

# MOSS ADVANCED VERSION

VOICE	IMAGES	REELS
1. Forests are dominated by large plants that crowd one another in their competition for light.	BUSH: Moss tape, 01:07 - 07:15 Pan across top of bush, down to stream below..... <u>Reel 2 04 03:20 - 03:42</u> (sun out, pan ends up in stream below)	LJ002 - 04:03:42:13- 04:03:36:17
2. But far below, on the forest floor there is a group of tiny plants known as the mosses.  With over 10,000 species, these plants thrive in many habitats.	Bush: stream valley scene at Cascades. Camera moves down stream	LJ008 9sec 20:23:10- 20:23:19 or 20:23:53- 20:24:03
3.		
4. These moss plants form gametes and are therefore <b>gametophytes</b> .	BUSH: Cascades, continue along stream.	
	<b>The Gametophyte</b>	
5. Moss gametophytes are haploid, containing only one set of chromosomes.	BUSH:Cascades, continue along stream. <b>BEGIN ANIMATION:</b> Moss clump.	
6. Their small and compact form enable the stems to stay upright, ..... while <b>rhizoids</b> anchor them to the soil.	BUSH: 07:26 - 07:36 Moving into moss stems	LJ008- 20:25:40- 20:25:50
	01:43 - 01: 53 Rain shower, camera moving down into a clump of moss.	Moss Anim Master 00:11:54- 00:12:39
	01:54 to 01:59  Filaments at the base of stems.	
7. Moisture easily accumulates around the densely spaced stems.	01:59 to 02:06  'Fog' in between spaces	
8. This often leaves a film of water on the leaves and on the stem tip.	02:07 to 02:12 Moving up stems to see the leaves.	
9. Hair like growths called <b>paraphyses</b> help to hold water around the stem tips.		

10. Some stem tips are male and contain reproductive structures called <b>antheridia</b> .	<b>Animation: 02:15 - 02:25</b> Fade-in to scene where camera is moving up the stem and inside water drop to see antheridia group.	Moss Anim Master 00:12:25- 00:12:35 water cross 00:14:05 00:14-10
11. These are complex organs consisting of many cells.	<b>Animation: 02:47 - 02:55</b> Cut to a closer view of antheridia ending up on a single antheridium.	MOSS ANIMATION MASTER 00:14:28- 00:14:57
12. Each is supported by a stalk.	<b>Animation: 02:56 - 02:59</b> Cut to a closer view of antheridia ending up on a single antheridium. Only the stalk showing at the end.	
13. The upper portion consists of an outer protective jacket that surrounds a group of sperm cells.	<b>Animation 03:04 to 03:09</b> Only jacket cells showing.	
14.	<b>Animation: 03:10- 03:15</b> internal view of fertile cells.	
15. At the tip of a female plant..... there are numerous reproductive structures known as <b>archegonia</b> .	<b>Animation</b>	LJ005 05:27:52.17 05:28:02:20
16.	<b>Animation: 02:14 - 02:20</b> moving inside water drop.	MOSS ANIMATION MASTER 00:12:25- 00:12:35
17. The top of each consists of a slender <b>neck</b> .	<b>Animation: 04:41 - 04:45</b> cross fade: group of archegonia; single	MASTER 00:17:47 00: MOSS ANIMATION N 18:31
18.	<b>Animation: 04:45 - 04:48: Neck</b>	
19. The middle region contains a chamber called the <b>venter</b> .	<b>Animation: 04:50 - 04:53: Venter</b>	
20. The base of the archegonium is attached to the moss stem by a stalk.	<b>Animation: 04:54 - 04:58</b>  Stalk	

21. An egg cell is formed inside the venter.	<b>Animation: 04:59 - 05:07f</b> egg	
22. Inside the neck, the breakdown of cells forms a central canal containing sperm attractant .	<b>Animation: 05:08 - 05:26</b>	

	<b>Fertilisation</b>	
VOICE	IMAGE	REEL
23.	GREENHOUSE <b>Reel 5a, 26:26 to 26:34</b> Moss stem tips	LJ005 05:26:25:24- 05:26:45:01
24. A rain shower provides the ideal conditions for sperm release and their transfer to a female plant.	GREENHOUSE <b>Reel 5a, 26:34 to 26:45</b> Moss stem tips; then rain falling	
24a. Droplets of rain water collect at the tips of the moss stems.	02:13 to 02:18 <b>Animation:</b> Stem tip with water drop on male stem. OR <b>Greenhouse:</b> close up of tip with water drop.	
25. Inside the drop of water at the tip of the male stem, the antheridia open.	<b>Animation: 03:21 - 03:35</b> Camera moving up the antheridium to the top which then opens up.	MOSS ANIMATION MASTER 00:16:32 00:16:58
26. This releases cells containing sperm, .....which float up to the surface.	<b>Animation: 03:36 - 03:45</b> Sperm -containing cells emerging and separating off individually into the water	
27	<b>Animation: 03:46 - 03:53</b> Sperm-containing cells floating upwards in water	
28. Rain drops splash some of this water out of the male plant.	<b>Animation: 03:54 - 04:04</b> Rain storm, drops striking tip of male plant	MOSS ANIMATION MASTER 00:11:58- 00:12:01
29. Some splash drops contain sperm cells and fall onto the tip of a female stem.	<b>Animation: 04:05 - 04:11</b> Splash drops upwards into the air. <u>Hold</u> on drop showing sperm. Drop moves down onto female shoot	MOSS ANIMATION MASTER 00:17:00- 00:17:33
30. The sperm now escape from their surrounding membrane .....and use their flagella to move about in search of an egg.	<b>Animation: 04:12 - 04:22</b> Membrane around sperm breaks down.	
31.	<b>Animation: 04:23 - 04:29</b> Sperm begin swimming movement.	

32.		
33. The archegonium now opens and releases the sperm attractant.	<b>Animation: 05:24 - 05:44</b> Camera moving up neck. (up close) Tip cells open, releasing attractant.	MOSS ANIMATION MASTER 00:18:32 00:19:24
34. The sperm swim towards the source of the attractant and into the opening.	<b>Animation: 05:45 - 05:58</b> Sperm swimming towards the opening of the archegonium	
35. Once inside, they are guided down to the egg.	<b>Animation: 05:59 - 06:08</b> Sperm swimming down inside the archegonium to the egg	
36. The first sperm to arrive enters the egg cell.	<b>Animation: 06:09 - 06:20</b> Fertilisation	
37. Fertilisation is completed when the sperm and egg nuclei fuse, creating a diploid <b>zygote</b> .	<b>Animation: 06:21 - 06:31</b> Sperm and egg nucleus fusing.	MOSS ANIMATION MASTER 00:19:50 00:20:01

	<b>The Embryo</b>	
VOICE	IMAGE	REEL
38. After fertilisation, many changes take place on the female stem tip .	<b>GREENHOUSE:</b> Real stem tip <b>Reel 5a, 26:14 to 26:25</b> move in close up to real stem	LJ005 05:26:14:15- 05:26:21:16
39. At first, the zygote remains within the venter .....where it forms an embryo.	<b>Animation 04:40 - 04:46</b> female shoot tip;archegonium	MOSS ANIMATION MASTER 00:17:47-
40.	<b>Animation NEW</b> fade away external skin to show zygote inside; zygote swelling in size.	MOSS ANIMATION Master 11:57:59-
41. However, one end of the embryo soon grows out of the venter and into the female stem.	<b>Animation 06:52 - 07:11</b> Embryo growing down through the base of the	MOSS ANIMATION MASTER 00:19:42-
42. This allows it to obtain water and nutrients from the female plant.	<b>Animation 07:12 - 07:18</b> Molecules entering the embryo foot.	MOSS ANIMATION MASTER 00:20:02- 00:20:35
43. The other end of the embryo grows upward.	<b>Animation 07:19 - 07:23</b> Cut-away view of archegonium: embryo growing upwards.	
44. The venter expands to accommodate this growth..... but eventually it is split in half.	<b>Animation 07:24 - 07:28</b> Archegonium enlarging	
45	<b>Animation 07:30 - 07:37</b> Archegonium breaking in half	MOSS ANIM MASTER 00:20:30- 00:20:37
46. The embryo now forms a very long stalk or <b>seta</b> , that lifts the top half of venter up into the air.	<b>Animation 07:39 - 07:45</b> The top half is lifted upwards	MOSS ANIM MASTER 00:20:52- 00:20:58
	<b>Animation 07:45 and hold</b> View upward into sky	
47. This results in a small diploid plant, the <b>sporophyte</b> , attached to the tip of the female stem.	<b>Greenhouse</b> Group of <i>Minium</i> with sporophytes attached.	

	<b>The Sporophyte</b>	
VOICE	IMAGES	REEL
48. These female stems have all been fertilised and support sporophytes above them.	WAITAKERE DAM: group of sporophyte plants	LJ005 05:29:05:12 05:29:22:12
49. The tip of each is covered by the torn venter or <b>calyptera</b> .	BUSH: Up close of few sporophyte plants.	MOSS ANIMATION MASTER
50. This soon falls away, exposing a <b>capsule</b> or sporangium.	<b>Animation 07:53- 07:57</b> Shell falling off, exposing the capsule	
51. The capsule contains fertile tissue consisting of <b>sporocytes</b> .	<b>Animation 07:58-08:06</b> Outer skin removed showing sporangium underneath.	
52.	<b>Animation 08:06 - 08:15</b> Sporocyte cells.	
53. Inside the nucleus of each sporocyte there are two sets of chromosomes.	<b>Animation 08:16 - 08:20</b> Ending up on one cell with its nucleus.	
54. The nucleus divides by the process of <b>meiosis</b> , forming four haploid nuclei.	<b>Animation: 08:20 - 08:34</b> <b>Hold on 08:34 if necessary.</b> Nucleus dividing	
55. Thin walls now form around each nucleus, resulting in a cluster of four cells known as a <b>tetrad</b> . . .	<b>Animation: 08:35 - 08:46</b> Cleavage taking place	
56.	<b>Animation: 08:47 - 08:54</b> Tetrad arrangement	
57. A deposit of <b>sporopollenin</b> produces cells with thick, resistant walls called <b>spores</b> .	<b>Animation: 08:55 - 09:12</b> Cells changing to red-brown. Pulling out .	
58. As the spores are forming, the capsule dries out and hardens.	<b>Animation 09:13 - 09:18</b> Capsule turning colour.	MOSS ANIMATION MASTER 11:59:05:00 11:59:39:00
59. Soon, the lid, or <b>operculum</b> , falls away revealing a ring of fine teeth called the <b>peristome</b> .	<b>Animation 09:22 - 09:28</b> Lid to capsule falling off. Peristome teeth visible.	<b>(redumped)</b>
60. These surround an opening in the capsule. As they dry out, they bend backwards, allowing the spores to escape.	<b>Animation 09:29 - 09:36</b> Camera moves in close	
61.	<b>Animation 09:37 - 09:43</b> Outer hairs bending	

62. A light breeze is all it takes to carry the spores away from the parent plant.	<b>Animation 09:44 - 09:55</b> Pull back to see many moss plants with sporophytes on top, releasing spores.	MOSS ANIMATION MASTER 00:23:07:00 00:23:19:00

	<b>The New Gametophyte</b>	
VOICE	IMAGES	REEL
63. Spores, carried by the wind, may land on an exposed surface	BUSH Waitakere dam dirt bank	LJ005 05:34:28:06- 05:34:36:14
64. After rain, the spore cell absorbs water and germinates.	<b>Animation: 09:56 - 10:07</b> Spore landing on a surface and a filament starting to come out	MOSS ANIMATION MASTER 00:23:19 00:23:42
65. But instead of growing into a new moss plant, it forms a branched filamentous <b>protonema</b> . . .	<b>Animation 10:08 - 10:20</b> Green filaments growing and branching	
66. However, after a period of growth, some of the protonema form buds.	<b>Animation 10:21 - 10:31</b> Bud forming on the side of a filament of cells.	MOSS ANIMATION MASTER 11:57:21:00 11:57:37:00
67. Each bud will proceed to grow into a new leafy gametophyte.	<b>Animation 10:32 - 10:53</b> Bud develops into an erect stem with leaves and rhizoids at the base.	MOSS ANIMATION MASTER 00:24:05 00:24:25
68. Spores then, enable mosses to spread and colonise new areas often some distance from the parent plant.	UNIVERSITY Waitakere dam bank	LJ005 05:34:37:02 05:43:52:20
<p>FINALE:</p> <p>Using both gametes and spores, these unassuming members of the plant kingdom quietly proceed to thrive and multiply.</p> <p>They have successfully spread from polar regions to the tropics, and are equally at home in our cities or in the countryside.</p> <p>Perhaps a key to their success is their small size.</p> <p>Perhaps it is due to their ancient lineage, going back more than 400 million years to a time when plants were first colonising the land.</p> <p>Whatever the reason, these tough, yet attractive opportunists hold many surprises for the interested observer.</p>		

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