

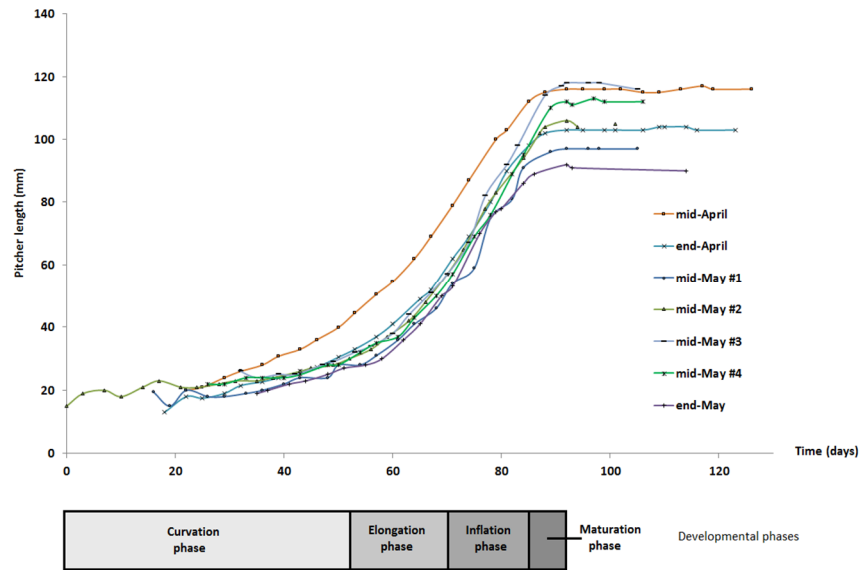
1 **Supplementary Material: Figures S1-S11 & Table S1**



3 **Figure S1.** *Nepenthes rafflesiana* lower pitcher ontogeny. (A) Curvation phase, (B) Elongation phase, (C) Inflation  
4 phase and (D) Maturation phase. Scale bar = 40 mm.

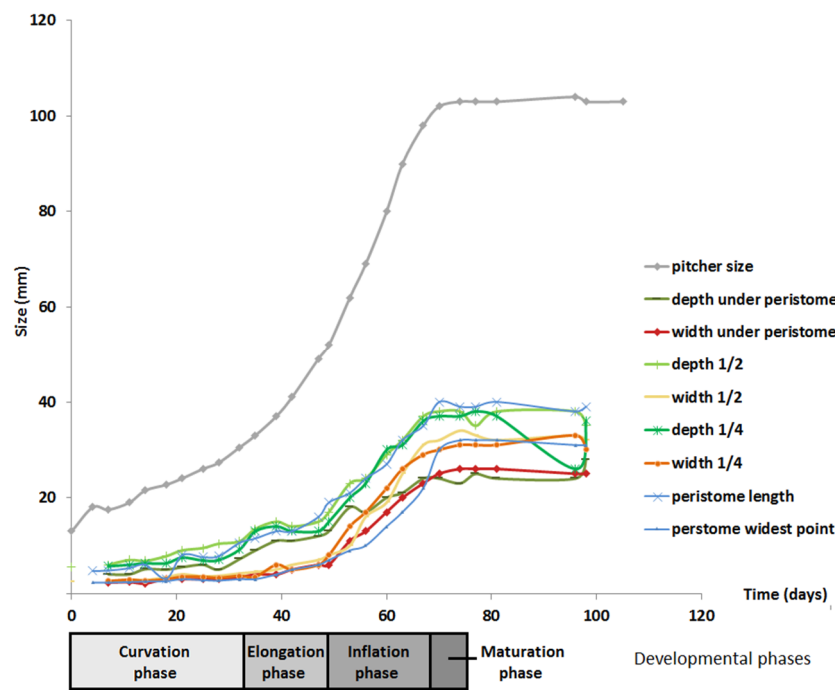


6 **Figure S2.** *Nepenthes rafflesiana* upper pitcher phases. (A) Curvation phase, (B) Elongation phase, (C) Inflation  
7 phase and (D) Maturation phase. Scale bar = 40 mm. Photographs by Rogier van Vugt.



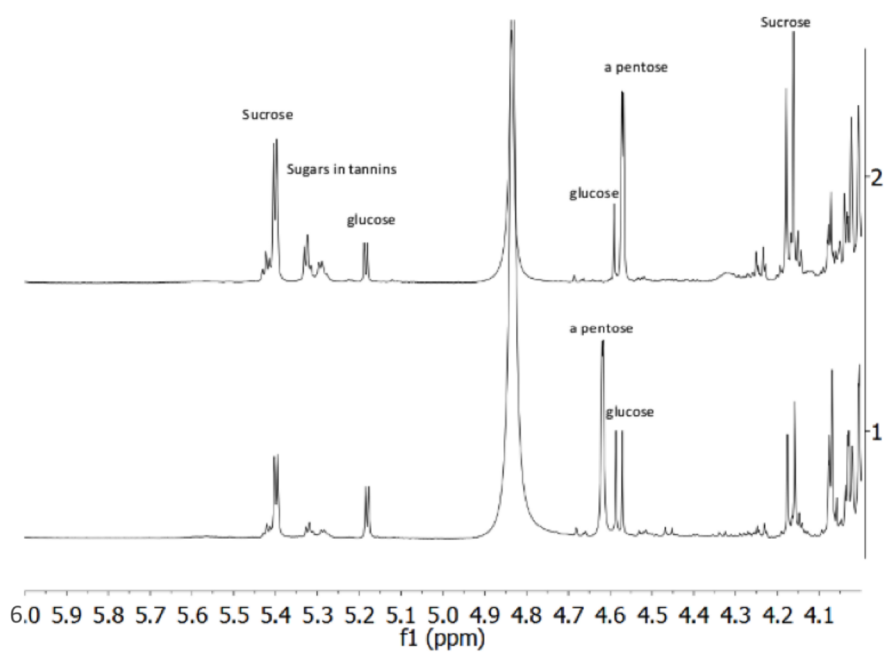
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9 **Figure S3.** Pitcher length of seven *Nepenthes rafflesiana* lower pitchers throughout development. Pitchers named  
10 according to maturation date.



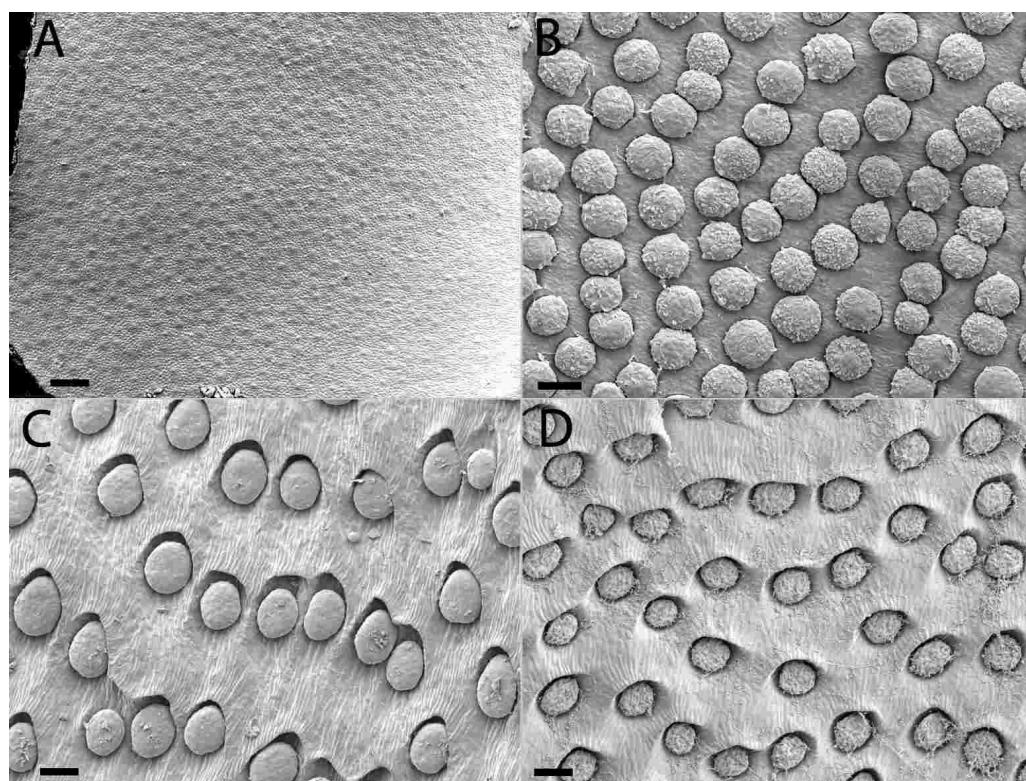
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12 **Figure S4.** Width and depth measurements of developing *Nepenthes rafflesiana* lower pitcher.



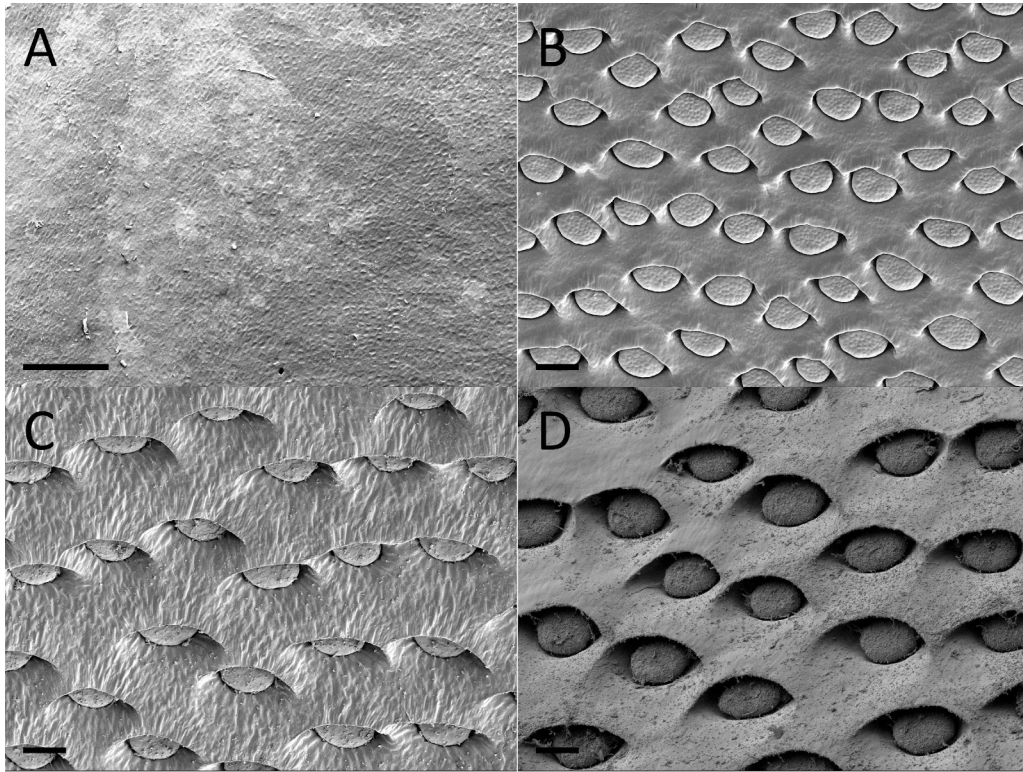
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14 **Figure S5.** HNMR spectrum chemical shifts (f1 ppm) of *Nepenthes rafflesiana* lower pitcher sugar regions. Pitcher  
 15 lid (1, bottom) and peristome secretory gland (2, top).



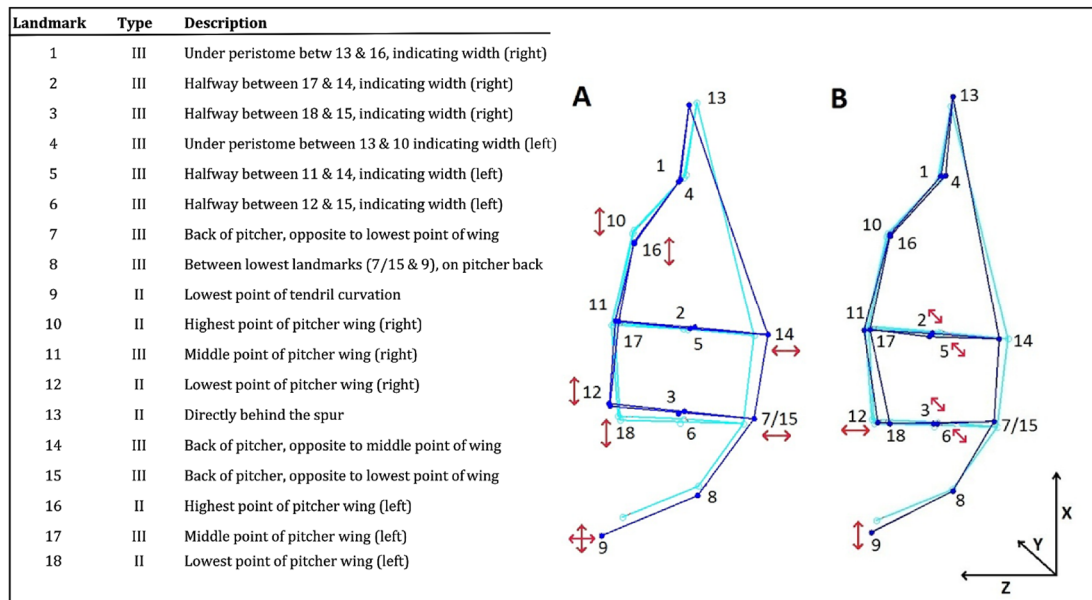
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17 **Figure S6.** Overview of digestive gland development of lower *Nepenthes rafflesiana* pitchers. Developmental  
 18 phases include the (A) curvation phase, (B) elongation phase, (C) inflation phase and (D) maturation phase. Scale  
 19 bar = 100  $\mu$ m.



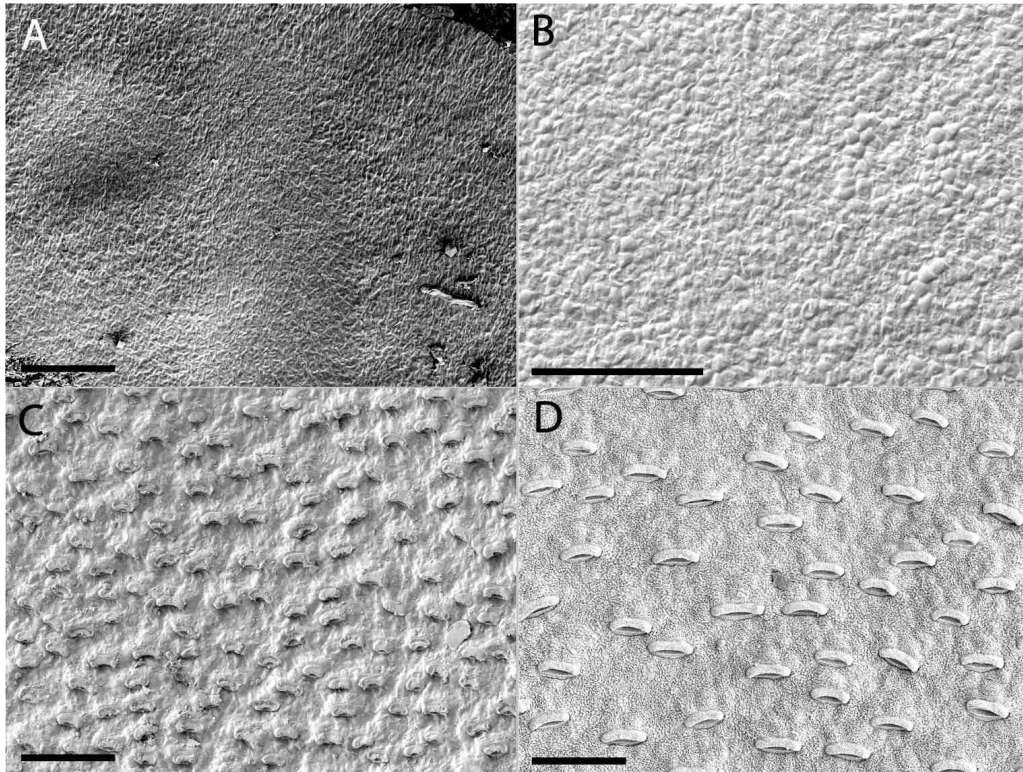
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21 **Figure S7.** Overview of digestive gland development of upper *Nepenthes rafflesiana* pitchers. Developmental  
 22 phases include the (A) curvation phase, (B) elongation phase, (C) inflation phase and (D) maturation phase. Scale  
 23 bar = 100  $\mu$ m.



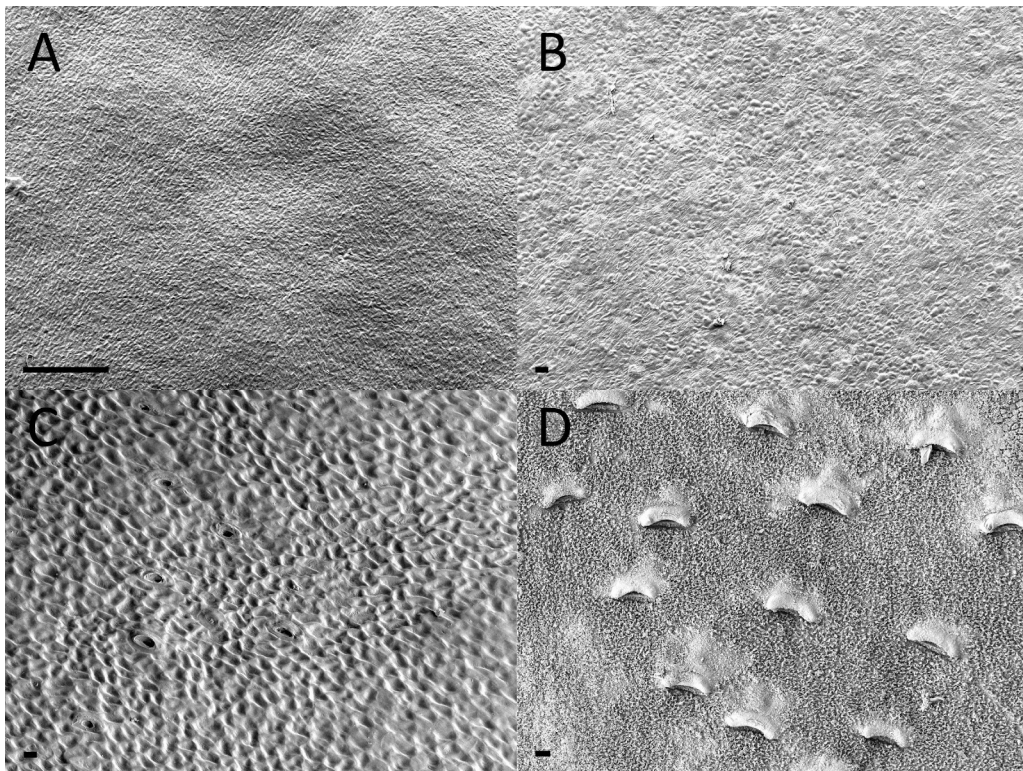
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25 **Figure S8.** Landmark category and placement description on *Nepenthes rafflesiana* pitchers. Type I landmarks  
 26 involve the juxtaposition of two types of tissue, type II is a maximum or minimum (top of pitcher, for example)  
 27 and type III uses type II landmarks as a reference (between top and bottom of pitcher, for example). The right  
 28 side of the figure shows a side view of pitcher wireframe with landmarks contributing to shape changes.  
 29 Numbers correspond to landmarks in adjacent table. Red arrows indicate principal component coefficients  
 30 above 0.200, and the orientation of the arrow indicates the axis (x, y or z). (A) Based on the Principal component  
 31 coefficients, PC1 encompasses three main shape variables: wing length (landmarks 10,12,16 and 18), tendril  
 32 curvation (landmark 9) and pitcher depth (landmarks 7/15 and 14). (B) Wireframe of PC2 shows that variance in  
 33 PC2 is largely described by an increasing pitcher width during development (landmark 2, 3, 5 and 6).



34

35 **Figure S9.** Overview of waxy layer progression and lunate cell development of lower *Nepenthes rafflesiana*  
 36 pitchers. Developmental phases include the (A) curvature phase, (B) elongation phase, (C) inflation phase and  
 37 (D) maturation phase. Scale bar = 100  $\mu\text{m}$ .



38

39 **Figure S10.** Overview of waxy layer progression and lunate cell development of upper *Nepenthes rafflesiana*  
 40 pitchers. Developmental phases include the (A) curvature phase, (B) elongation phase, (C) inflation phase and  
 41 (D) maturation phase. Scale bar = 100  $\mu\text{m}$ .

42 **Supplementary Table 1.** Specimen information of *Nepenthes rafflesiana* for Scanning Electron Microscopy and 3D  
 43 Morphometric analysis. Vouchers for each sample harvested is deposited in the Netherlands (L) and sourced  
 44 from the *Hortus botanicus* Leiden (HBL) or during fieldwork in Sabah, Borneo (author collection).

45

| Pitcher Type                    | Voucher   | Sample Source    |
|---------------------------------|-----------|------------------|
| <i>Lower pitcher curvation</i>  |           |                  |
| 1.1                             | L.2055339 | HBL 817241-23100 |
| 1.2                             | L.2055342 | HBL 817241-23100 |
| 1.3                             | L.1026137 | HBL 20130488     |
| 1.4                             | L.1026137 | HBL 20130488     |
| 1.5                             | L.2055343 | HBL 817241-23100 |
| <i>Lower pitcher elongation</i> |           |                  |
| 2.1                             | L.2055342 | HBL 817241-23100 |
| 2.2                             | L.2055342 | HBL 817241-23100 |
| 2.3                             | L.2055343 | HBL 817241-23100 |
| 2.4                             | L.2055339 | HBL 817241-23100 |
| 2.5                             | L.2055339 | HBL 817241-23100 |
| <i>Lower pitcher inflation</i>  |           |                  |
| 3.1                             | L.2055349 | HBL A84131-24458 |
| 3.2                             | L.2055344 | HBL 84102-24442  |
| 3.3                             | L.2055342 | HBL 817241-23100 |
| 3.4                             | L.2055337 | HBL 817241       |
| 3.5                             | L.2055347 | HBL A84107-23710 |
| <i>Lower pitcher maturation</i> |           |                  |
| 4.1                             | L.2055342 | HBL 817241-23100 |
| 4.2                             | L.1026132 | HBL 20070071     |
| 4.3                             | L.1026139 | HBL 20070071     |
| 4.4                             | L.2055337 | HBL 817241-23100 |
| 4.5                             | L.2055339 | HBL 817241-23100 |
| <i>Upper pitcher curvation</i>  |           |                  |
| 5.1                             | L.1026140 | HBL 20130487     |
| 5.2                             | L.1026141 | HBL 20130487     |
| 5.3                             | L.1026133 | HBL 84107-23710  |
| 5.4                             | L.1026140 | HBL 20130487     |
| 5.5                             | L.1026141 | HBL 20130487     |
| <i>Upper pitcher elongation</i> |           |                  |
| 6.1                             | L.1026131 | HBL A84107-23310 |
| 6.2                             | L.2055340 | HBL A84107-23710 |
| 6.3                             | L.2055347 | HBL A84107-23710 |
| 6.4                             | L.2055347 | HBL A84107-23710 |
| 6.5                             | L.1026139 | HBL 20070071     |

|                          |           |                         |
|--------------------------|-----------|-------------------------|
| Upper pitcher inflation  |           |                         |
| 7.1                      | L.2055336 | HBL A84107-23710        |
| 7.2                      | L.1026134 | HBL A84107-23310        |
| Upper pitcher maturation |           |                         |
| 8.1                      | L.1026139 | HBL 20070071            |
| 8.2                      | L.2055347 | HBL A84107-23310        |
| 8.3                      | L.4331617 | Author field collection |

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