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The genera *Polygonum* and *Bilderdykia* (Polygonaceae) in southern Africa: morphology and taxonomic value of the ocrea and fruit

G. GERMISHUIZEN*, P.J. ROBBERTSE** and P.D.F. KOK**

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ABSTRACT

The external morphology of the fruit and the ocrea of 16 taxa of *Polygonum* and *Bilderdykia* in southern Africa was studied. Fruits are either lenticular or trigonous. Six types of fruit surfaces were distinguished. Five types of ocreae were found, characterized by: a green undulating limb; a silvery hyaline sheath; a brown tubular sheath without terminal hairs; a terminal fringe of short cilia or setae; and a bristly hairy sheath fringed with long rigid setae.

UITTREKSEL

Die uitwendige morfologie van die vrug en die okrea van 16 taksons van die genusse *Polygonum* en *Bilderdykia* in suidelike Afrika is ondersoek. Vrugte is òf lensvormig òf driehoekvormig. Vrugoppervlakke word in ses groepe verdeel. Vyf verskillende okrea-tipes word aangetref, gekenmerk deur: 'n groen golwende aanhangsel; 'n silweragtige hialiene skede; 'n bruin buisvormige skede sonder hare aan die punt; 'n fraiing kort siliums of borselhare; en 'n borselharige skede met 'n fraiing lang, stywe borselhare.

INTRODUCTION

The aim of this study was to examine the morphology of the ocrea and fruit of 16 of the southern African species of the genera *Polygonum* and *Bilderdykia*, and to determine their taxonomic importance.

MATERIALS AND METHODS

The herbarium voucher specimens mentioned in the captions of the figures are all kept at the National Herbarium (PRE), Botanical Research Institute, Pretoria.

Fruits were coated with gold-palladium and studied and photographed with the aid of a scanning electron microscope (Hitashi-Akashi Model MSM-4). The negatives are stored in the Botanical Research Institute, Pretoria.

* Botanical Research Institute, Private Bag X101, Pretoria 0001.
** Department of Botany, University of Pretoria, Pretoria 0002.

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RESULTS

Organography of the fruits

In *Polygonum* and *Bilderdykia* the ovary is superior, sessile, 1-locular, with a solitary basal, sessile or stalked ovule. The fruit is a nut enclosed by the persistent perianth (Dyer 1975). During dispersal the seed remains enclosed in the entire fruit wall (Harder & Firbas 1965).

Based on the shape of the fruit, two types are recognized (Table 1): 1, trigonous or 3-angled fruits (Figure 1A) and 2, lenticular fruits (Figure 1B). In both types the surfaces are either concave (Figure 1A) or convex (Figure 1C). Trigonous fruits and lenticular fruits with convex surfaces

TABLE 1.—Fruit shape, surface type and ocrea type found in species of *Polygonum* and *Bilderdykia*

	Fruit shape	Fruit surface	Ocrea
P. aviculare	trigonous	with protuberances	silvery hyaline
plebeium		smooth, shiny	silvery hyaline
kitaibelianum		smooth, shiny	silvery hyaline
maritimum		criss-cross	silvery hyaline
meisnerianum		criss-cross	without terminal hairs
B. convolvulus		with protuberances	without terminal hairs
P. salicifolium		smooth, shiny	short rigid setae
P. lapathifolium	lenticular, concave	smooth, shiny	without terminal hairs
senegalense		ridged	without terminal hairs
P. nepalense	lenticular, convex	areolate	without terminal hairs
hystriculum		ridged	short rigid setae
amphibium		warty	without terminal hairs
undulatum		smooth, shiny	silvery hyaline
hydropiper		ridged	short rigid setae
limbatum		smooth, shiny	spreading limb
pulchrum		smooth, shiny	bristly hairy

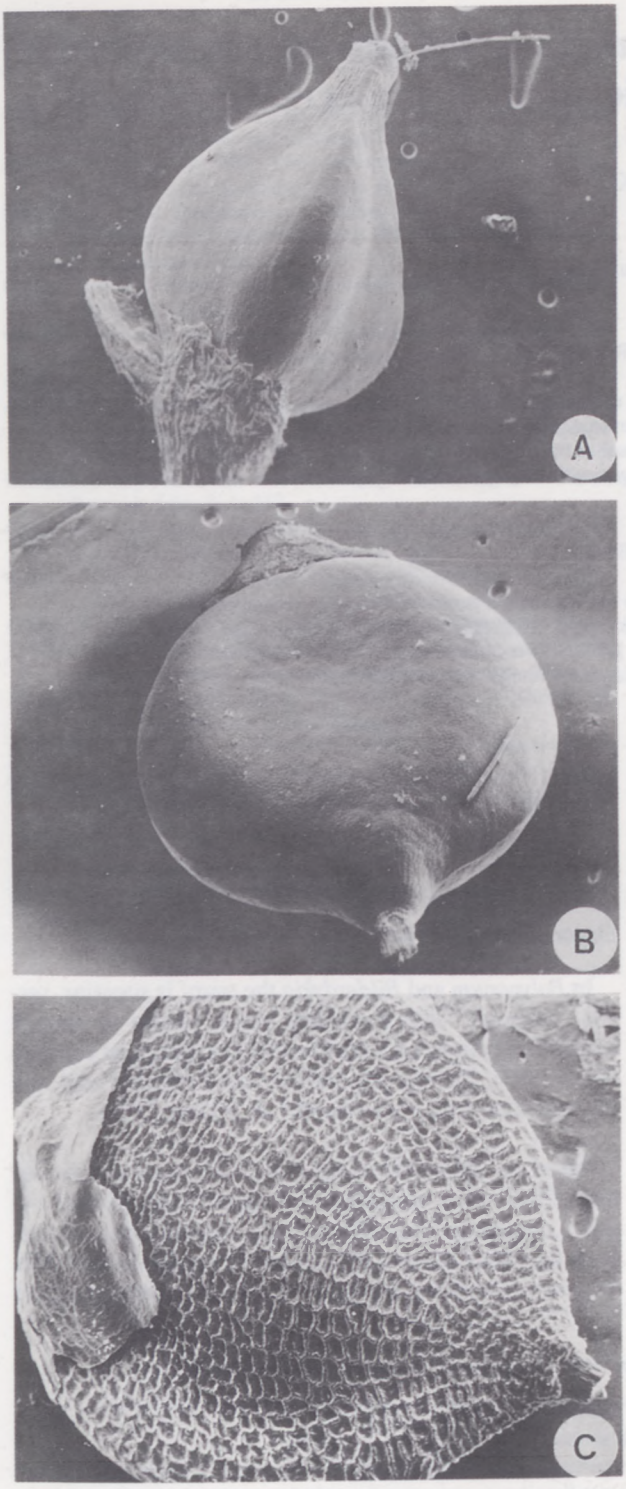

FIGURE 1.—Electron micrographs of *Polygonum* spp. A, trigonous fruit, *P. plebeium, Germishuizen 1386*, × 36; B, lenticular-concave fruit, *P. senegalense* subsp. *senegalense, Germishuizen 1169*, × 30; C, lenticular-convex fruit, *P. nepalense, Scheepers 1130*, × 54.

are common, whereas lenticular fruits with concave surfaces are found only in *Polygonum lapathifolium* and *P. senegalense* (Table 1).

The surface of the fruits varies considerably and six different types of surfaces can be distinguished (Table 1):

1, with protuberances of varying size (Figure 2A). The fruits have a dull matted appearance;

2, smooth and shiny (Figure 2B);

3, with criss-cross pattern (Figure 2C);

4, ridged (Figure 2D);

5, areolate (Figure 2E), found only in *P. nepalense*;

6, warty (Figure 2F), found only in *P. amphibium*.

Organography of the ocrea

The ocrea (plural: ocreae; sometimes spelled ochreae), is a tubular sheath formed when the stipules are united into a hood, which covers the stem apex at first; later it is ruptured and remains as a membranous tube surrounding the stem at the nodes (Harder & Firbas 1965).

Ocreae of the southern African species of the genera *Polygonum* and *Bilderdykia* can be divided into five different types (Table 1):

1, a tubular membranous sheath ending terminally in a spreading or recurved, green, leaf-like undulating limb with a strigose margin (Figure 3A). This type occurs only in *P. limbatum*.

2, a silvery hyaline sheath, conspicuously veined, reddish at the base or red all over, lacerating easily (Figure 3B). This type is found in five species.

3, a brown membranous tubular sheath, conspicuously veined without or rarely with short terminal hairs (Figure 3C). This type occurs in six species.

4, a tubular membranous sheath fringed with short rigid cilia or setae (Figure 3D). This type occurs in three species.

5, a brown tubular sheath, bristly hairy and fringed with numerous long rigid setae and tearing readily on one side (Figure 3E). This type is found only in *Polygonum pulchrum*. Ocreae can be smooth and hairless (Figure 4A) or pubescent with multicellular trichomes (Figure 4B).

DISCUSSION AND CONCLUSION

From Table 1 a key has been compiled using only fruit shape, fruit surfaces and ocreae found in species of *Polygonum* and *Bilderdykia*.

1a Nut trigonous:
 2a Ocrea silvery hyaline:
  3a Nut smooth, shiny ..... *P. plebeium*
  P. kitaibelianum
  3b Nut with protuberances ..... *P. aviculare*
  3c Nut with criss-cross pattern ..... *P. maritimum*
 2b Ocrea not silvery hyaline:
  4a Ocrea with short rigid setae ..... *P. salicifolium*
  4b Ocrea without terminal hairs:
   5a Nut surface with protuberances ..... *B. convolvulus*
   5b Nut surface with criss-cross pattern ..... *P. meisnerianum*
1b Nut lenticular:
 6a Nut with concave surface:
  7a Nut surface smooth, shiny ..... *P. lapathifolium*
  7b Nut surface ridged ..... *P. senegalense*
 6b Nut with convex surface:
  8a Ocrea with green spreading limb ..... *P. limbatum*
  8b Ocrea without spreading limb:
   9a Nut surface smooth, shiny:
    10a Ocrea silvery hyaline ..... *P. undulatum*
    10b Ocrea bristly hairy ..... *P. pulchrum*
   9b Nut surface ridged, areolate or warty:
    11a Ocrea without terminal setae:
     12a Nut surface areolate ..... *P. nepalense*
     12b Nut surface warty ..... *P. amphibium*
    11b Ocrea with short rigid terminal setae; nut surface ridged ..... *P. hystriculum*
    P. hydropiper

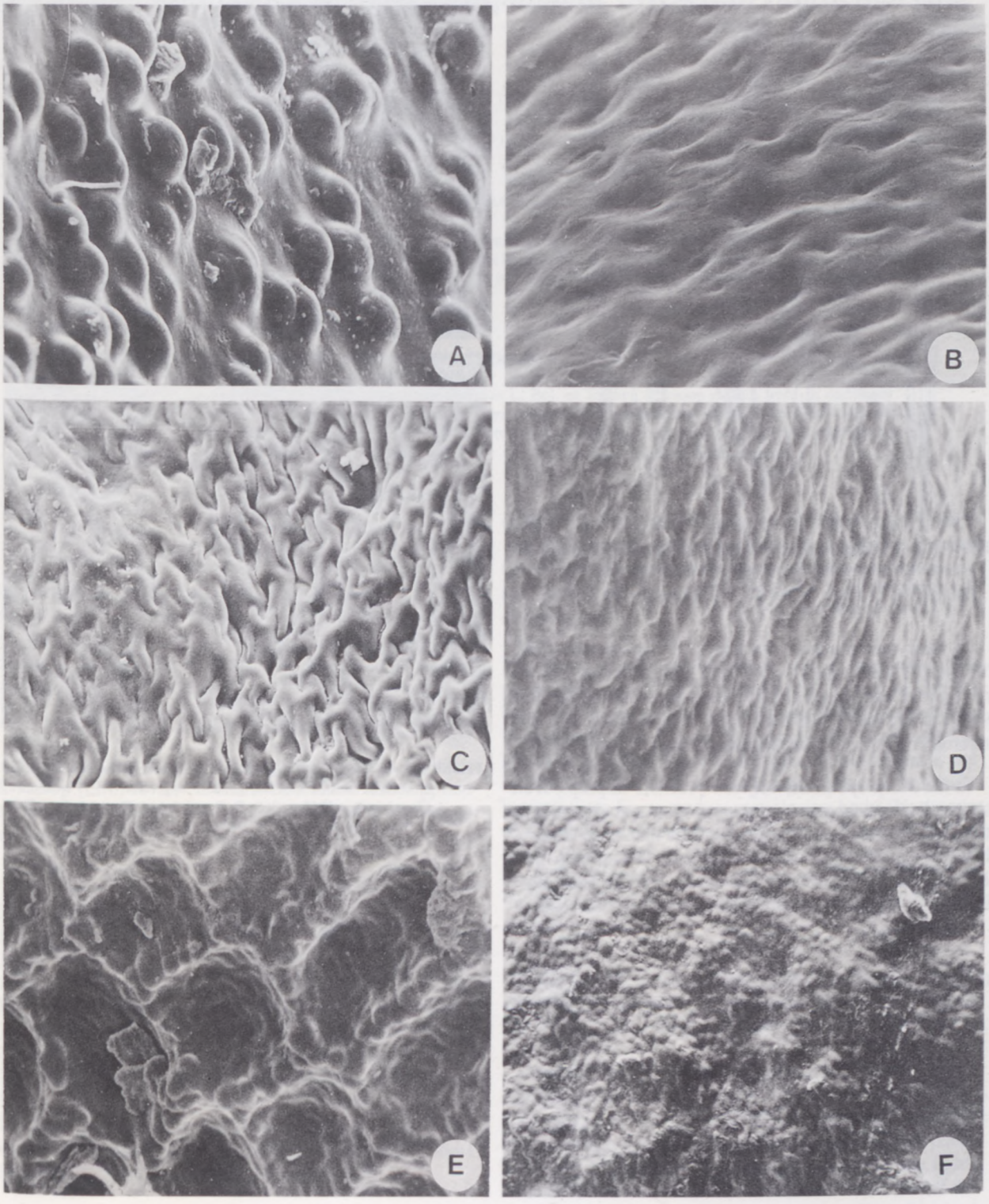

FIGURE 2.—Electron micrographs of fruit surfaces of *Polygonum* and *Bilderdykia* species. A, surface with protuberances, *B. convolvulus*, *Jacobsz 196*, × 860; B, surface smooth, *P. salicifolium*, *Germishuizen 1291*, × 4000; C, surface with criss-cross pattern, *P. maritimum*, *Taylor 4897*, × 850; D, surface ridged, *P. hystriculum*, *Germishuizen 1357*, × 520; E, surface areolate, *P. nepalense*, *Scheepers 1130*, × 650; F, surface warty, *P. amphibium*, *Nelson 226*, × 220.

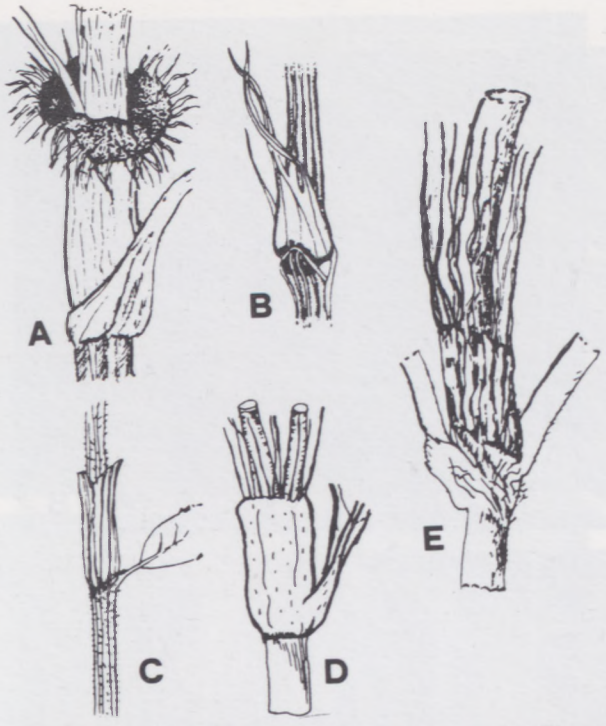

FIGURE 3.—Schematic representation of ocrea types found in some taxa of the genus *Polygonum*. A, *P. limbatum*, × 4; B, *P. kitaibelianum*, × 2; C, *P. meisnerianum*, × 2; D, *P. hydropiper*, × 4; E, *P. pulchrum*, × 4.

In their treatments of the family Polygonaceae, C.H. Wright in *Flora capensis* (1912) and R.A. Graham in *Flora of tropical east Africa* (1958) make some use of the fruit shape and ocrea type in their species keys, and they make reference to them in their descriptions.

In the *Flora of southern Africa* (Vol. 9,1 in prep.) fruit shape, fruit surface and ocrea type play a major role in the keys. In this paper it is the first time that these features have been illustrated. In the genera *Polygonum* and *Bilderdykia* the fruit and the ocrea are the two most important organs for distinguishing between the taxa.

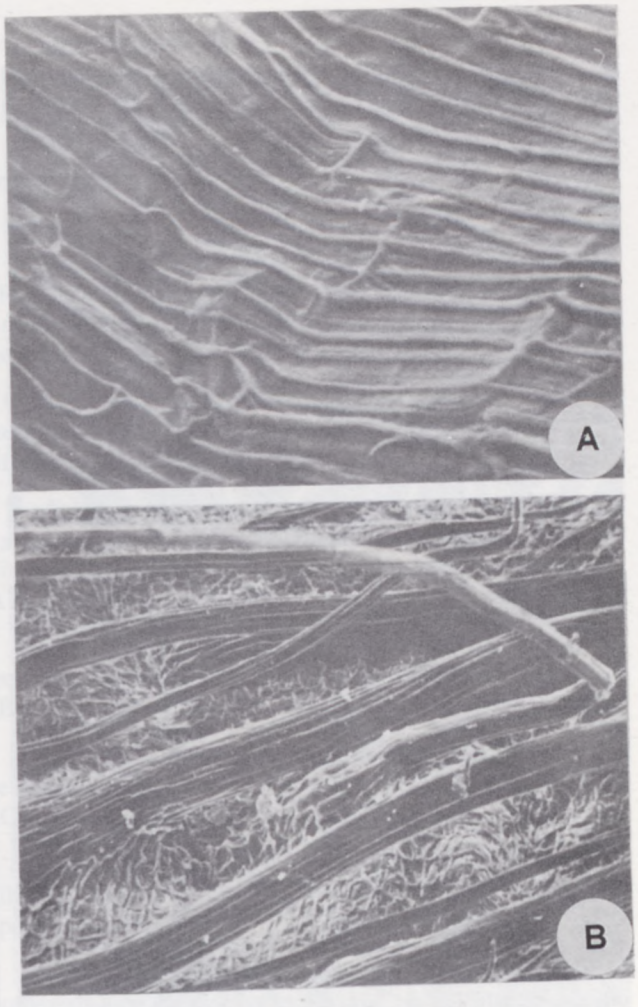

FIGURE 4.—Electron micrographs of a portion of the ocrea surface of certain members of the genus *Polygonum*. A, *P. aviculare*, *Germishuizen 1265*, × 360; B, *P. pulchrum*, *Germishuizen 1240*, × 102; C, *P. limbatum*, *Germishuizen 1361*, × 204.

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