jointed
appendages, legs never >3
pairs

Mites (non-insectan)

Arachnids: two body regions
(head+thorax fused, large
abdomen), jointed
appendages but >3 pair legs
normal

HEAD

PROTHORAX



ABDOMEN



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Some common approved and registered insecticides used for prophylactic treatments are:-

Sl. No.	Common Name	Trade name	Dilution, rate of application & source of availability
1.	Malathion 50% EC	(Cythion)	1:100 @ 3 lit/100 m ² M/S. Cyanamid India Ltd. P.B. 9109, Bombay.
2.	Pyrethrin 2.0%	(Pyrethrum)	1:300 @ 3 lit/100 m ² M/S. Bombay chemical Pvt. Ltd.
3.	DDVP 100% EC (Dimethyl Dichlorovinyl phosphate)	(Divipan/ Nuvan)	1:100 @ 3 lit/100 m ² M/S. Tropical Agro System Ltd., Madra.
4.	Pirimiphos methyl 50% EC	(Actellic)	1:100 @ 3 lit/100 m ² M/S. Alkali & Chemical Corpn. Of India Ltd., New Delhi.
5.	Deltamethrin 2.5%W.P.	(K-othrine)	40 gm/lit @ 3lit/100 ² M/s. Roussel Pharmaceutical Ltd., New Delhi 110 001.



Curative treatment / fumigation by Aluminium Phosphide (covered fumigation / chamber fumigation)

Dosage and exposure period of the common fumigant is given below:

Name of the fumigant	Dosages		Exposure period
	Per ton	Per cubic meter	
Aluminium phosphide	2-tablets (3-gm each tonne)	1.5 gm	7 days



Covered fumigation by polythene cover





Covered fumigation stack covered and made air tight with sand snakes





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Covered fumigation





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Rodent Pest Management



RODEN

T

- ❑ The Rodent word is derived from Greek word, *Roder* which means to gnaw.
- ❑ Ranging in size from the smallest mice to larger species such as porcupines, rats, squirrels, prairie dogs, beavers. Also includes guinea pigs, hamsters, rabbits, hares, pikas, etc.
- ❑ Its order is Rodentia; they are characterized by a single pair of continuously growing incisors in each of the upper and lower jaws.
- ❑ About 40% of all mammal species are rodents.



Characterist

1. The incisors grow continuously through out the animal life.
2. They are strongly curved .
3. These incisors have thick layers of enamel
on the front but little enamel on the back.
4. While the largest species, the capybara, can weigh as much as 66 kg, most rodents weigh less than



RAT

- The rodents commonly known as rat, is a major enemy of mankind.
- It is essentially a pest of food and fodder.
- Rats comprise a major group of pests, which are of great economic importance due to their destructive role in creating shortage of food and other daily use



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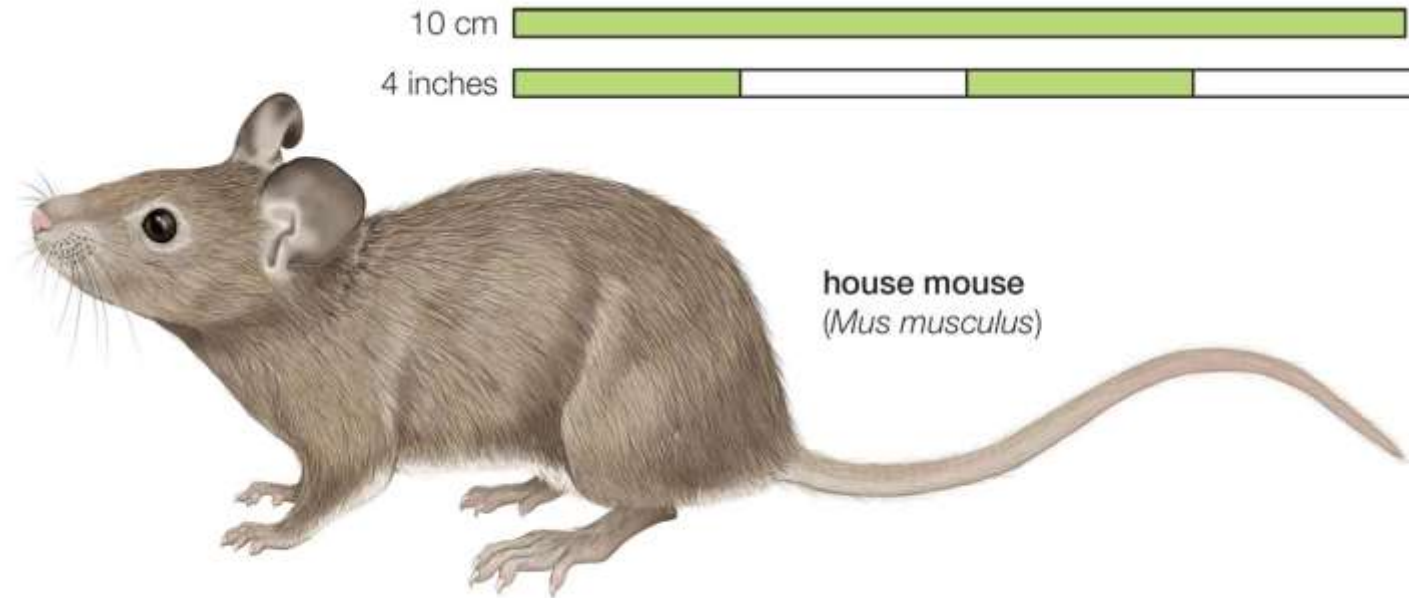
- They have only one pair of chisel shaped incisor teeth in both the lower and upper jaws and no canines.
- Wide gap present between the paired incisors.
- The habit, nature, behaviour and ecological adaptation of rodents have become major factors for their wide distribution and enormous population.
- Since 1975 Rat identified as a “National Pest” and enemy number one of mankind by ICAR .



- Some of the important rodent species associated with the grain storage/field crops are given below :–
- 1. Rattus rattus. (House rat)
- 2. Mus musculus. (House mouse)
- 3. Bandicota bengalensis (Lesser bandicoot or Indian mole rat)
- 4. Bandicota Indica (Large bandicoot rat)
- 5. Rattus norvegicus (Brown rat/ship rat)



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house mouse
(*Mus musculus*)

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Identification of House Mouse are as follows–

- i) Dark brown to sandy brown with short hairs and under part whitish to light grey.
- ii) Rounded eyes can be stretched.
- iii) Average weight is 25 to 45 gms .
- iv) Tail is usually longer than body plus head.



Identification of Black Rats are as follows–

- i) Soft grey to black coloured, hairs on belly rough with rusty tinge.
- ii) Small eyes, large sparsely haired ears.
- iii) Snout is pointed.
- iv) Tail is equal to the size of the body plus head.



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Bandicota bengalensis
(Lesser bandicote Rat)



Bandicota Indica
(greater bandicote Rat)



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**Rattus
Norvegicus
(Ship Rat/Brown
Rat)**



**Tatera Indica
(Indian Gerbil)**



HABITS

- Rats are very clever & suspicious animal by nature and have distant reaction to the new objects called Neophobia.
- Water is essentially required daily by the rodents, but mouse can survive without water for many days. Rats can survive without food up to a week but it cannot survive without water continuously for more than 3 days.
- They become worried as and when a



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- Their feeding times are normally confined between dusk and dawn.
- The rodent normally runs along the walls . A hole of 1.25 cms in diameter is sufficient to allow the entry in to godown.
- For mice, lesser diameter of hole or gap between doors and wall is sufficient, size being 0.6 cms.



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NATURE OF DAMAGE

1. Rodents not only feed on grains but also contaminate 20 times more than what they consume with their faeces, urine, hair and even some times with their own dead bodies.
2. On an average each rat drops 25 to 150 pellets of faeces, 15 to 25 ml urine and shed 500000 hairs daily.
3. Gunny bags are torn by rats which leads to spoilage of foodgrains.



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4. Rats are known to eat the grains partly and also to eat its embryo part making it unfit as seed leading to waste.
5. The rodents damage the foundations of the building and other articles of daily use.
6. Besides they transmit at least 35 types of communicable diseases to man.



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EXTENT OF DAMAGE

1. The estimate of foodgrain losses by rodents in India range from 2.4 million tonne to 26 million tonne per year.
2. According to an estimate, 6 rats eat one man's food daily and there are 2400 million rats in India.
3. According to Panse's report about 2.5% losses in storage are caused due to rodents.
4. The rodents on an average consume food grains about 8 to 15% of their body



BIOLOGY

- Rodents are prolific breeders, highly adaptable and versatile feeders.
- Life span is about a year. They mature in 3 to 5 months. But in case of Mus musculus life span is more than one year, even 2 years and sexual maturity attains at 1.5 months.
- The gestation period is 3–4 weeks. There are about 4–6 litters per year, with 3–8 young ones in each litter.
- In this way a pair of rat can make 800 rats in a year & the population of rats is 6 times



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DETECTION OF RAT INFESTATIONS

- (i) Visual sighting or sounds
- (ii) Rats holes
- (iii) Scraps
- (iv) Rat droppings
- (v) Foot or tail marks
- (vi) Gnawed articles
- (vii) Rat runs/tracks with greasy marks
- (viii) Pet excitement
- (ix) Rat urine/odours marks
- (X) Disappearance of bait



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RODENTS PEST MANAGEMENT (Physical Methods)

Pest management is essentially to apply integrated approach according to various biotic and abiotic factors. Like other pest control operations rodent control can also be achieved by non-chemical and chemical methods.



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Environmental Manipulation	Mechanical	Physical	Biological
Maintenance of Hygiene & Sanitation Rodent Proofing	Killing of Solitary Rat by Stick / Broom / Some other means Trapping Use of sticky	Use of Ultrasonic Devices	Predators (Snakes, Owls, Mongoose, Eagles) Parasites, Pathogens



Poisons

Poisons used for killing the rodents are known as Rodenticides and being poisonous are to be used carefully because of hazards to other animals.

The efficacy of a rodenticide under field/godown conditions depends upon various factors such as

- a. Toxicity,
- b. Dose level,
- c. Degree of acceptance,
- d. Reacceptance,
- e. Development of tolerance,
- f. Bait shyness,
- g. Odour use, etc.



The rodenticides have been categorized into following categories:

- a) Single dose (Acute poisons)
- b) Multiple dose (Chronic poisons)
- c) Single dose Anticoagulants
- d) Tracking poisons
- e) Fumigants



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SINGLE DOSE RODENTICIDES

- i) Zinc Phosphide
- ii) Red Squill/Silmurin
- iii) Vacor (RH-787)
- iv) Strychnine Salts
- v) Arsenious Trioxide
- vi) Alpha Naphthyl Thio Urea (ANTU)
- vii) Thallium Sulphate
- viii) Sodium Mono Fluoro Acetate (1080)
- ix) Barium Carbonate
- x) Norbromide



BAIT PREPARATION OF ZINC

PHOSPHIDE

Zinc Phosphide is used at 2% concentration mixed in bait as mentioned below:

$\frac{3}{4}$ teacup wheat flour/crushed grain	– 96
g	
$\frac{1}{2}$ tsp edible oil	– 2
g	
$\frac{1}{2}$ tsp of Zinc Phosphide	=
<u>2 g</u>	
	100 g

Toxic action of Zinc phosphide



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USE OF ZINC PHOSPHIDE

1. In a compartment of godown with a capacity of 1500 tonne such baits are kept at four to five places (20–25 g each).
2. However, it is always desirable to use plain baits of the same food for one to two days.
3. This is called prebaiting.
4. The poison baiting on the third or fourth day leads to immediate death of the rats who consume this bait.



5. As such, Zinc phosphide often leads to development of poison shyness amongst the remaining population.
6. It has, therefore, been decided that poison baiting should not be repeated earlier than one month in any particular warehouse.



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SINGLE DOSE ANTICOUGLANT

The second generation anticouglants includes:

- Brodifacoum (Talon)
- Difnacoum (Ratak)
- Bromadiolone (Maki) Roban and Ratinol
- Diphathelone (LM-2219)
- Storm



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BROMADIOLONE

Out of the single dose anticouglants mentioned above, only Bromadiolone is registered with CIB, Faridabad and being used in our country extensively. The trade name of Bromadiolone is Roban and Ratonil which is available both in powder and cake (ready to use bait). It is used at 0.005% concentration mixed in bait. The bait (500 g) is prepared as follows:

4 tea full cups flour/crushed foodgrain	–	465
g		
3 tsp powdered sugar	–	15 g
2 tsp edible oil	–	10 g
2 tsp Roban powder	–	<u>10</u>
g		

500



USE OF ROBAN / RATONIL BAIT

1. The quantity of bait (500 g) prepared is sufficient for keeping it at 4–5 places (120 g to 125 g at one place) in a compartment with a capacity of 1500 tonne.
2. The poison bait will be placed in a container (earthen bowl, pieces of broken pitcher, paper plate, coconut shell, etc.) for a period of 1–2 days.
3. Since these poisons are safer TO use, these are recommended to be used in residential areas.