K. Lekha priya.
Date 19BAG0045

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Floral Biology, Emasculation & Hybridization Techniques in different crop species.

Jute

Floral Biology of Corchorus capsularis:

- Flower is small, 0.3-0.5 cm in length & yellow in colour.
- Calyx - 5, green in colour
- Corolla - 5, yellow in colour
- Androecium - 20-30, colour of pollens are yellow or light yellow in colour.
- Gynoecium - style is 2-4 mm long, stigma is divided into 2-3 parts. In one ovary 50 ovules are present.

Floral Biology of Corchorus olitorius:

- Flower is big about 1 cm in length & yellow in colour.
- Calyx - 5-6, green in colour
- Corolla - 5-6, yellow in colour
- Androecium - 30-60, colour of pollens are yellow in colour.
- Gynoecium - style - 3-5 mm long, stigma is round in shape. In one ovary 200 ovules are present.

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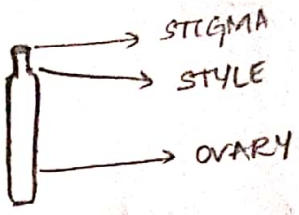

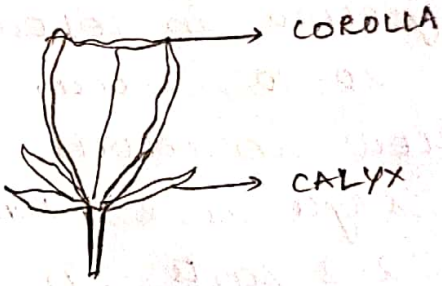

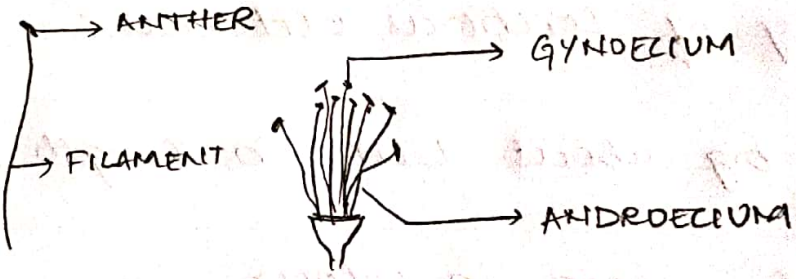

JUTE

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Self pollination

It the rule in this crop in both C. capsularis & C. olitorius. The natural crossing in C. capsularis is higher rate & its due to the wind pollination & insect visitation. Anthesis starts one to two hours after sunrise in C. capsularis & about an hour before sunrise in C. olitorius. The stamens usually burst before anthesis.

Selfing

To ensure self fertilisation, the flowers may be protected by covering them with fine mesh muslin bags or a polyethylene lantern. This is necessary in the C. capsularis species where cross pollination is much higher. The supports by bamboo stakes are given to bags which are covering the flowers, since the jute is a tall plant & inflorescence is at the top.

Crossing

Cross pollination between varieties within a species are readily made but the interspecific crosses are rarely successfull. This is due to endosperm abortion. Emasculation is done one day ahead or at the time of opening of the flowers. Normally the first bud to open in an inflorescence is

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emasculated & the other buds are removed. The most advanced bud in the inflorescence can be identified from its size & yellow colour of the petals & anthers. The buds selected is opened & the stamens are removed with fine pointed forceps. The emasculated flowers are covered with small butter paper bags to protect them from the dew & rain.

Pollination

Pollination is made following morning upto 9:20 am incase of C. olitorius & upto around 11 am incase of C. capsularis. The stigma of the emasculated flower is lightly touched with a ripe anther & the pollen is dusted on the stigma. After pollination, the flowers are bagged for 24 hours. Seed capsules matured in about 6 weeks.

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Floral biology of Rice

- Terminal panicle bears perfect flower.
- sessile, bi-sexual, self-pollinated flower.
- Flower having six stamens
- Flower surrounded by lemma & palea.
- Gynoecium consists of carpel-1, superior ovary and one chambered hypogynous.
- Most of the flowers bloom between 2-4 days.
- Blooming of the spikelets starts from panicle apex and proceeds downward.
- Pollen shed at the time of flower opening.
- Stigma remains receptive for 4-5 days.
- Pollen shed at the time of flower opening.
- Stigma remains receptive for 4-5 days.
- Pollen preservation possible for 24 hours at 54 degree at 95% humidity.
- Fertilization completes within 3 hours after pollination.

Selection of female plants:-

- Insect and disease free healthy plant.
- Selection of flowers expected to open by next morning.
- Removal of immature and open flowers.

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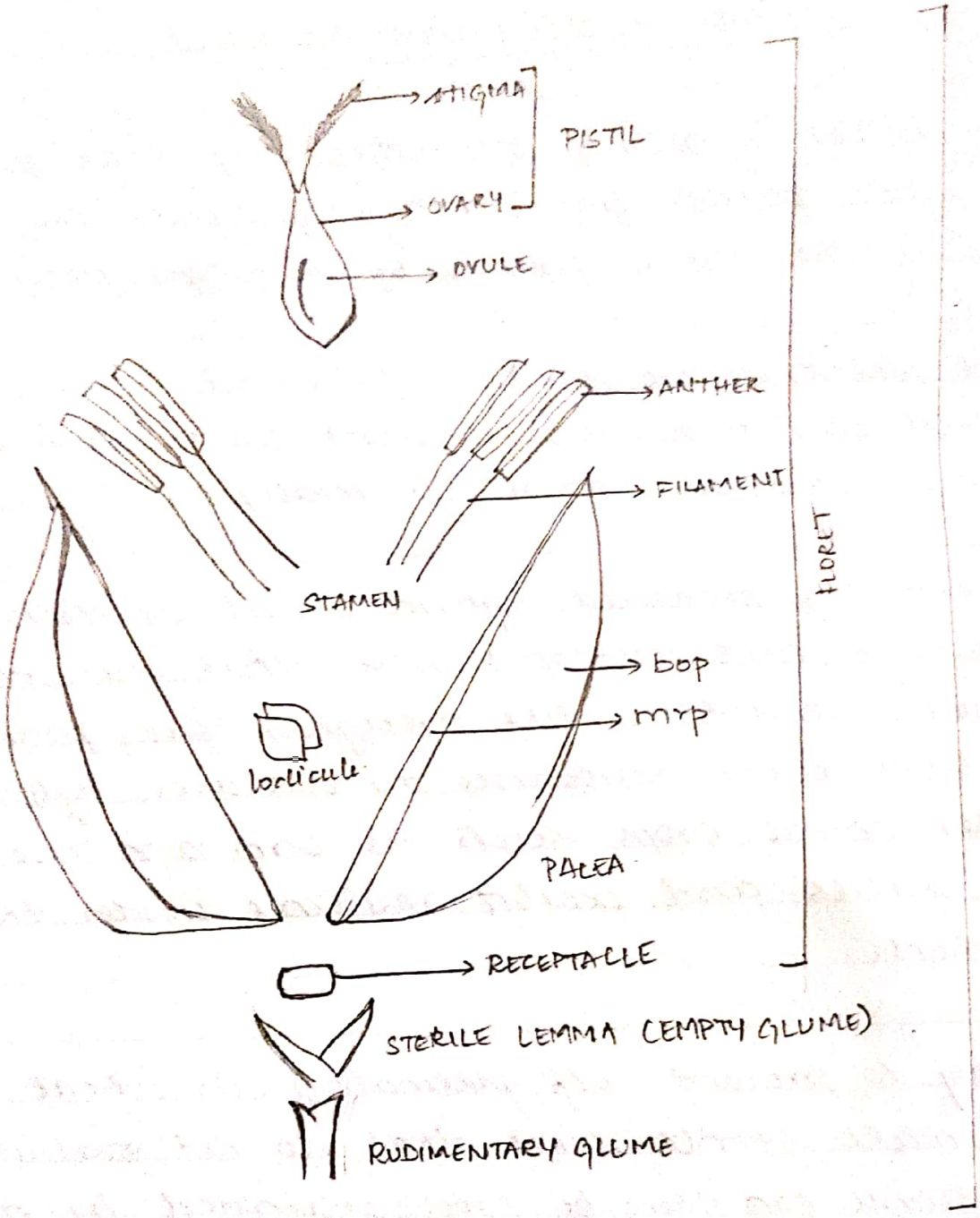

WHORLS OF RICE FLOWER

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Emasculation:-

- Emasculation is necessarily followed by controlled pollination.
- Emasculation is done during early morning between 6 and 8 am in spikelets, as they open on the same day.
- It should be over well ahead of the time of anthesis.
- Crossing techniques in rice differ based on the method of emasculation.
- Since maximum number of spikelets open on the 3rd or 4th day of anthesis, panicles of that stage are selected for emasculation.

Pollination:-

- Process of collecting anther and pollen grains of desired male parent and putting in the stigma at the emasculated flower of desired female parent.
- The yellow turgid anthers are dusted over the stigma surface of emasculated buds.
- Sometimes whole anther is inserted inserted inside the florets with the help of forceps.

Hybridisation methods:-

1) Clipping method:-

In the previous day evening, top 1/3rd and bottom 1/3rd portions in the panicle of the desired female parent are clipped off by using scissors leaving the middle spikelets. With the help of scissors again, top 1/3 portion in each

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spikelet is clipped off in a slanting position. Next day morning, the blooming panicle from the desired male parent is taken & rubbed against the emasculated buds.

•) Hot water method :-

This is similar to clipping method. The tillers is bent over & the selected panicle is immersed in hot water contained in a thermos bottle at 40-44°C for a period of 5 to 10 minutes.

•) Dr. Ramiah method :-

Panicles on the 3rd/4th day of its blooming are selected; top & lower spikelets are removed. It is covered with a wet cloth & is air blown from mouth, for 2-3 minutes.

•) Vacuum emasculation method :-

This works on the principle of suction pressure. The spikelets are removed. The minute pipette is to be shown at the point of clipping & pollen is sucked in. Six panicles can be emasculated at a time.

•) Cuttack method :-

This technique was developed by CRRI, cuttack. The panicle to be emasculated is inserted into hollow piece of bamboo closed at one end & plugged with cotton wool & split cork at the other end, for 5-10 minutes. The contents are removed.

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•) Brown paper method:-

The panicles are enclosed in brown paper bags for couple of hours of blooming. Heat develops inside due to which anthers extrude, but don't dehisce, this is for 15-30 minutes. Later the crossed panicle is then properly tagged.

•) Rhind's method:-

In this method hot water is kept in the flask and it is poured outside. After pouring out the water inside of the flask will be warm & humid. The panicle to be emasculated will be put the flask for sometime.

Tagging:-

- cross combination
- date of emasculation
- date of pollination
- number of pollinated buds
- signature of the breeder.

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Maize

Floral Biology

- Poacea famicy
- cross-pollinated crop
- Monoecious flowers
- Staminate flower - tassel; pistillate flower - cob
- protandry in nature
- Each staminate flowers have palea, lemma & three stamens
- Pollen sheds 1-3 days before the silk has emerged.

Selfing

- Bag the tassel before anthesis with a paper cover.
- Bagging of tassels should be done in the previous day evening to avoid contamination from foreign pollen.
- Cut the tip of the cob before the silks emerge & cover with a paper cover.
- After 3-4 days, the silks will emerge in the form of a "saving brush" in which the silks will be of same height & stand erect.
- Remove the cover of the tassel containing pollen & insert in over the cob after removing the cob-cover.
- The inserted cover is then tied.

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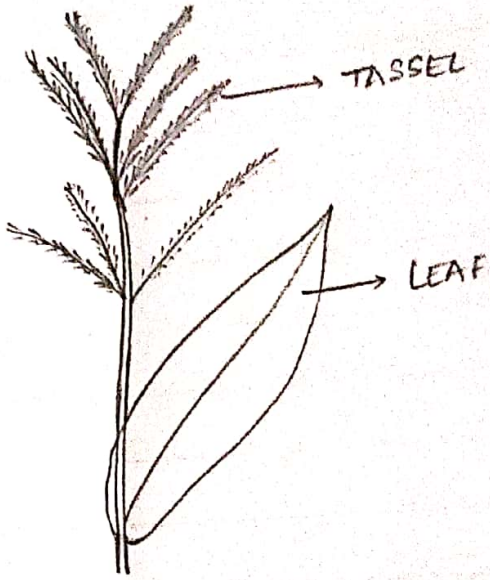

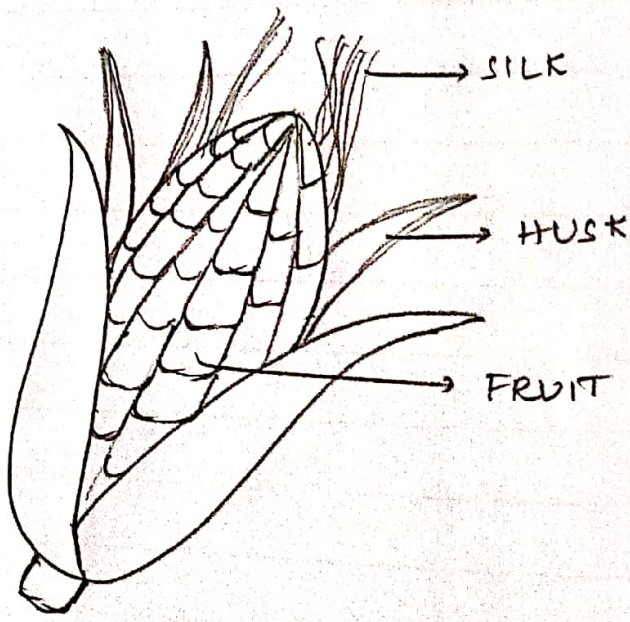

MAIZE

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Crossing Techniques

Female parent
↳ detassel
↳ Cut the tip of the cob before the silks emerge & cover with a butter paper cover.

Male parent
↳ cover the tassel before anthesis begins or as soon as the tassel emerges.

- When the silks emerges in the female parent in the form of a brush, pollination is done by transferring the freshly shed pollen cover from the male parent & inserting it over the cob of the female parent after removing the cover from the cob.

- The details like date of pollination, parentage & breeding programme to be carried out are clearly written by water proof pencil.

- The date of pollination will be one day later than the day of tasseling.

- Pollination should be completed within one week of silk emergence.

- Isolation distance of maize is 400m.

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Sorghum

Floral biology

- Poaceae family.
- Self - pollinated crop.
- Protogyny in nature, 3 stamens & gynoecium with 2 stigma.
- Anthesis starts at the tip & then downwards @ 2-5 cm per day & completes within 7 days.
- Pollen & stigma are receptive for 8-16 hours.

Selfing

- Head bagging becomes efficient for selfing the earheads.
- Once the decision to bag heads has been made, all heads in a row should be covered.
- If a head has already begun to flower, the flowering portion should be cut off.
- During head bagging, boot leaf of the plant is usually removed prior to placing the bag.

Crossing techniques.

Important crossing tools:
- Hand emasculations
- Emasculations by hot water treatment.
- Use of male sterile lines - CGMS
- Plastic bags / mass emasculation techniques.

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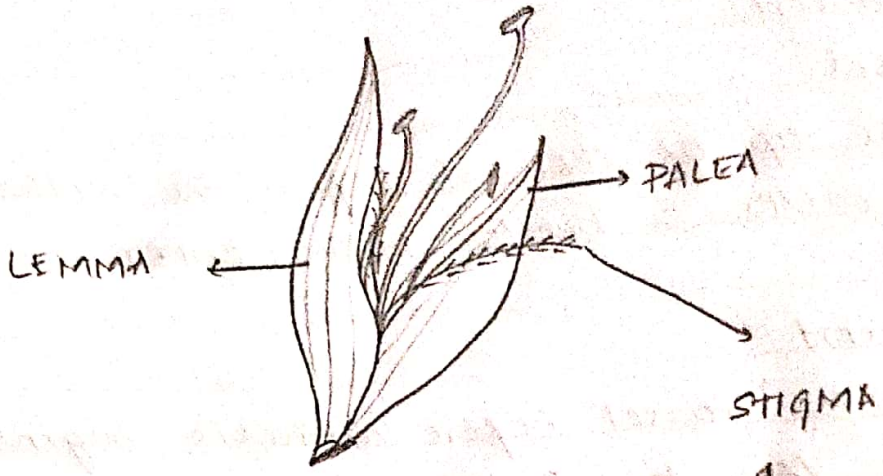

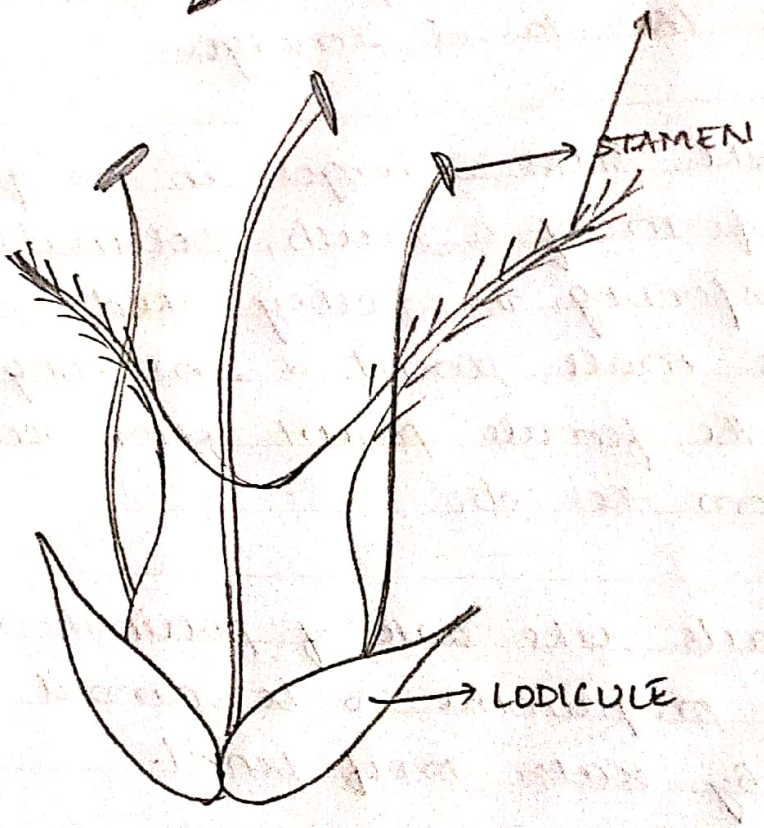

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Hand emasculation

only a part of the panicle is emasculated & the remaining panicle is clipped away

↓

During clipping, flowered tip & the lower panicle branches are removed.

↓

50 florets - flower the following day are selected for emasculation

↓

The needle is inserted at the middle of the floret & moved across the glumes

↓

The needle is rotated at 90 degree & three anthers are lifted out

↓

The emasculate panicle is covered by a suitable paper bag.

Hot water method

- Panicle flowered tip & lower panicle branches are removed.
- About 50 florets (in clusters of two or three) are immersed in hot water at 48°C for 10 minutes.

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Plastic bag/ mass emasculation technique

Sorghum panicle is covered with plastic bag (creates high humidity inside the bag) - florets open. the anthers emerge.

↓

Anthers are knocked free of head by tapping

↓

Hand pollination may begin around 9.30 am (dry morning), 11:30 - 12:30 am (rainy day)

↓

Pollen is collected in paper bags (viable for 10 - 20 minutes).

↓

The selected male parent panicle will be covered with brown paper bag the previous day evening before dehiscence of anthers.

↓

Next day the pollen will be collected by tapping the bag.

↓

The collected pollen will be dusted on to the emasculated head & covered with butter paper bag labelled properly.

↓

Dusting of pollen is done for two or three days continuously.

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Ragi

Floral biology

- Poacea family.
- self pollinated
- The inflorescence takes 7-8 days to complete anthesis.
- Time of anthesis 1 am - 5 am.
- In each spike the order of opening is from the top to bottom.
- In each spikelet the opening of the floret is from the base to top & one floret in each spikelet opens a day.

Selfing

- The panicle before commencing anthesis is covered with paper cover & retained till the blooming is over.

Crossing

- emasculation & crossing are tedious
- However, both hand emasculation & hot water treatments are followed.
- Hand emasculation - evening.
- Pollination - morning i.e., before 6 am.
- Hot water technique of emasculation of florets is also successful.
- Hot water treatment at 52°C for 2 minutes
- Then the spikelets are pollinated early in the morning.

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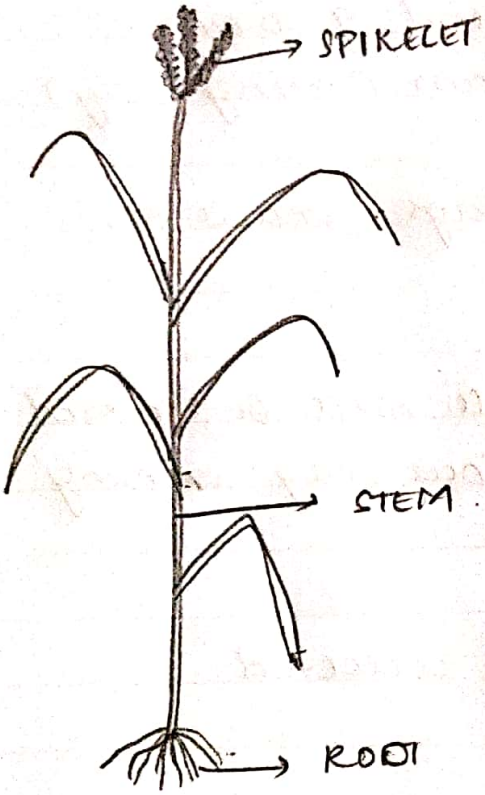

RAGI

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Approach Method or contact method.

- The inflorescence to be opened will be selected & cut with long stalk from the male parent. This is brought to the emasculated flower.
- The male flower as a whole will be tied round with female flower.
- Then they are covered with butter paper bag.
- The cut end of the male inflorescence will be immersed in water kept in a bottle.
- Natural cross pollination takes place in 2-5 days.
- Marker genes are utilized for identifying the hybrid seedlings in the nursery plot. 60-90% seed set is recorded in both methods.

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Cumbu/ Pearl Millet (Pennisetum glaucum)

Floral biology:-

- Cumbu (Bajra) is naturally cross pollinated (Allogamous).
- Wind is the chief agent of pollination (anemophily).
- Adaptations for cross pollination is protogyny
- Inflorescence consists of a central rachis covered with soft/ short hairs and bears fascicles on rachillae.
- The destiny of fascicles and the length of rachillae determine the degree of compaction of the panicle.
- Each fascicle contains spikelets surrounded by a whorl of bristles (i.e., involucre).
- The prolongation of the fascicle axis determines the length of bristles.
- A spikelet may contain 2-4 florets or flowers, but generally two. The lower floret is staminate and the upper floret is bisexual or hermaphrodite
- Anthesis commence from 1/3rd of the apex of spike and proceeds both ways.
- Stigma emerges first and anthesis is over within 2-3 days.
- This is followed by the first male phase in which the anthers from the perfect (hermaphrodite) florets emerge out.
- On the fifth day of anthesis the 2nd male phase begins in which anthers from the staminate florets emerge.
- Anthesis time is 8pm-2am.

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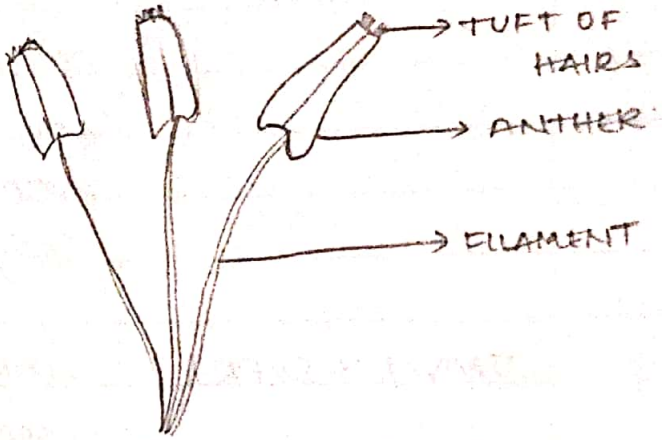
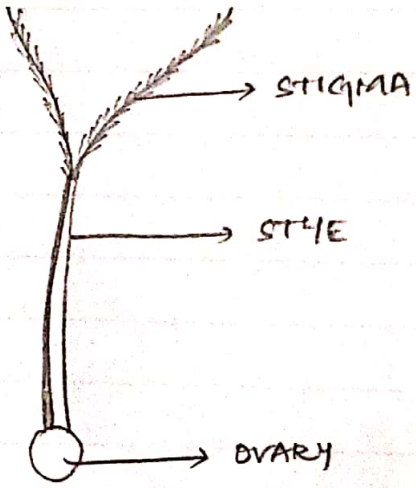


STAMEN



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Selfing:-

- To ensure selfing, spikes may be bagged before emergence of the stigmas.
- Generally, the safest stage is when about one third of the inflorescence is out of the flag leaf sheath.
- As the spike elongates it may be necessary to adjust the bag to cover the lower most spikelets.
- Another procedure is to enclose within a bag two full spikes from the same plant, one day (or) 2 days older than the other and ready to shed pollen as the stigmas are emerging from the younger spike.

Crossing:-

- Emasculation in Cumbu is laborious and difficult due to the small size of the flowers and the late maturity of the anthers when compared to the stigma.
- About four-fifths of the upper portion of the spike is removed and the rest is bagged before the styles appear to prevent contamination.
- Flowers are pollinated by dusting them with fresh pollen obtained from the desired male parent or by shaking a spike which is shedding pollen over the exposed stigmas.

Controlled cross pollination:-

- Pearl millet does not require emasculation for making crosses. The female line will be covered before stigma

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emergence with butter paper bag. Without removing butter paper bag we can see the emergence of stigma. Once most of the stigma has emerged, pollen from desired male parent is collected and dusted on to the female line. Pollination is usually made in the morning. Care should be taken to cover pollen parent previous day with butter paper bag. The crossed heads are labelled.

- Another method is instead of removing the sealing bag of female and dusting, the top of the cover clipped of desired male parent inflorescence in the process of pollen bursting is inserted to brush the stigma. Then the clipped top of the bag is folded and stapled. The crossed heads can be collected after 30-35 days.

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