

Supporting data information for paper:

Acoustic levitation of pollen to study hygroscopic behaviour

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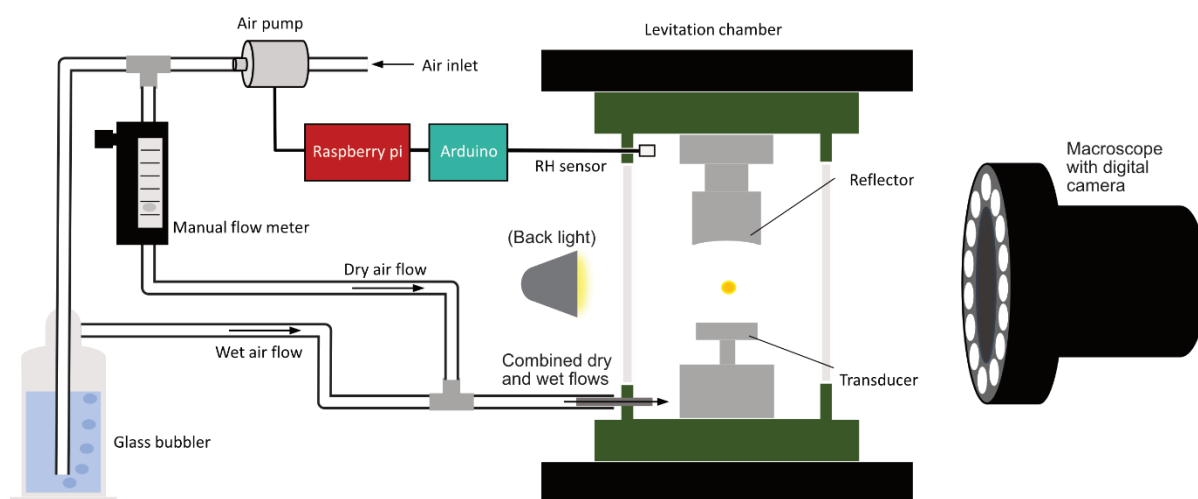
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Two different species of pollen, *Lilium orientalis* (Oriental Lily) and *Populus deltoides* (Eastern Cottonwood), were levitated using a modified commercial acoustic levitator (tec5, Oberursel, Germany) with the setup described below. Relative humidity (RH) was measured by a DHT22 RH sensor (2–5% RH accuracy between 0-100% RH) controlled by an Arduino and Raspberry pi, connected to the air pump that delivered air, via wet and dry channels, into the chamber. A Leica MC190 HD macroscope with digital camera attached was used to take snapshot images at varied RH increments between ambient and maximum RH. At the end of this document in the Appendix, tables for each of the experiments reported in this work can be found which give the corresponding RH values for the raw image snapshots available within this supporting data.



A bespoke program using Python 3.9 was used to construct contours around the pollen grains in each image and determine the area within the contour by pixels, as well as the perpendicular diameters of an ellipse fitted on the contour. Datasets were outputted in each experiment case and aggregated and processed by the accompanying Python (Jupyter Notebook) script 'DataAggregation.ipynb'. The processing involved pairing the raw measurements of pixel areas and diameters with the corresponding RH value for each data point, averaging over the 5 image samples for each RH increment, and then area ratio and diameter ratio measurements were calculated to produce the

processed dataset 'AllDataProcessed.csv'. The table below describes each of the columns present in this dataset.

Column name	Description	Units
Index	Numbers 0-185 for each row	-
Direction	'1Increasing' or '2Decreasing' denoting whether relative humidity (RH) was being increased or decreased respectively for given data point.	-
RH	Relative humidity	%
Area	Area of pollen grain determined from contour fitted on image by Python program, averaged over 5 images.	Pixels
DiameterA	Shorter measured diameter from ellipse fitted on pollen grain image by Python program, averaged over 5 images.	Pixels
DiameterB	Longer measured diameter from ellipse fitted on pollen grain image by Python program, averaged over 5 images.	Pixels
Expt	Individual experiment identifier	-
ID	Experiment group identifier (e.g. 'Lily_stat' for stationary <i>Lilium orientalis</i> experiments and 'EC_lev' for levitated <i>Populus deltoides</i> pollen).	-
AreaRatio	Area as a ratio of initial area for given experiment, i.e. area/initial area.	-
DiameterRatio	Ratio of measured diameters, the shorter diameter over the longer, i.e. DiameterA/DiameterB	-

This aggregated dataset was then analysed and visualised by the Jupyter Notebook script 'AllExptAnalysis.ipynb' to produce the results presented in the paper.

Individual experiment data

The following are tables for each of the experiments reported in this work (and some not reported) which give the experimental conditions and corresponding RH values for the raw image snapshots taken by the macroscope, which are also available within this supporting data. Each experiment run is in a separate folder named with its date, and within the folder can be found: a folder containing the raw images from the macroscope, a folder containing each image as output from the Python program with a fitted contour, Python scripts used to process the image and draw the contour, and the CSV file output from this script with image name, calculated area within the contour, and perpendicular diameters of the fitted ellipse for each image.

2020/12/03 (not used in paper)

Lilium orientalis (levitated)

Back-lit

Image name	RH (%)
AM100707	50
AM100708	60
AM100714-16	61
AM100717-19	61
AM100720-22	70
AM100723-5	48
AM100726-8	50
AM100729-32	60
AM100733-35	70
AM100736-38	80
AM100739-40	85
AM100741-43	90
AM100744-46	95
AM100747-48	90
AM100749-51	85
AM100752-54	80
AM100755-56	70
AM100757-59	60
AM100760-62	50

2020/12/04_A (not used in paper)

Lilium orientalis (levitated)

Back-lit

Image name	RH (%)
AM100766-8	45
AM100769-74	50
AM100775-79	60
AM100780-84	70
AM100785-88	75

AM100789-92	80
AM100793-96	85
AM100797-803	90
AM100804-11	95

2020/12/04_B (not used in paper)

Lilium orientalis (levitated)

Back-lit

Image name	RH (%)
AM100812-17	50
AM100818-20	60
AM100821-24	70
AM100825	75
AM100826-29	80
AM100830	85
AM100831-34	90
AM100835-38	95
AM100839	80
AM100840	70
AM100841	60
AM100842-44	50

2020/12/04_C (not used in paper)

Lilium orientalis (levitated)

Back-lit

Image name	RH (%)
AM100848-52	50
AM100853	55
AM100854-55	75
AM100856057	85
AM100858	90
AM100859-67	95

2021/03/09_A (used in paper)

Lilium orientalis (levitated)

Back-lit

Image name	RH (%)
AM100878-882	45
AM100883-887	50
AM100888-892	60
AM100893-897	70
AM100898-902	80

AM100903-907	85
AM100908-912	90
AM100913-917	95
AM100918-922	99
AM100923-927	95
AM100928-932	90
AM100933-937	85
AM100938-942	80
AM100943-947	70
AM100948-952	60
AM100953-957	50

2021/03/09_B (used in paper)

Same conditions as above.

Image name	RH (%)
AM100958-962	45
AM100963-967	50
AM100968-972	60
AM100973-977	70
AM100978-982	80
AM100983-987	85
AM100988-992	90
AM100993-997	95
AM100998-1002	99
AM101003-1007	95
AM101008-1012	90
AM101013-1017	85
AM101018-1022	80
AM101023-1027	70
AM101028-1032	60
AM101033-1037	50

2021/03/09_C (used in paper)

Same conditions as above.

Image name	RH (%)
AM101038-042	42
AM101043-047	50
AM101048-052	60
AM101053-057	70
AM101058-062	80
AM101063-067	85
AM101068-072	90
AM101073-077	95
AM101078-082	99
AM101083-087	95
AM101088-092	90

AM101093-097	85
AM101098-102	80
AM101103-107	70
AM101108-112	52
AM101113-117	50

2021-03-20_A (used in paper)

Lilium orientalis (levigated)

Back-lit

Image name	RH (%)
AM101119-23	50
AM101124-28	60
AM101129-33	70
AM101134-38	80
AM101139-43	85
AM101144-48	90
AM101149-53	95
AM101154-58	99
AM101159-63	93
AM101164-68	90
AM101169-73	85
AM101174-78	80
AM101179-83	70
AM101184-88	56
AM101189-93	50

2021-03-30_B (used in paper)

Same conditions as above.

Image name	RH (%)
AM101194-198	50
AM101199-203	60
AM101204-208	70
AM101209-213	80
AM101214-218	85
AM101219-223	90
AM101224-228	95
AM101229-233	99
AM101234-238	95
AM101239-243	90
AM101244-48	83
AM101249-253	80
AM101254-258	68
AM101259-263	60
AM101264-268	50

2021-03-31_C (used in paper)

Same conditions as above.

Image name	RH (%)
AM101269-273	48
AM101274-278	60
AM101279-283	70
AM101284-288	81
AM101289-293	86
AM101294-298	90
AM101299-303	95
AM101304-308	99
AM101309-313	95
AM101314-318	90
AM101319-323	85
AM101324-328	80
AM101329-333	70
AM101334-338	59
AM101339-343	50

2021/07/06_A (used in paper)

Lilium orientalis (stationary) x2 pollen grains

Back-lit

Image name	RH (%)
AM101345-349	70
AM101350-354	75
AM101355-359	80
AM101360-364	85
AM101365-369	90
AM101370-374	95
AM101375-379	96
AM101380-384	95
AM101385-389	90
AM101390-394	85
AM101395-399	80
AM101400-404	75
AM101405-409	70

2021/07/06_B (used in paper)

Lilium orientalis (stationary) x2 pollen grains

Front-lit

Image name	RH (%)
AM101410-414	70
AM101415-419	75

AM101420-424	83
AM101425-429	85
AM101430-434	90
AM101435-439	95
AM101440-444	96
AM101445-449	95
AM101450-454	90
AM101455-459	85
AM101460-464	80
AM101465-469	75
AM101470-474	65

2021/07/06_C (used in paper)

Lilium orientalis (stationary) x1 grain

Back-lit

Image name	RH (%)
AM101475-479	60
AM101480-484	70
AM101485-489	75
AM101490-494	80
AM101495-499	85
AM101500-504	90
AM101505-509	95
AM101510-514	95
AM101515-519	90
AM101520-524	85
AM101525-529	80
AM101530-534	75
AM101535-539	60

2021/08/11 (used in paper)

Populus deltoides (stationary)

3 grains chosen out of multiple visible grains.

Back-lit

Image name	RH (%)
AM101540-544	60
AM101545-549	65
AM101550-554	70
AM101555-559	75
AM101560-564	80
AM101565-569	85
AM101570-574	90
AM101575-579	94
AM101580-584	94

2021/08/26 (used in paper)

Populus deltoides (levitated)

Back-lit

Image name	RH (%)
AM101614-624	48
AM101625-635	95
AM101636-640	90
AM101641-645	50