

List of the Teachers, Departments, and Committee's YouTube Channels

SN	Name of the Department/Faculty	Youtube URL
01	Prof. Prasad Purekar	https://www.youtube.com/@prasadpurekar298/featured
02	Prof. Yugandhara Topare	https://www.youtube.com/playlist?list=PLLGBm6RXba9U9stbFMkjenRxcfSAwVx1T
03	Prof. Pankaja Waghmare	https://www.youtube.com/@user-qq7ic4tu4u/about
04	Dr. Vaishali S. Deshmukh	https://youtube.com/@DrVaishaliDeshmukh
05	Dr. Bharat Usare	https://www.youtube.com/@totalgeography9109
07	Dr. Vidya Ingole	https://www.youtube.com/@vimingole/videos
08	Dr. Sangeeta Dongare	https://www.youtube.com/@sangeetadongre1134
09	Dr. Amol Sonawane	https://www.youtube.com/@mathematics_amolsonawane
10	Dr. Eknath Futane	https://www.youtube.com/@Dr.EknathPhutane
11	Mr. Samadhan Satav	https://www.youtube.com/@samadhansatav954/featured
12	Mr. Pavan Shinde	https://www.youtube.com/channel/UCpSr4dor84jiBmkIrZ07wnA
13	Dr. Ajaykumar Gandhi	https://www.youtube.com/channel/UCg9E_A6ZxyIVV9K-JRSaTig
14	Chemistry & Polymer Chemistry	https://www.youtube.com/channel/UCC07oKGS7qAgnqWDUOmWDcg
16	Microbiology	https://youtube.com/playlist?list=PLqb377S6ERVrknIpjERm8G1wT_J9kcfjA
17	Competitive Exam Guidance Centre	https://www.youtube.com/channel/UCoT4vEkDNunmQV9FWTHteDw

Government of Maharashtra

Govt. College of Arts & Science, Aurangabad. NAAC Reaccredited 'A' Grade

E-mail :- gasca1923@gmail.com Fax No. 0240-2331476 website: www.gasca.ac.in

No. GASCA /EST-1/20120-21/1050

Date: - 10-8-2020

20/08/2020

Certificate for E content Development

This is to certify that **Mr. Ajaykumar Gandhi, Assistant Professor, Department of Chemistry, Government college of Arts & Science, A'bad** has developed **E content** based on the Four Quadrant Approach as per UGC guidelines.

He has developed online course module under Faculty development program entitled 'Learning Management System - Various ICT Tools for Developing Proficiency in Teaching Learning'. E content development on the use of LMS is application based will help teachers to adopt ICT to acquire proficiency in Teaching & Learning Process.

Features of the content are

- Video Content is explained in Regional Language (Marathi) so that teachers Teaching subjects in Marathi Medium can understand and Use these ICT Tools.
- Application of these ICT tools in every possible subject is explained with examples.
- ICT blended Pedagogical Approach



Rakulkeemi
Principal

Dr. Rohini Kulkarni Pandhare

Government College of Arts & Science, A'bad

e-Content

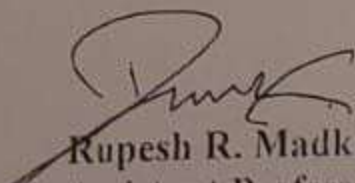
(Quadrant format as per UGC guidelines)

For Online Certificate Course in an Introduction to Ancient Indian Scripts: Brahmi & Kharoshti
5th – 14th April 2020

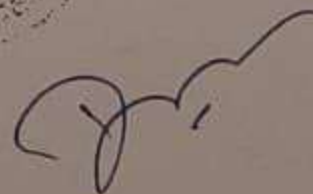
<p>2nd Quad e – Tutorial</p> <p>1. Video lectures on an Introduction to Ancient Indian Scripts: Brahmi & Kharoshti</p> <p>Total 16 videos https://drive.google.com/drive/folders/1BYvn8nY6Wdjz-Mq7OFAq_BZQs6pXxdkyp</p>	<p>1st Quad e – Content</p> <p>1. e-Text – For Course in an Introduction to Ancient Indian Scripts: Brahmi & Kharoshti</p> <p>(https://drive.google.com/drive/folders/1hxUF2e2_jfUURxpU1N5SWhsW0sl_s0521)</p>
<p>3rd Quad – Web Resources</p> <p>1. Lecture by Dan Everett https://www.youtube.com/watch?v=qFxxg5vkaPgk</p> <p>2. Lecture by Khan Academy on Alphabets https://youtu.be/lkeXaqoXDYQ & https://youtu.be/6NrFrBzC6dk</p> <p>3. Lecture by ePG Pathshala on Brahmi & Kharoshti https://www.youtube.com/watch?v=HfextfHS8bs&list=P_L_a1TI5CC9REgLxMrzPS5u0FOkvDwiqyo&index=10&t=0s & https://www.youtube.com/watch?v=kOpupPRq8Ck</p> <p>4. PDF documents</p> <p>1. https://www.torahinmyheart.com/v/vsptfiles/downloadables/00_Origins_of_the_Aleph-Bet.pdf</p> <p>2. https://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780199935413.001.0001/oxfordhb-9780199935413-e-61</p> <p>3. http://www.ece.lsu.edu/kak/writ.pdf</p>	<p>4th Quad -Self Assessment</p> <p>1. Quizzes (Total 7) https://drive.google.com/drive/folders/17WDIGYCA5K-m0BuSEiBl_JTugqNP_YKGd</p> <p>2. Final Test https://docs.google.com/forms/d/1_QLnytjFVwWpirEgLPYTQUBDXnZzHdIB9ZyXrvHz3W4/edit?usp=drive_web</p>

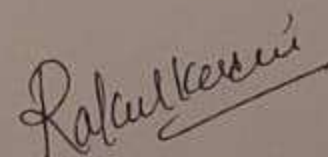
- Total students enrolled for the online course: 95

Remark _____


Rupesh R. Madkar,
Assistant Professor (History)
Online Course developed &
Coordinated.






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Government of Maharashtra

Govt. College of Arts & Science, Aurangabad.

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20/08/2020.

Certificate for E content Development

This is to certify that Mr. Rupesh Madkar, Assistant Professor, Department of History, Government college of Arts & Science, A 'bad has developed E content based on the Four Quadrant Approach as per UGC guidelines. He has developed E content for ten days online value added certificate course entitled "An introduction to Indian Scripts: Brahmi & Kharoshti."



Ratulkumar

Principal
Principal

Dr. ~~Balaji Kulkarni~~ ~~Pandhare~~
Aurangabad.

Government College of Arts & Science, A'bad

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Date: - 10-8-2020

20/08/2020

Certificate for E content Development

This is to certify that **Mr. Ajaykumar Gandhi, Assistant Professor, Department of Chemistry, Government college of Arts & Science, A'bad** has developed **E content** based on the Four Quadrant Approach as per UGC guidelines.

He has developed E content for twenty-one days online short-term course (30 Hours+) for under graduation entitled "**Must know Basic Concepts in Chemistry**".



Rakul Kasevi
Principal

Principal
Dr. Rohini Kulkarni Pandhare

Government College of Arts & Science, A'bad

Unit I

5. Concept of Binomial Nomenclature and its advantages-

A. Introduction or Concept of Binomial nomenclature

- Nomenclature is one of the functions of Taxonomy.
- The term nomenclature means the scientific naming of organisms.
- The naming of plants on a scientific basis is called botanical or plant nomenclature.
- Binomial Nomenclature is a type of Nomenclature.
- Binomial nomenclature is a formal system of naming species of living organisms.
- It is also called binary nomenclature.
- According to this system of nomenclature, name of an organism is composed of two names.
- The first name of the name identifies the genus to which the organism belongs.
- The second name part identifies the species within the genus.

For example, Binomial name of Mango is *Mangifera indica*.

- The formal introduction of this system of naming species is credited to Carl Linnaeus, effectively beginning with his work *Species plantarum* published on 1st May, 1753.
- But Gaspard Bauhin, in as early as 1623, had introduced this system for the first time in his book *Pinax theatri botanici*.
- The Principles and Rules of Binomial nomenclature of plants are designed by IBC (International Botanical Congress).
- The code and conduct of Botanical Nomenclature is known as **International Code of Botanical Nomenclature (ICBN)**.
- The ICBN only deals and control to the naming of plants but does not do any work on taxonomy.
- The head office of ICBN is situated at Utrecht in the Netherlands.

B. Rules of Binomial nomenclature:

Some rules of Binomial nomenclature framed under ICBN as well as the rules set by Linnaeus are as follows:

1. The Scientific name consists of two names.
2. The first name is name of Genus known as **generic name**.
3. The generic name starts with capital letter.
4. The second name recognizes species, it is known as **specific epithet**.
5. Specific epithet begins with small letter.
6. The generic name and specific epithet are together called as **specific name**.

7. Scientific names should be in Latin or Greek because it is not national language of any Nation and officially a dead language.
8. These names should be in italics when printed or separately underlined when hand written to indicate their Latin origin.
9. The name of the author, first reporting it should remain in abbreviated or full form at the end of the scientific name,
e.g. *Oriza sativa* L.
10. The scientific name with name of the author at the end is called complete scientific name.
11. Only one valid name for one species is permitted and it is based on the rule of priority that is the author first effectively and validly publishing the name up to 1st May, 1753 will be considered.
12. When a plant species is reported, the author should submit a herbarium sheet of the specimen.

C. Advantages of Binomial Nomenclature-

1. Binomial Nomenclature is convenient way for communication of a plant species.
2. The system of Binomial Nomenclature universally accepted.
3. It is recognized by IBC (International Botanical Congress).
4. It avoids confusion created by common names.
5. Because of Binomial Nomenclature names of plants and animals have been standardized.
6. It provides immense value and convenience in taxonomical and other publications.

Unit I Gymnosperms

Chapter 4 a) Cycadales – Cycas

A) Classification-

Division-	Phanerogams (Spermatophyta)
Sub-division-	Gymnosperms
Class-	Cycadopsida
Order-	Cycadales
Family-	Cycadaceae
Genus-	<u>Cycas</u>

B) Distribution-

1. Cycas, is the most widely distributed genus of order Cycadales.
2. It is distributed in Japan, Australia, India, Indochina, China, Mauritius, Africa, Nepal, Bangladesh, Sri Lanka and Myanmar.
3. In India, Cycas grows naturally in Orissa, Assam, Meghalaya, Tamil Nadu, Karnataka and Andaman Nicobar Islands.
4. Cycas is represented by 15-20 species.
5. Some species like Cycas circinalis, Cycas pectinata, Cycas rumphii and Cycas beddomei, occur in the wild state in India,
6. Cycas revoluta and Cycas siamensis are species which are cultivated commonly in the Indian gardens.
7. Cycas revoluta is the most commonly cultivated species of the Indian gardens.

C) General Morphology of Cycas:

1. Cycas is a palm-like, evergreen plant.
2. The plant body consists of a columnar aerial trunk with a crown of pinnately compound leaves at its top.
3. A tap root system persists in the adult plant.



i) Roots:

1. Roots in Cycas are of two types, i.e., normal tap roots and coralloid roots.
2. Normal tap-roots are positively geotropic, grow deep into the soil and generally possess no root hairs.
3. Their function is to fix the plant in the soil and to absorb water and other minerals.
4. From the normal roots develop some lateral branches near the ground surface.
5. These lateral roots are symbiotically associated with some nitrogen fixing bacteria and algae, and are called coralloid roots.

6. They grow- first horizontally in the soil and become swollen at their tips.
7. They divide repeatedly to form big bunches of greenish or brownish structures, which are coral like in appearance.
8. They divide dichotomously, come out of the soil on the ground surface and are phototrophic in nature.
9. Young plants bear more coralloid roots than the older ones.

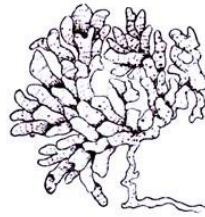


Fig. 8.9. *Cycas*: A bunch of coralloid roots

ii) Stem:

1. The stem is thick, woody and usually un-branched.
2. It is tuberous when young but becomes columnar, erect, unbranched and stout at maturity.
3. Branching in stem is also not rare after the plants have reached a certain age.
4. The aerial part of the trunk remains covered by thick armour of large and small leaf bases.
5. The larger leaf bases represent the bases of foliage leaves, while the smaller ones are the bases of scaly leaves.
6. The age of the plant can be calculated by counting the number of crowns of leaves which are produced every year.
7. Among all *Cycas* species, *Cycas media* is tallest, attaining a height up to 20 metres.
8. Regarding the age of *Cycas*, the plants can survive for a long period.
9. *Cycas circinalis*, if allowed to grow undisturbed, may attain an age of 100 years or even more.

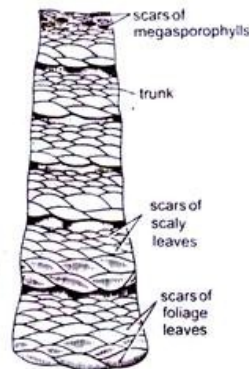


Fig. 8.11. *Cycas circinalis* Basal part of columnar trunk

iii) Leaves:

- I. Two types of leaves are present in *Cycas*.
- II. These are green foliage leaves, and scaly leaves.

I. Foliage Leaves:

1. These are green, large, pinnately compound and stout leaves.
2. They have a spiny petiole and large, strong rachis.
3. They are produced at the apex of the stem in the form of crown.

4. The rachis bears many leaflets.
5. Two rows of strong and stiff spines are present on the petiole.
6. Leaves, when young, are circinately coiled (From apex to base).
7. Very young parts of Cycas leaves are covered by hairs or ramenta.
8. These leaves are known as **Foliage Leaves** as they do photosynthesis.



Fig. 8.12. Cycas. A single foliage leaf.

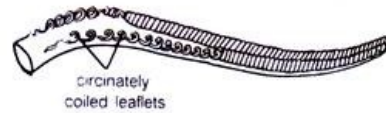


Fig. 8.14. Cycas. A young leaf showing circinate vernation.

II. Scaly Leaves or Cataphylls:

1. These are dry, brown-coloured, somewhat triangular leaves with pointed apex.
2. They are also known as cataphylls.
3. They are present at the apex of the stem.
4. They are covered with several ramenta or hairs.
5. They protect foliage leaves in their young condition.



Fig. 8.15. A scaly leaf of Cycas

D. Anatomy:

(i) T. S. of Normal Root:

1. It is circular in outline and resembles structurally with dicotyledons.
2. Outermost layer is epiblema or exodermis.
3. Epiblema consists of tangentially elongated cells.
4. From some of its cells arise root hairs.
5. Epiblema is followed by the large parenchymatous cortex.
6. In the wide zone of parenchymatous cortex there are present many intercellular spaces.
7. Cells of the cortex remain filled with starch.
8. Some tannin-filled cells, mucilage cells are also present in the cortex.
9. The cortex is delimited by a single-layered endodermis.
10. Endodermis is followed by multilayered pericycle.
11. Xylem and phloem bundles in the root are radially arranged, i.e. present on different radii.

12. The roots are usually diarch.
13. Phloem is present alternately with xylem groups.
14. Pith is generally absent.

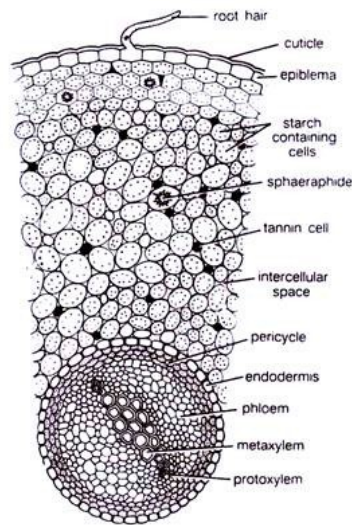


Fig. 8.16. *Cycas revoluta*. T.S. normal root (Young)

(ii) T. S. of Coralloid Root:

1. It is circular in outline and resembles structurally with normal root.
2. Outermost layer is epiblema which later converts into periderm.
3. Epiblema is followed by the large cortex.
4. Cortex is differentiated into 3 zones- Outer cortex, Middle cortex. Inner cortex
5. Outer cortex and inner cortex is of parenchymatous tissue there are present many intercellular spaces.
6. Cells of the Outer cortex and inner cortex remain filled with starch.
7. Some tannin-filled cells, mucilage cells are also present in the Outer cortex and inner cortex.
8. Middle cortex is composed of large, elongated cells.
9. It is also known as Algal-zone, as it consists cells occupied by blue-green algae and some nitrogen-fixing bacteria in symbiotic association.
10. Due to the presence of blue-green algae and nitrogen-fixing bacteria, the function assigned to the coralloid roots is chiefly the nitrogen fixation.
11. The presence and structure of endodermis, pericycle and vascular bundles in the coralloid roots are similar to that of normal roots.
12. The xylem is exarch and triarch.
13. Pith is generally absent.

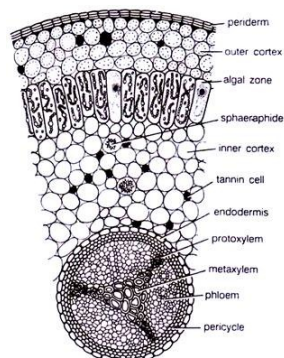


Fig. 8.18. *Cycas revoluta*. T.S. coralloid root

(iii) T. S. of Stem:

1. Similar to root, the stem of Cycas also resembles internally with a dicotyledonous stem.
2. It shows the following anatomical features:
3. Epidermis is the outermost layer consisting of compactly arranged thick-walled cells.
4. Presence of several persistent leaf bases makes the epidermis a discontinuous and ruptured layer.
5. Cortex is large and consists of thin-walled, parenchymatous cells, filled densely with starch grains.
6. It contains numerous mucilaginous canals and leaf traces.
7. Endodermis and pericycle are not clearly demarcated.
8. Numerous vascular bundles remain arranged in a ring.
9. Each vascular bundle is conjoint, collateral, open and endarch.
10. Conjoint means both xylem and phloem are present.
11. Collateral means xylem and phloem are present on same radius.
12. Open means cambium is present between xylem and phloem.
13. Endarch means protoxylem (young xylem) is toward inner side.
14. The xylem is towards inner side and phloem towards outer side.
15. In-between xylem and phloem cambium is present.
16. Several broad and well-developed medullary rays are present between the vascular bundles.
17. In the centre pith is present.
18. Pith is large, well-developed and parenchymatous.
19. It contains many mucilaginous canals.

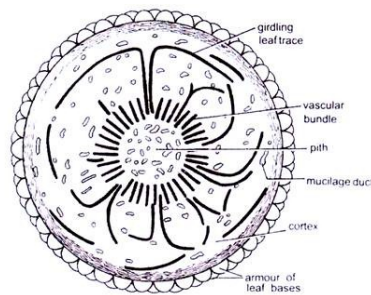


Fig. 8.20. *Cycas*. Diagrammatic representation of T.S. young stem.

(iv) T. S. of Rachis:

1. The outline of transverse section of rachis is biconvex to cylindrical.
2. Two arms of the bases of leaflets are present on the rachis, one on each side.

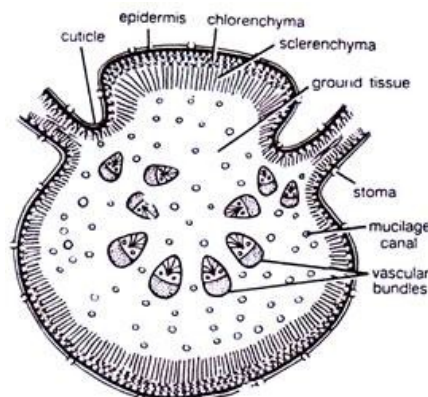


Fig. 8.25. *Cycas*. T.S. rachis (diagrammatic).

3. In T.S. the rachis reveals the following structures from outside within:
 - a) Epidermis is the outermost layer of the rachis consisting of thick-walled cells.
 - b) It is heavily circularized.
 - c) On its upper as well as lower sides are present irregularly distributed sunken stomata.
 - d) Hypodermis is present below the epidermis.
 - e) It is differentiated into outer 2-3 layers of chlorophyll-containing thin-walled cells of chlorenchyma and inner 4-6 layers of thick-walled cells of sclerenchyma.
 - f) Ground tissue is a large region consisting of thin-walled, parenchymatous cells.
 - g) Many mucilaginous canals and vascular bundles are present in this region.
 - h) Vascular bundles are arranged in the shape of an inverted Greek letter Omega (Ω).
 - i) Each vascular bundle remains surrounded by a bundle sheath.
 - j) It is conjoint, collateral and open.
 - k) The xylem in each vascular bundle is present towards inner side.
 - l) Phloem, present towards the outer side of the vascular bundle.

(v) **T. S. of Leaflet:**

1. Cycas leaflets are large, tough, thick and leathery.
2. In a transverse section the leaflet is differentiated into a swollen midrib portion and two lateral wings.

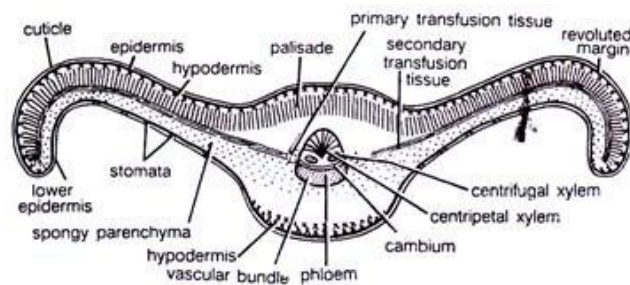


Fig. 8.28. *Cycas revoluta*. T.S. leaflet (diagrammatic)

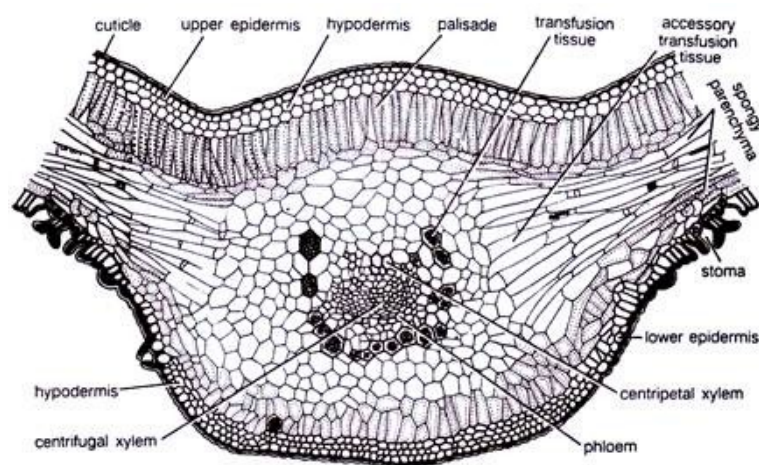


Fig. 8.29. *Cycas revoluta*. A part cellular of T.S. leaflet. (modified after Pant, 1973)

3. Cycas leaflet shows following regions- Epidermis, Hypodermis, Mesophyll, Transfusion tissue, Vascular bundle.
4. Epidermis is the outermost layer consisting of thick-walled cells.

5. It is surrounded by a thick layer of cuticle.
6. Upper epidermis is a continuous layer while the continuity of the lower epidermis is broken by many sunken stomata.
7. Epidermis is followed by 2-3 layers of Sclerenchymatous hypodermis.
8. Mesophyll is well-developed and remains differentiated into palisade and spongy parenchyma.
9. A continuous layer of palisade is present below the sclerenchymatous hypodermis.
10. Its cells are radially elongated and filled with chloroplasts.
11. Spongy parenchyma is present only in the wings. Its cells are oval, filled with chloroplasts, and loosely arranged having many air-filled intercellular spaces
12. Few layers of transversely elongated cells are present in both the wings just in between the palisade and spongy parenchyma called as Transfusion tissue.
13. Vascular bundle is one, and present in the midrib region of the leaflet.
14. It is conjoint, collateral, open and diploxylic (Centripetal Xylem and Centrifugal Xylem).
15. Phloem is present below xylem.
16. Cambium is present between Xylem and Phloem.
17. The portion of the midrib in between the palisade layer and lower hypodermal region is filled with parenchymatous cells.
18. Some of these cells contain calcium oxalate crystals.

E. Reproduction in Cycas: Cycas shows three types of reproduction-

- i) **Vegetative Reproduction**
- ii) **Asexual Reproduction**
- iii) **Sexual Reproduction**

(i) **Vegetative Reproduction:**

1. The most common method of vegetative propagation in Cycas is by bulbils.
2. The bulbils develop from the axil of the scaly leaves.
3. They are more or less oval structures with a broad base narrowing towards the apex.
4. It is produced by a bunch of scaly leaves.
5. On detachment from the stem, a bulbil starts germination by producing many roots towards the lower side and a leaf towards the upper side.
6. A bulbil from male plant will develop only into the male plant, while from the female plant will form only the female plant because Cycas is a strictly dioecious plant.

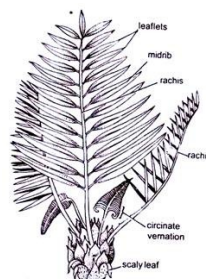


Fig. 8.30. Cycas. A single bulbil.

(ii) Asexual Reproduction:

1. Asexual reproduction takes place by formation of spores.
2. Spores are produced on sporophylls.
3. Cycas is strictly dioecious, i.e. male and female sex organs are borne on separate plants.
4. After several years of vegetative growth the plants start to form sex organs.
5. Generally, Cycads of more than 10 years of age produce the sex organs.
6. The male plants develop male cones or male strobili bearing microsporophylls, while the female plants produce a loose collection of megasporophylls.
7. The male cone is terminal while the megasporophylls are produced in succession with the leaves at the top of the stem.

a) Male Reproductive Structures:

1. Male Cone:

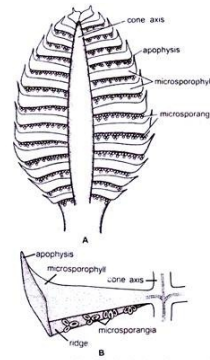
1. The male cone or male strobilus is a large, conical or ovoid, compact, solitary and shortly-stalked structure.
2. It is produced on male plant.
3. It is terminal in position.
4. It sometimes attains a length of as much as 1.5 metre.
5. In the centre of the cone is present a cone axis
6. Several perpendicularly attached microsporophylls are arranged around the cone axis in spirals.
7. At the base of male cone are present many young leaves.
8. All the microsporophylls in a male cone are fertile except a few at its basal and apical parts.



2. Microsporophyll's, Microsporangia and Microspores:

1. Microsporophylls are flat, leaf-like, woody and brown-coloured structures with narrow base and expanded upper portion.
2. The upper expanded portion becomes pointed and is called apophysis.
3. Narrow base is attached to the cone axis with a short stalk.

- Each microsporophyll contains two surfaces, i.e. an adaxial or upper surface and an abaxial or lower

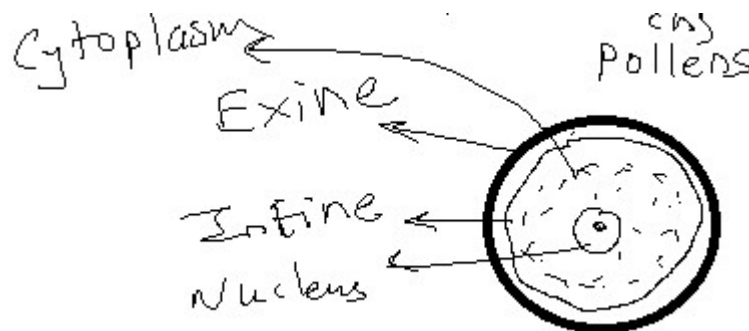


surface. Fig. 8.32. Cycas. A, L.S. cone. B, L.S. of a single microsporophyll, along with cone axis.

- On the adaxial surface is present a ridge-like projection in the middle and an apophysis at the apex.
- On the abaxial surface are present thousands of microsporangia in the middle region in the groups of 3-5.
- Each such group is called a sorus.
- Microsporangia bear microspore mother cells.
- Microspore mother cells are diploid in nature.
- The diploid microspore mother cells undergo meiosis to produce haploid microspores/ pollen grains.

Microspore Mother cell $\xrightarrow{\text{Meiosis}}$ Microspores
(2n) (n)

- Each microspore or pollen grain is a rounded, unicellular and uninucleate structure surrounded by an outer thick exine and inner thin intine.

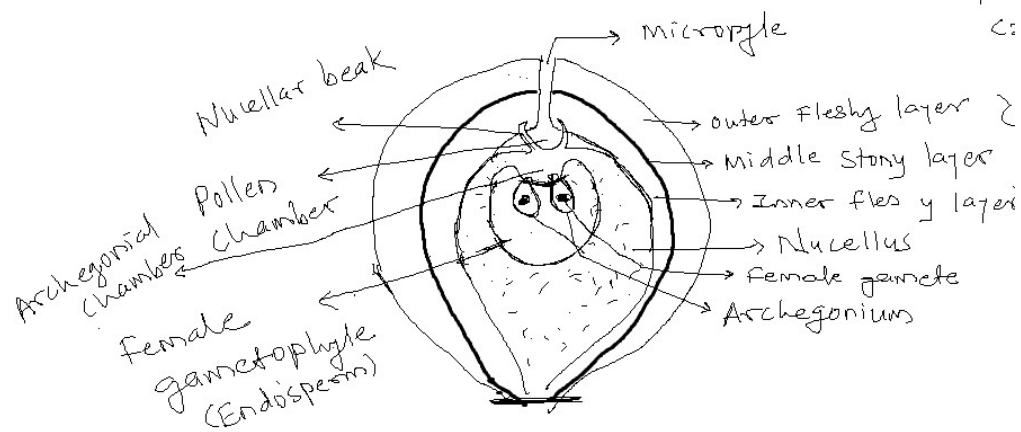


b) Female Reproductive Organs:

- True female cone or strobilus is absent in Cycas.
- Female reproductive organs are present in the form of megasporophylls.
- Many megasporophylls are present around the apex of the trunk of the female plant.

1. Megasporophyll:

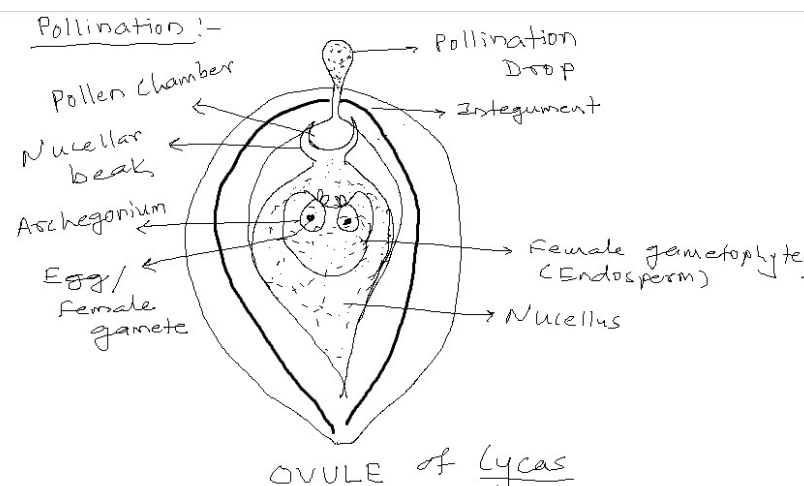
- Each megasporophyll is considered a modification of foliage leaf.
- It reaches up to 30 cm or more in length in different species.
- It is a flat body consisting of an
 - Upper dissected or pinnate leafy portion- Sterile region
 - Middle ovule bearing portion- Fertile region
 - Lower petiole- Stalk.
- The middle part (Fertile region) is comparatively wider than petiole and bears ovules arranged in two rows.
- The number of ovules varies between 2-12 in different species.



(iii) Sexual Reproduction:

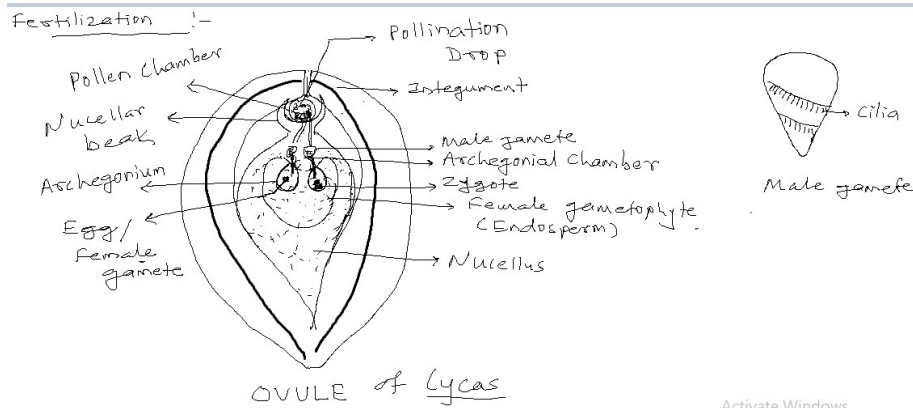
1. Pollination:

1. The pollination is anemophilous.
2. The cells of nucellar beak present in the pollen chamber disintegrate and form a viscous fluid.
3. This fluid is cohesive in nature.
4. This fluid oozes out of the micropyle and collects in the form of a pollination drop.
5. The pollen grains present in the air current are entangled in the pollination drop.
6. Gradually the pollen drop dries up and the pollen grains are sucked into the pollen chamber through micropyle.
7. Further drying of this drop seals up the micropyle.
8. Pollen drop helps in collecting the pollen grains at the micropyle in all gymnosperms.
9. After a definite period of rest (pollen grains may lie inside the pollen chamber for quite some time say for four months).
10. The exine breaks up and intine comes out in the form of pollen tube.
11. Pollen tube, penetrates the nucellar tissue and comes to lie in the archegonial chamber.
12. In archegonial chamber the sperms or male gametes are liberated.
13. Each sperm is more or less triangular, top shaped mobile structure having five to six spiral bands with thousands of cilia with a single large nucleus.
14. By means of their cilia, they move freely in the pollen tube.



2. Fertilization:

1. At the time of fertilization, the nucellar tissue between the pollen chamber and the archegonial chamber disorganize.
2. The pollen tube reaches the archegonial chamber.
3. The tip of the pollen tube ruptures releasing two male gametes and fluid contents.
4. Due to this archegonial chamber becomes moist and the sperms move freely in it with the help of cilia.
5. Only a single sperm enters violently in each archegonium through neck.
6. Only the male nucleus of the sperm fuses with the egg nucleus to form a zygote or oospore (2x).
7. The fertilization in Cycas takes place with the help of motile sperms. This process is known as zooidogamy. Converts into embryo and ovule into seed.
8. After fertilization Zygote converts into embryo.
9. Some times more than one embryos are formed and it is called as **Polyembryony**.
10. Though more than one embryos are formed, only one remains functional.



3. Structure of seed:

1. After fertilization, the ovule is transformed into seed.
2. The nucellus and the inner layer of integument are used up as nourishment by developing embryo.
3. The mature seed appears as orange-red or reddish brown structure.

It comprises the following structures:

a. Testa or seed coat:

It is formed by the outer brightly coloured fleshy layer and the middle layer of the integuments.

b. Micropyle:

It is present in the form of small opening at the top of the seed.

c. Endosperm:

Inner to the seed coat laid the wall tissues called endosperm. The cells store a large amount of food material.

d. Embryo:

Embedded in the endosperm lies the embryo. It consists of two cotyledons, plumule and radicle. The embryo remains suspended in the endosperm by a long spirally coiled suspensor.

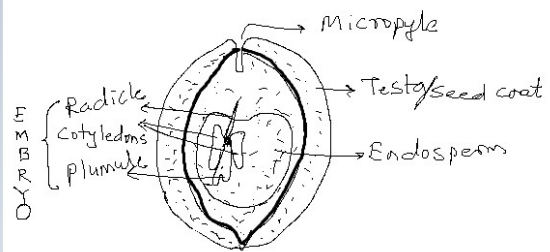


fig - Seed

Unit II

2. Study of diversity of families

a. Family- Asclepiadaceae (Calotropis Family) रुई

A. Classification-

Division-	Spermatophyta
Subdivision-	Angiosperms
Class-	Dicotyledons
Sub-class-	Gamopetalae
Series-	Bicarpellatae
Order-	Gentianales
Family-	Asclepiadaceae

B. Distinguishing Characters-

1. Herbs or undershrubs
2. Presence of milky latex
3. Leaves simple, opposite decussate
4. Flowers actinomorphic
5. Presence of corona (Outgrowth on corolla)
6. Stamens modified in Pollinia or Translators
7. Presence of Gynostegium (Androecium united with Gynoecium)
8. Gynoecium bicarpellary subapocarpus i.e. Ovaries and styles are free but stigma united.
9. Stigma pentangular.
10. Fruit a pair of follicles.

C. Distribution and General Information-

1. **Asclepiadaceae family** is represented by about 384 genera and over 1800 species distributed mostly in the tropical and temperate regions of world.
2. In India family is represented by about 53 genera and over 250 species.
3. Family is famous for plants like Capotropis procera, Gymnema sylvestre, Tylophora indica etc for their medicinal properties.

D. Description of Family-

I. Vegetative Characters-

1. **Habitat-** Terrestrial, wild
2. **Habit-** Mostly herbs and undershrubs sometimes climbers are also found. Presence of milky latex.
3. **Root-** Tap root system
4. **Stem-** Aerial, erect, branched, woody, solid, cylindrical, smooth, pubescent, presence of milky latex, green.
5. **Leaves-** Exstipulate, petiolate, opposite decussate, reticulate unicostate, simple, Apex-obtuse, Base-cordate, Margin- entire, presence of waxy coating on leaves.

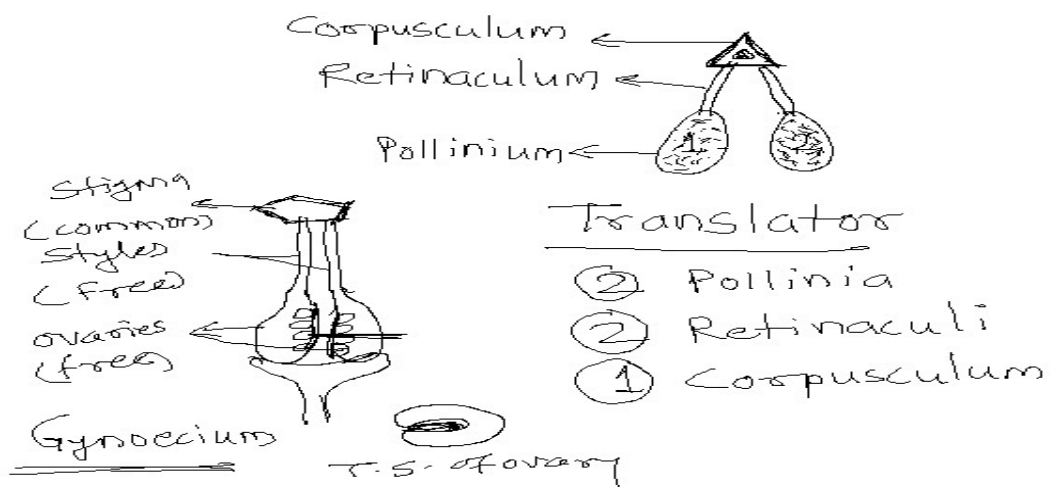
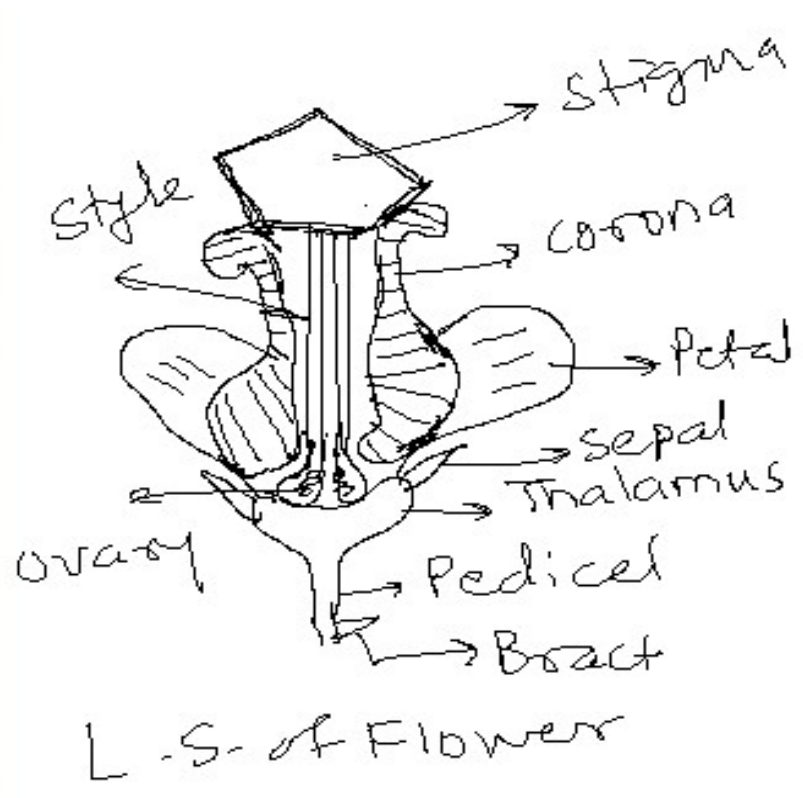
II. Floral Characters-

1. **Inflorescence-** Axillary, Terminal cymose.
2. **Flower-** Bracteate, Pedicellate, Actinomorphic, Bisexual, Complete, Hypogynous, presence of corona and gynostegium.
3. **Calyx-** Sepals- five, gamosepalous, imbricate, green.
4. **Corolla-** Petals-five, gamopetalous, twisted, white or coloured, presence of outgrowths on petals called as corona.
5. **Androecium-** Stamens- five, epipetalous, dithecos.

Anthers are modified into sac like structures called pollinia which contain pollen grains in viscous fluid. There are two pollinia in each unit. Each pollinium is attached to a stalk like structure called as retinaculum. The two retinaculi are attached to a triangular structure called as Corpusculum. The corpusculum is attached to the angle of pentangular stigma. The complete unit is called as Translator. Each translator has 1 corpusculum, 2 retinaculi and 2 pollinia.

6. **Gynoecium-** Bicarpellary, subapocarpous (Ovaries and styles are free but stigma is common), stigma- pentangular. Presence of Gynoestegium i.e. Androecium is attached to the Gynoecium.

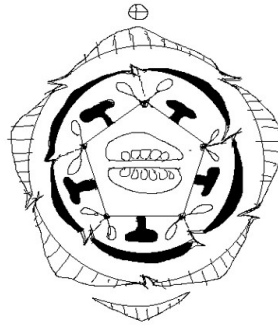
In section each ovary shows single locule with ovule at marginal placentation.



7. **Floral Formula-**

┌───┐ ───┐
Br, ⊕, ♀, K₍₅₎, C₍₅₎, A₅, G₂.

8. **Floral Diagram-**



9. **Fruit-**

A pair of follicles (fruit ruptures at one margin).

E. Pollination-

Pollination in Asclepiadaceae is very special. It is Entomophilous i.e. by the agency of insects. Insect visits the flower and rests on stigma. The Translator is attached to the leg of insect with the help of corpusculum. When insect visits another flower, the translator is deposited on stigma and entomophily is happened.

F. Economic Importance-

1. **Tylophora indica** (बेडकी)-The roots of are used as medicine for the treatment of respiratory diseases like asthma, bronchitis and whooping cough.
2. **Hemidesmus indicus** (अनंतमूळ)- The dried root is used as a blood purifier. It is used in chronic rheumatism, urinary diseases and also in skin diseases.
3. **Gymnema sylvestre** (गुडमार)- Leaves are used to cure diabetes. Leaves are also used as stomachic, stimulant, laxative and diuretic. It is also useful in cough, biliousness and sore eyes.
4. **Calotropis procera** (रुई)- The latex is used in tanning industry for deodorizing, removing hair and imparting yellow color to the hides.