



## Seed Morphology of the Subtribe Barleriinae and Andrographinae (Acanthaceae) in Thailand

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### ABSTRACT

Mature seeds of the representatives in subtribe Barleriinae (2 genera), *Barleria*: (*Barleria cristata* L., *B. lupulina* Lindl., *B. strigosa* Willd.) and *Lepidagathis*: *Lepidagathis dissimilis* Imlay, *L. falcata* Nees, *L. fasciculata* Nees, *L. incurva* Ham. ex D.Don) and the subtribe Andrographinae (3 genera), (*Andrographis*: *Andrographis laxiflora* (Blume) Lindau; *Gymnostachyum*: *Gymnostachyum leptostachyum*; *Phlogacanthus*: *Phlogacanthus curviflorus* (Wall.) Nees, *P. pedunculatus* J.B. Imlay, *P. pulcherrimus* T. Anders.) in Thailand were conducted by the comparative seed morphology of some species in 2019. These morphological features have been described as ovoid and strongly compressed or compressed. The testa were recognized in various characters such as rugulose-tuberle, rugulose, finely tuberculate, finely scaled, coarsely scaled, suborbicular. The seed shape varied in different groups, such as ovoid, ellipsoidal, suborbicular. The current study is evidence to support the taxonomic significance of both subtribes in Thailand.

## INTRODUCTION

Acanthaceae was included the 221 genera treated by Scotland & Vollesen (2000), classified it into three subfamilies, i.e. Nelsonioideae, Thunbergioideae and Acanthoideae. The last one is the largest subfamily which composes of two tribes, i.e. Acanthaceae and Ruellieae. The latter tribe is composed of four subtribes and, including the selected subtribe Barleriinae and Andrographinae, are to be revised for this research, as they are well-known as the Thai medicinal plants used by traditional herbalists. Some well-known species in the tropical zone are *Andrographis paniculata* Nees and *Barleria lupulina* Lindl. The seeds of Acanthaceae are shape, size, and testa structure that plays an important role for the taxonomic feature. However, the how seeds relate in the system of this family remain largely unknown.. Some comprehensive studies of testa at the generic level have been completed e.g., *Peristrophe* (Balkwill and Balkwill., 1996). *Siphonoglossa* (Immelman, 1990) and *Thunbergia* (Balkwill & Campbell – Young, 2008).

## MATERIALS AND METHODS

At least 5 seeds of every fresh specimen were measured to cover their variation. Seeds were affixed to aluminum stubs with double-sided carbon tape, then sputter-coated with a platinum mixture, and observed with a Hitachi model SU 8020 SEM. The samples were fixed in 3 % phosphate buffer glutaraldehyde and 1 % osmium tetroxide. (Hopwood and Milne, 1991). The SEM study was conducted by putting a droplet of pollen-ethanol sputter-coated with a platinum. And then, they were affixed to aluminum stubs with double-sided carbon-tape and sputter-

coated with a platinum, and observed with a scanning electron microscope (SEM) (Hitachi model SU 8020).

## RESULTS AND DISCUSSION

Mature seeds of 12 representative species of the subtribe Barleriinae (2 genera), *Barleria*: (*Barleria cristata*, *B. lupulina*, *B. strigosa*) and *Lepidagathis*: *Lepidagathis dissimilis*, *L. falcata*, *L. fasciculata*, *L. incurva*) and the subtribe Andrographinae (3 genera), (*Andrographis*: *Andrographis laxiflora*; *Gymnostachyum*: *Gymnostachyum leptostachyum*; *Phlogacanthus*: *Phlogacanthus curviflorus*, *P. pedunculatus*, *P. pulcherrimus*) in Thailand were collected in the field. Voucher specimens from the fieldwork were deposited in BK (Table 1). Morphological features of representative seeds of the Subtribe Barleriinae and Andrographinae, Family Acanthaceae have been described as ovoid and strongly compressed or compressed. The testa were recognized as tubercle, tuberculate, rugulose, coarsely or finely scaled. The result showed that the seed varies in slightly and markedly compressed forms. The result showed that the testa were found in various species (Table 1) and (Figure 5 and 6), viz rugulose-tuberle (*Andrographis laxiflora*), rugulose (*Gymnostachyum leptostachyum*), finely tuberculate (*Phlogacanthus pedunculatus*), finely scaled (*Barleria cristata*, *B. lupulina*), coarsely scaled (*B. strigosa*, *Lepidagathis dissimilis*, *L. falcata*, *L. fasciculata*, *Phlogacanthus pulcherrimus*); suborbicular (*Lepidagathis falcata*, *L. incurva*). It was found that typical types of testa (rugulose-tuberle, rugulose and finely tuberculate) are found

**Table 1.** Seed morphology of the Subtribe Barleriinae and Andrographinae, Family Acanthaceae in Thailand.

Taxa	Shape	Color	Testa	Size	
				width(mm)	length(mm)
<i>Andrographis laxiflora</i>	ovoid	reddish brown	rugulose-tubercle	1241.56±31.22	2201.37±230.85
<i>Barleria cristata</i>	ovoid	pale brown	finely scaled	2081.20±131.87	2517.70±134.41
<i>B. lupulina</i>	ellipsoid	yellowish brown	finely scaled	3395.75±69.99	6242.65±162.72
<i>B. strigosa</i>	ovoid	yellowish brown	coarsely scaled	3180.61±365.22	3416.67±215.09
<i>Gymnostachyum leptostachyum</i>	ovoid	pale brown	Rugulose-tuberculate	585.97±64.47	932.41±108.97
<i>Lepidagathis dissimilis</i>	ovoid	yellowish brown	coarsely scaled	4807.95±580.38	5013.31±411.78
<i>L. falcata</i>	suborbicular	yellowish brown	coarsely scaled	3395.75±69.99	6242.65±162.72
<i>L. fasciculata</i>	ovoid	yellowish brown	coarsely scaled	2880.72±146.21	3480.71±301.16
<i>Lepidagathis incurva</i>	suborbicular	pale brown	finely scaled, adpressed	1280.89±228.04	1361.23±157.47
<i>Phlogacanthus curviflorus</i>	ellipsoidal	yellowish brown	finely tubercle	2616.78±275.08	3210.31±359.80
<i>P. pedunculatus</i>	ovoid	pale brown	coarsely scaled	2819.46±164.40	2800.09±72.60
<i>P. pulcherrimus</i>	ovoid	reddish brown	coarsely scaled	2619.06±501.32	3074.10±251.93

especially in subtribe Andrographinae. On the contrary, the other (finely and coarsely scaled and sub-orbicular types) are found in both subtribes. The seed shape showed that they vary in different species, viz ovoid group (*Andrographis laxiflora*, *Barleria cristata*, *B. strigosa*, *Gymnostachyum leptostachyum*, *Lepidagathis dissimilis*, *L. fasciculata*, *Phlogacanthus pedunculatus*, *P. pulcherrimus*); ellipsoid (*Barleria lupulina*, *Phlogacanthus curviflorus*). Immelman (1990) recognized that seed testa may be considered of major importance in placing many species in their sections, and delimiting some sections in *Justicia* which is evidence to support the taxonomic significance. Some studies including morphological traits of seeds have revealed important taxonomic characters for some groups within the family (Balkwill & Campbell – Young, 2008). Cross (2013) reported that the seed shape and size of Acanthaceae may vary slightly. Fruit morphology and pollen morphology are the main features for identifying amongst the family.

## CONCLUSION

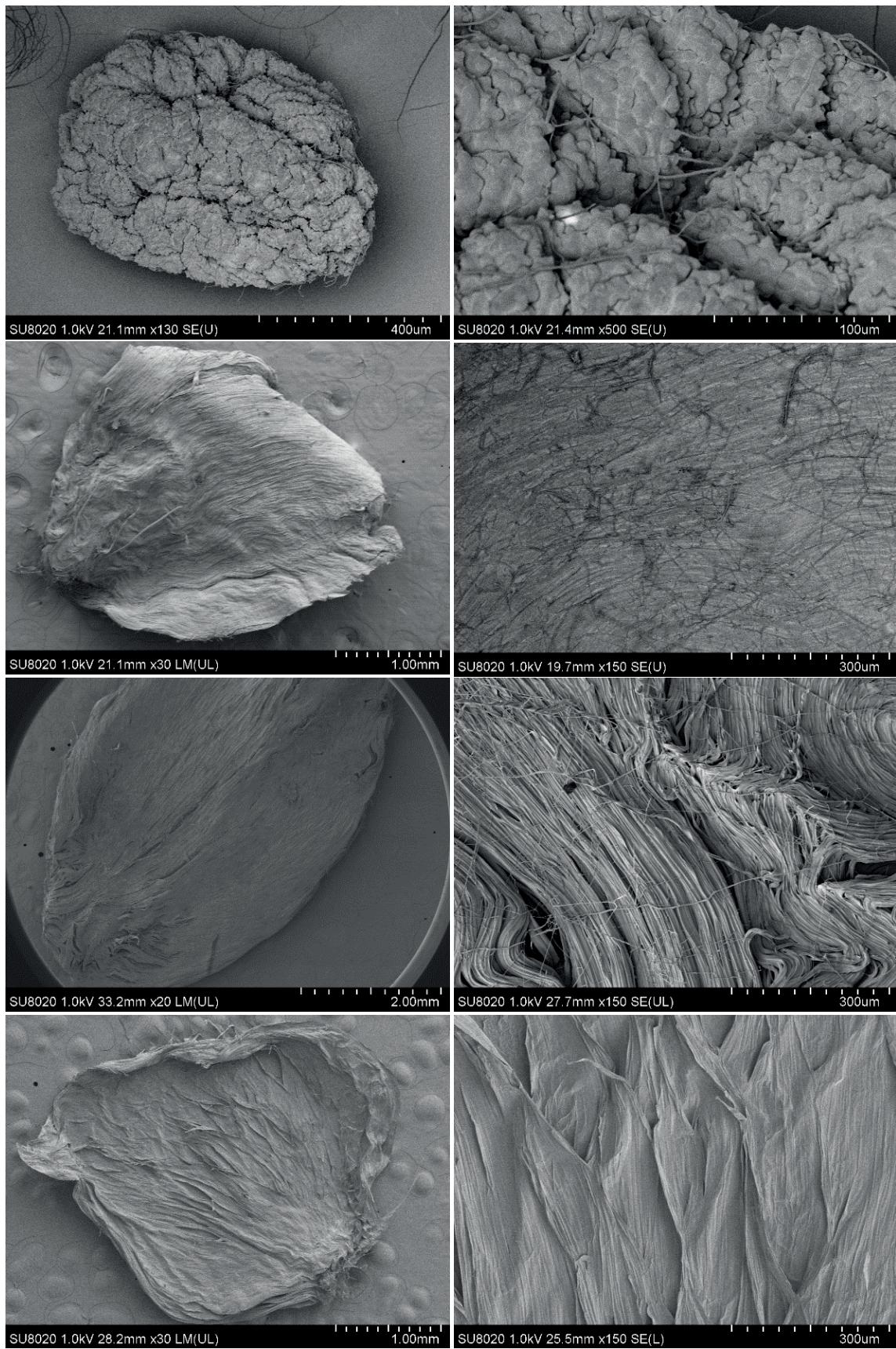
1. Morphological features of representative seeds of the Subtribe Barleriinae and Andrographinae, Family Acanthaceae have been described as ovoid and strongly compressed or compressed 12 representative species of the subtribe Barleriinae (2 genera), *Barleria*: (*Barleria cristata*, *B. lupulina*, *B. strigosa*) and *Lepidagathis*: *Lepidagathis dissimilis*, *L. falcata*, *L. fasciculata*, *L. incurva*) and the subtribe Andrographinae (3 genera), (*Andrographis*: *Andrographis laxiflora*;

*Gymnostachyum*: *Gymnostachyum leptostachyum*; *Phlogacanthus*: *Phlogacanthus curviflorus*, *P. pedunculatus*, *P. pulcherrimus*) in Thailand.

2. The testa were recognized as tubercle, tuberculate, rugulose, coarsely or finely scaled. The result showed that the seed varies in slightly and markedly compressed forms. The result showed that the testa were found in various species, viz rugulose-tubercle (*Andrographis laxiflora*), rugulose (*Gymnostachyum leptostachyum*), finely tuberculate (*Phlogacanthus pedunculatus*), finely scaled (*Barleria cristata*, *B. lupulina*), coarsely scaled (*B. strigosa*, *Lepidagathis dissimilis*, *L. falcata*, *L. fasciculata*, *Phlogacanthus pulcherrimus*); suborbicular (*Lepidagathis falcata*, *L. incurva*). The features of seed shape vary in different species, viz ovoid group (*Andrographis laxiflora*, *Barleria cristata*, *B. strigosa*, *Gymnostachyum leptostachyum*, *Lepidagathis dissimilis*, *L. fasciculata*, *Phlogacanthus pedunculatus*, *P. pulcherrimus*); ellipsoid (*Barleria lupulina*, *Phlogacanthus curviflorus*).

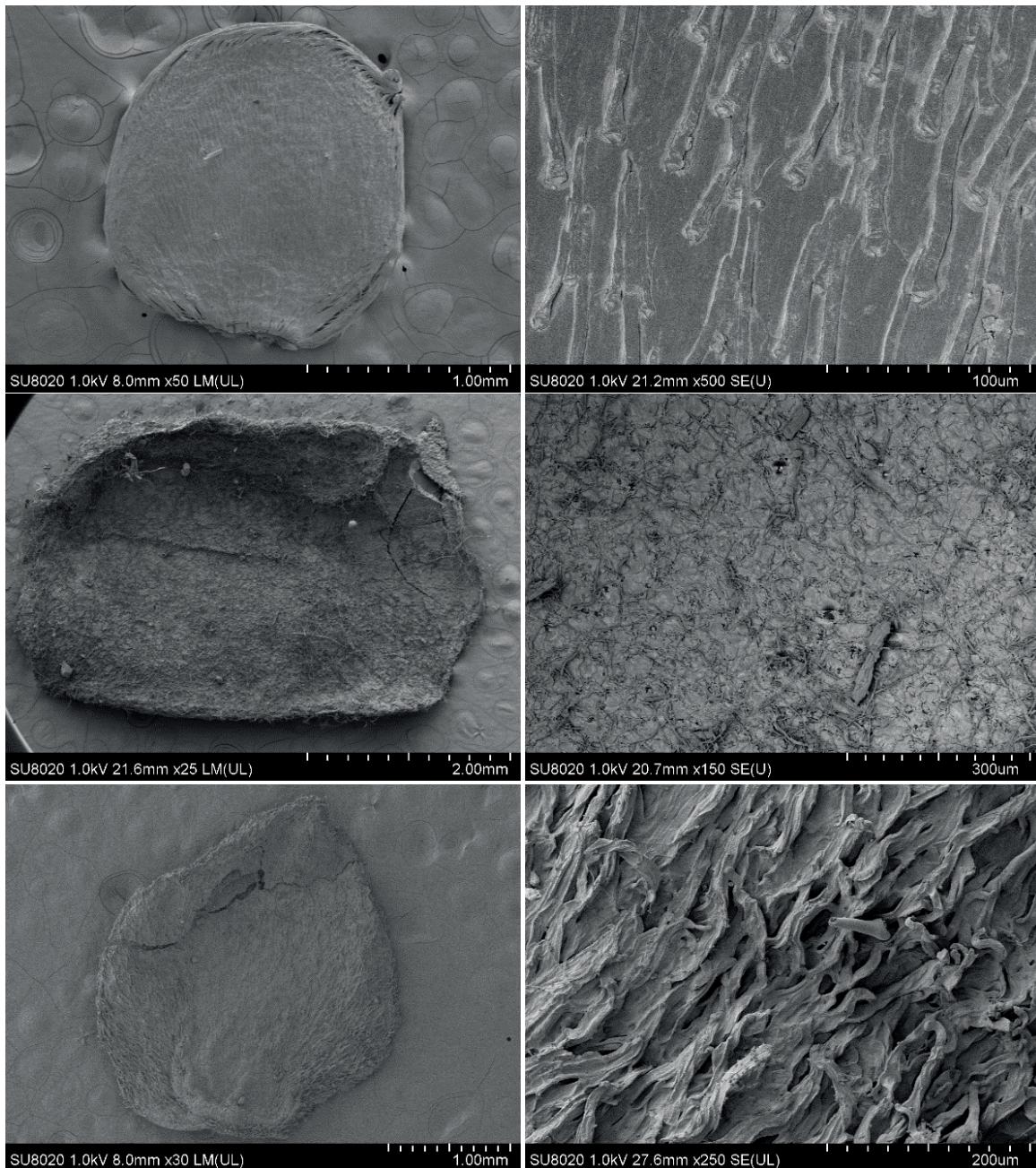
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**Figure 1.** SEM micrographs of seeds in the Subtribe Barleriinae and Andrographinae, Family Acanthaceae in Thailand.

A-B: *Gymnostachyum leptostachyum*, C-D: *Lepidagathis dissimilis*, E-F: *L. falcata*, G-H: *L. fasciculata*.



**Figure 2.** SEM micrographs of seeds in the Subtribe Barleriinae and Andrographinae, Family Acanthaceae in Thailand.

A-B: *Lepidagathis incurva*, C-D: *Phlogacanthus curviflorus*, E-F: *P. pulcherrimus*.

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