

Pollenkitt is associated with the collectability of Malvoideae pollen for corbiculate bees

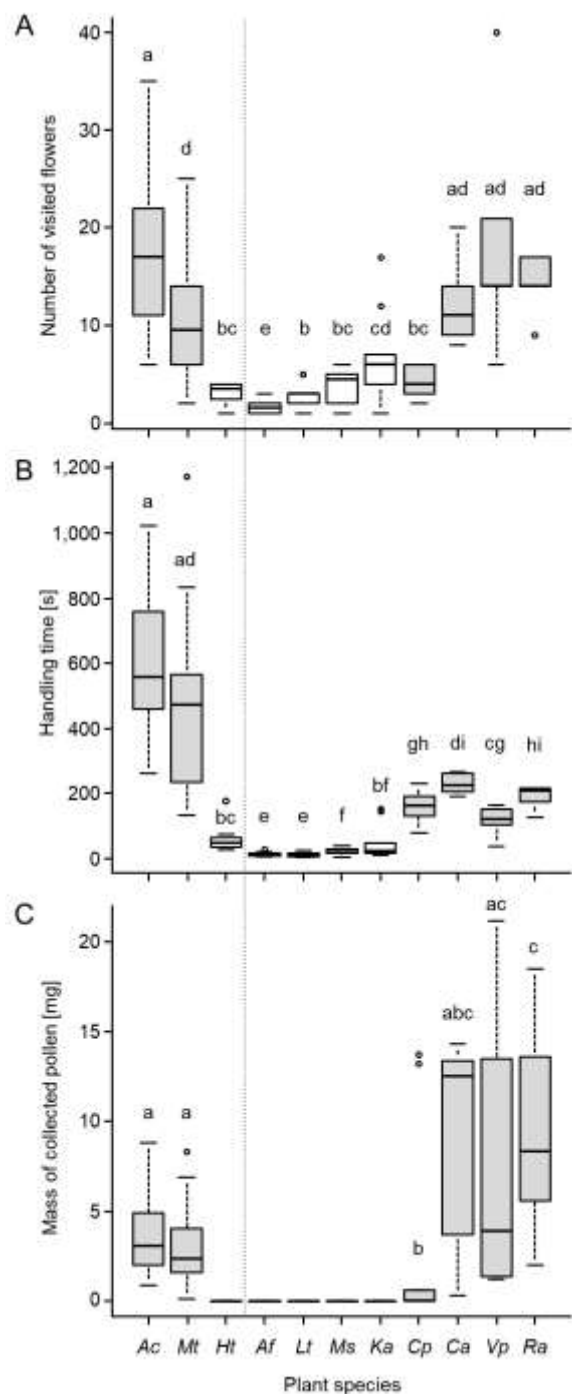
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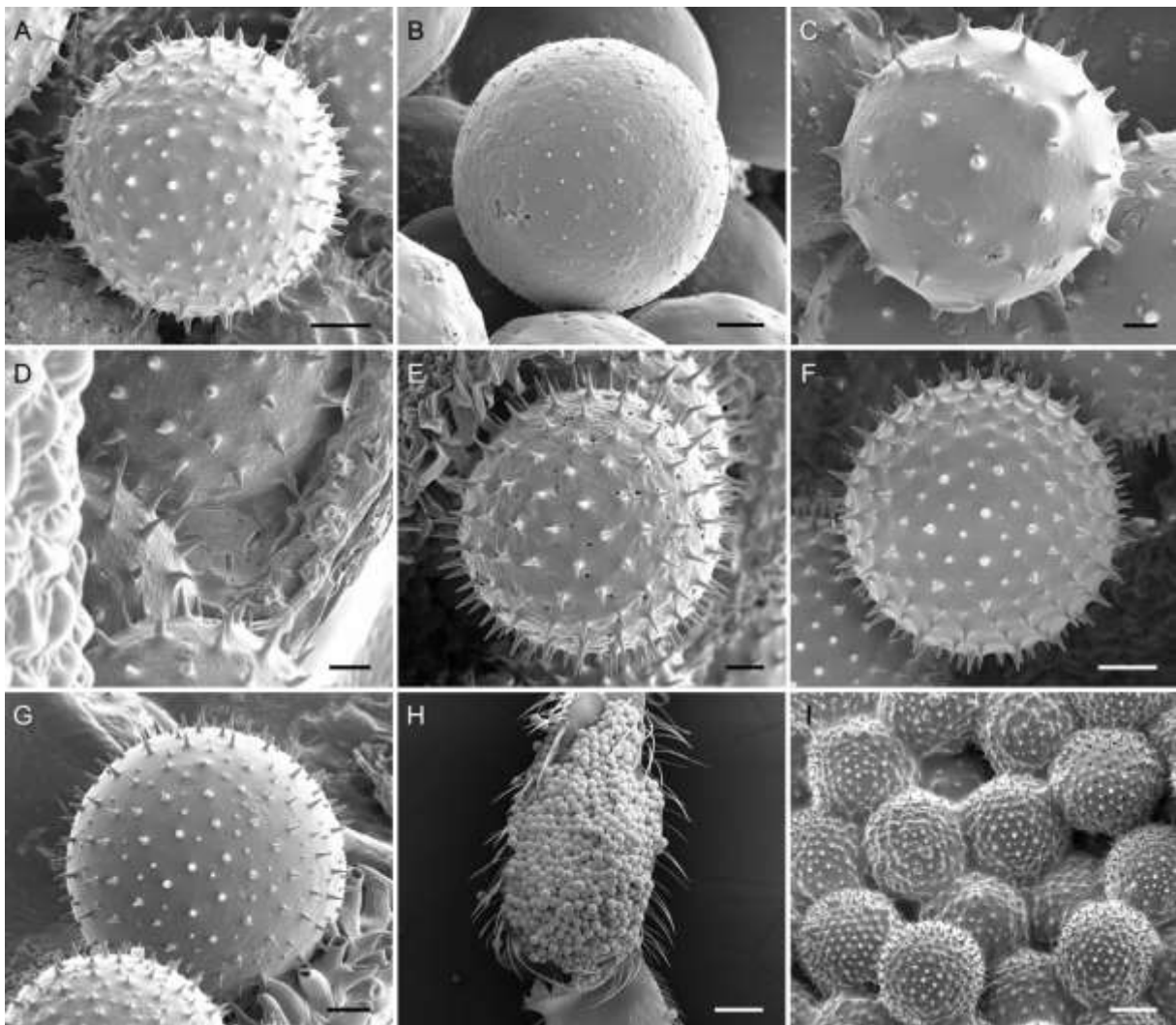
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Appendices



Appendix I. Comparison of present and previously published data on pollen collection by individual *Bombus terrestris* workers. The vertical, dotted line divides newly obtained data (left) and data published in Konzmann et

al. (2019) (right). (A) Number of visited flowers, (B) handling time, and (C) mass of pollen collected during one foraging bout (left of dotted line: dry mass; right of dotted line: fresh mass). Plant species are colour-coded for pollen collectability by corbiculate bees: grey = collectable (*Ac*, *Mt*, *Cp*, *Ca*, *Vp*, *Ra*); white = uncollectable (*Ht*, *Af*, *Lt*, *Ms*, *Ka*). 26 bees sampled for *Anoda cristata* (*Ac*), 18 bees sampled for *Malope trifida* (*Mt*), 8 bees sampled for *Hibiscus trionum* (*Ht*), 10 bees sampled for *Alcea ficifolia* (*Af*), *Lavatera thuringiaca* (*Lt*), *Malva sylvestris* (*Ms*) (Malvaceae, subfamily Malvoideae), *Knautia arvensis* (*Ka*) (Dipsacaceae), and *Cucurbita pepo* (*Cp*) (Cucurbitaceae), and 5 bees sampled for *Campanula alliarifolia* (*Ca*) (Campanulaceae), *Verbascum phlomoides* (*Vp*) (Scrophulariaceae), and *Rosa arvensis* (*Ra*) (Rosaceae). Different letters indicate significant differences after Kruskal-Wallis test and Mann-Whitney *U* test with *fdr* correction ($P < 0.05$).



Appendix II. Cryo-SEM micrographs of fresh Malvoideae pollen on recently opened anthers of (A) *Althaea officinalis*, (B) *Anoda cristata*, (C) *Hibiscus syriacus*, (D) *H. trionum*, (E) *Lavatera trimestris*, (F) *Malope trifida*, and (G) *Malva sylvestris*. Despite the morphological similarities, only pollen grains of *A. cristata* and *M. trifida* are collectable for corbiculate bees. (H, I) SEM micrographs of a dried *M. trifida* pollen pellet in the corbicula of an *Apis mellifera* worker. Scale bars indicate 20 μm (A-G), 400 μm (H) and 40 μm (I), respectively.

Appendix III. Original dataset of the pollen collectability assays (results presented in Fig. 1 and Appendix I). Black font indicates newly obtained data; grey font marks data published in Konzmann et al. (2019). VF = Number of visited flowers; HT = Handling time [s]; PM = Mass of collected pollen [mg].

Plant species	VF	HT	PM	Plant species	VF	HT	PM
<i>Alcea ficifolia</i>	2	15.3	0	<i>Malope trifida</i>	14	835	6.7
<i>Alcea ficifolia</i>	1	11.6	0	<i>Malope trifida</i>	10	534	3.1
<i>Alcea ficifolia</i>	2	13.6	0	<i>Malope trifida</i>	8	172	2.3
<i>Alcea ficifolia</i>	2	27.2	0	<i>Malope trifida</i>	2	427	2.8
<i>Alcea ficifolia</i>	1	9.2	0	<i>Malope trifida</i>	11	519	1.6
<i>Alcea ficifolia</i>	1	21	0	<i>Malope trifida</i>	5	237	1.8
<i>Alcea ficifolia</i>	3	14.2	0	<i>Malope trifida</i>	6	565	1.2
<i>Alcea ficifolia</i>	2	16	0	<i>Malope trifida</i>	10	558	4.5
<i>Alcea ficifolia</i>	1	7.6	0	<i>Malope trifida</i>	13	263	4
<i>Alcea ficifolia</i>	1	11.2	0	<i>Malope trifida</i>	17	1174	1.3
<i>Anoda cristata</i>	21	526	5.2	<i>Malope trifida</i>	15	722	1.6
<i>Anoda cristata</i>	19	714	1.8	<i>Malope trifida</i>	25	531	2.4
<i>Anoda cristata</i>	33	631	8.8	<i>Malope trifida</i>	6	225	1.6
<i>Anoda cristata</i>	28	460	4.9	<i>Malva sylvestris</i>	5	30.9	0
<i>Anoda cristata</i>	18	504	6.3	<i>Malva sylvestris</i>	2	23.7	0
<i>Anoda cristata</i>	14	497	2.8	<i>Malva sylvestris</i>	4	23.7	0
<i>Anoda cristata</i>	15	527	5.7	<i>Malva sylvestris</i>	2	14.5	0
<i>Anoda cristata</i>	18	628	6.1	<i>Malva sylvestris</i>	5	39.7	0
<i>Anoda cristata</i>	22	820	2.3	<i>Malva sylvestris</i>	4	16.5	0
<i>Anoda cristata</i>	6	262	2.2	<i>Malva sylvestris</i>	5	27.1	0
<i>Anoda cristata</i>	30	880	1.3	<i>Malva sylvestris</i>	6	40.5	0
<i>Anoda cristata</i>	19	861	2.5	<i>Malva sylvestris</i>	1	4.4	0
<i>Anoda cristata</i>	6	518	1.4	<i>Malva sylvestris</i>	5	30.5	0
<i>Anoda cristata</i>	11	320	0.9	<i>Knautia arvensis</i>	7	22.6	0
<i>Anoda cristata</i>	22	556	4.8	<i>Knautia arvensis</i>	6	17	0
<i>Anoda cristata</i>	35	958	2	<i>Knautia arvensis</i>	6	29.3	0
<i>Anoda cristata</i>	14	557	4.2	<i>Knautia arvensis</i>	4	13.5	0
<i>Anoda cristata</i>	11	641	3.6	<i>Knautia arvensis</i>	1	12.5	0
<i>Anoda cristata</i>	9	270	3.3	<i>Knautia arvensis</i>	12	145.4	0
<i>Anoda cristata</i>	25	759	4.4	<i>Knautia arvensis</i>	6	47.8	0
<i>Anoda cristata</i>	16	390	2	<i>Knautia arvensis</i>	17	153.3	0
<i>Anoda cristata</i>	16	769	2.4	<i>Knautia arvensis</i>	3	24	0
<i>Anoda cristata</i>	10	451	1.4	<i>Knautia arvensis</i>	4	23.7	0
<i>Anoda cristata</i>	23	1023	6.7	<i>Cucurbita pepo</i>	6	193.4	0.6
<i>Anoda cristata</i>	12	703	4.4	<i>Cucurbita pepo</i>	4	146.9	0
<i>Anoda cristata</i>	11	450	2.8	<i>Cucurbita pepo</i>	6	183.2	0
<i>Hibiscus trionum</i>	4	56	0	<i>Cucurbita pepo</i>	5	223.0	0
<i>Hibiscus trionum</i>	2	75	0	<i>Cucurbita pepo</i>	4	166.0	0
<i>Hibiscus trionum</i>	4	41	0	<i>Cucurbita pepo</i>	3	231.2	0.3
<i>Hibiscus trionum</i>	4	179	0	<i>Cucurbita pepo</i>	2	79.5	0
<i>Hibiscus trionum</i>	1	29	0	<i>Cucurbita pepo</i>	3	157.6	13.2
<i>Hibiscus trionum</i>	3	28	0	<i>Cucurbita pepo</i>	4	102.3	0
<i>Hibiscus trionum</i>	4	49	0	<i>Cucurbita pepo</i>	6	133.1	13.7
<i>Hibiscus trionum</i>	3	48	0	<i>Campanula alliarifolia</i>	14	194.4	13.4
<i>Lavatera thuringiaca</i>	3	13.2	0	<i>Campanula alliarifolia</i>	8	268	0.3
<i>Lavatera thuringiaca</i>	3	10	0	<i>Campanula alliarifolia</i>	9	261.4	3.7
<i>Lavatera thuringiaca</i>	5	20.8	0	<i>Campanula alliarifolia</i>	20	226.3	12.5
<i>Lavatera thuringiaca</i>	3	12.6	0	<i>Campanula alliarifolia</i>	11	206.6	14.3
<i>Lavatera thuringiaca</i>	2	4.7	0	<i>Verbascum phlomoides</i>	40	164.1	21.2
<i>Lavatera thuringiaca</i>	1	5.7	0	<i>Verbascum phlomoides</i>	14	122.5	1.2
<i>Lavatera thuringiaca</i>	2	7.4	0	<i>Verbascum phlomoides</i>	21	153.4	13.5
<i>Lavatera thuringiaca</i>	3	18.2	0	<i>Verbascum phlomoides</i>	14	104.9	3.9
<i>Lavatera thuringiaca</i>	3	12.3	0	<i>Verbascum phlomoides</i>	6	38.1	1.33
<i>Lavatera thuringiaca</i>	5	25.4	0	<i>Rosa arvensis</i>	17	174.3	13.6
<i>Malope trifida</i>	7	292	4	<i>Rosa arvensis</i>	9	208.7	5.6
<i>Malope trifida</i>	6	407	6.9	<i>Rosa arvensis</i>	14	128.3	2
<i>Malope trifida</i>	9	150	0.1	<i>Rosa arvensis</i>	14	215.9	8.3
<i>Malope trifida</i>	14	600	8.3	<i>Rosa arvensis</i>	17	216.7	18.5
<i>Malope trifida</i>	5	134	0.8				

Appendix IV. Original dataset of the high-speed rotation test (results presented in Fig. 2). Pre = Number of pollen grains adhering to dorsal bumble bee setae after application; Post = Number of pollen grains adhering to setae after high-speed rotation.

Plant species	Body part	Pre	Post
<i>Anoda cristata</i>	Abdomen	49	0
<i>Anoda cristata</i>	Abdomen	135	0
<i>Anoda cristata</i>	Abdomen	97	4
<i>Anoda cristata</i>	Abdomen	92	9
<i>Anoda cristata</i>	Abdomen	95	0
<i>Anoda cristata</i>	Thorax	131	4
<i>Anoda cristata</i>	Thorax	88	1
<i>Anoda cristata</i>	Thorax	113	1
<i>Anoda cristata</i>	Thorax	156	6
<i>Anoda cristata</i>	Thorax	148	4
<i>Hibiscus trionum</i>	Abdomen	55	29
<i>Hibiscus trionum</i>	Abdomen	53	27
<i>Hibiscus trionum</i>	Abdomen	83	50
<i>Hibiscus trionum</i>	Abdomen	48	28
<i>Hibiscus trionum</i>	Abdomen	79	22
<i>Hibiscus trionum</i>	Thorax	75	20
<i>Hibiscus trionum</i>	Thorax	77	28
<i>Hibiscus trionum</i>	Thorax	97	52
<i>Hibiscus trionum</i>	Thorax	137	81
<i>Hibiscus trionum</i>	Thorax	81	24
<i>Malope trifida</i>	Abdomen	81	2
<i>Malope trifida</i>	Abdomen	24	0
<i>Malope trifida</i>	Abdomen	25	0
<i>Malope trifida</i>	Abdomen	23	1
<i>Malope trifida</i>	Abdomen	33	1
<i>Malope trifida</i>	Thorax	91	5
<i>Malope trifida</i>	Thorax	69	2
<i>Malope trifida</i>	Thorax	107	2
<i>Malope trifida</i>	Thorax	78	0
<i>Malope trifida</i>	Thorax	134	4