

**Comparative Anatomy of the Leaf and Stem of
Antirrhinum meoanthum Hoffmanns. & Link
and *A. braun - blanquetii* Rothm**

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The histology of the leaves and stems of *Antirrhinum meoanthum* Hoffmanns. & Link and *A. braun-blanquetii* Rothm. is described. Comparison of the characters of the two species shows them to be so closely similar. The presence of trichomes having cells with warty, striated walls and the absence of trichomes with unicellular heads on *A. meoanthum* and also differences in the length of the inflorescence and the size of flowers for both species support the views that *A. meoanthum* Hoffmanns. & Link and *A. braun-blanquetii* Rothm., may be separate species.

Members of *Antirrhinum* (Scrophulariaceae) are indigenous to the Mediterranean region of Europe, a few species extending Northward, and to the Southwestern areas of the North America (Wettstein, 1891., Pennell, 1935, Rothmaler, 1956).

The genera *Antirrhinum* Tourn., *Linaria* Tourn. and *Elatine* Dill., were amalgamated by Linnaeus (1753) under a single genus *Antirrhinum* L. which contained 27 species. Chavannes (1833) subdivided *Antirrhinum* L. into two sections, Asarina and Antirrhinastrum, comprising nine species. Bentham (1846) reclassified *Antirrhinum* L. into three sections, Orontium, Antirrhinastrum and Asarina comprising 11 species. Bentham and Hooker (1876) reorganized *Antirrhinum* L. into six sections to include 25 species. Wettstein (1891) subdivided *Antirrhinum* L. into seven sections containing 32 species. Pennell (1935) divided *Antirrhinum* L. into two sections, Antirrhinastrum Chav. (including *A. majus* L.) and orontium Benth. (including *Misopates orontium* Rafin. = *A. orontium* L.). Rothmaler (1956) subdivided *Antirrhinum* L. into sections, subsections and series comprising 40 species. Webb (1971) reclassified European species of *Antirrhinum* L. into 17 species.

Rothmaler (1956) assigned *A. meoanthum* Hoffmanns. & Link and *A. braun - blanquetii* Rothm., under one series, Meoantha, distinguishing between them only

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by the morphology of the inflorescence. However, Webb (1971) reported that the occasional plants, of *A. braun - blanquetii* which Rothmaler distinguishes as a var., *oreophelum* Rothm. are hybrids with *A. meoanthum* Hoffmanns. & Link.

Material and Methods

Plants were cultivated in the Experimental Gardens of the University of Bradford. In the case of *A. meoanthum* Hoffmanns. & Link from seed obtained from the John Innes Institute, Norwich; *A. braun-blanquetii* Rothm. seeds were collected at Saja (Santander), Spain, in 1975. All plant materials have been fully authenticated.

Collection of flowering plants from cultivated material was made from July to September, collection of wild material was made in Spain during June/July, 1975.

Surface preparations were made from the leaves and stems by stripping the epidermis and mounting in 50% v/v glycerol solution.

Sections prepared by freezing microtomy and mounted in 50% v/v glycerol solution, in phloroglucinol solution and hydrochloric acid when examined for lignified elements.

Morphology

A. meoanthum Hoffmanns. & Link is an erect perennial herb, up to 120 cm tall with few branches. Leaves opposite below, alternate above, simple, entire, lanceolate to ovate with acute apices, lower leaves commonly hairy. Stems terete, glandular - pubescent only on inflorescence axis and occasionally hairy throughout. Flowers zygomorphic with short pedicels, forming a dense compact, simple raceme; calyx, 5 zygomorphic, deeply lobed, glandular pubescent, ovate to lanceolate sepals; corolla bilabiate personate, yellow, 15-22 mm long, androecium 4 epipetalous stamens with free filaments, gynoecium asymmetrical with ovate ovary having two unequal loculi and terminal style with a simple stigma. Fruit a capsule dehiscent by three apical pores.

A. braun-blanquetii Rothm., is an erect perennial herb, up to 120 cm tall, differing from *A. meoanthum* Hoffmanns. & Link in the length of the inflorescence and in the corolla which is about 25 to 40 mm long.

Histology

(I) *A. meoanthum* Hoffmanns. & Link.

(a) Leaf

1 - *Intercostal region*: Upper epidermis: cuticle thin, striated; cells slightly elongated, polygonal with thin, sinuous anticlinal walls. Stomata frequent, anisocytic, ovate. Glandular trichomes frequent only on the lower leaves, uniseriate 3 to 5 - celled stalks with thick, smooth cellulosic walls, bicellular to multicellular, clavate heads. Covering trichomes occasional only on the lower leaves, uniseriate, 7 to 9 cells with thick, smooth cellulosic walls and acute apices (Fig. 1, E & Fig. 3, C).

Lower epidermis: cuticle and cells similar to those of the upper epidermis; stomata, frequent, ovate or circular, mainly anomocytic occasionally anisocytic. Glandular and covering trichomes frequent, only on the lower leaves, similar to those of the upper epidermis (Fig. 1,D & Fig. 3,C).

2. *Midrib*: Upper epidermis: cuticle thin, longitudinally striated; cells rectangular, with thick, straight, beaded anticlinal walls. Stomata absent. Glandular trichomes frequent becoming dense towards the basal region of the lamina, uniseriate, occasionally biseriate immediately below the head, 2 to 6 - celled stalks, occasionally branched with thin or slightly thickened, commonly smooth, occasionally warty walls with cuticular striations on the basal cells and multicellular subspherical or clavate heads. Covering trichomes frequent, uniseriate, 1 to 3 cells with thick, warty cellulosic walls and blunt apices (Fig. 2, A & C).

Lower epidermis: cuticle and cells similar to those of the upper epidermis. Stomata occasional, anisocytic ovate. Glandular and covering trichomes occasional only on the lower leaves similar to those of the intercostal region, upper epidermis (Fig. 2, A & C).

3. *Petiole*: Epidermis: cuticle and cells similar to those of the midrib epidermis. Stomata frequent only on the abaxial surface, ovate, anisocytic. Glandular trichomes frequent on the adaxial surface, occasional only on the abaxial surface of lowest leaves, similar to those of the midrib, upper epidermis, (Fig. 2, A & C).

(b) - Stem

Epidermis: cuticle thin, longitudinally striated; cells rectangular with straight, beaded anticlinal walls. Stomata frequent, anisocytic, ovate. Covering trichomes occasional only in the basal region, uniseriate 5 or 6 cells with thick smooth, cellulosic walls and blunt apices, Glandular trichomes very frequent only on the inflorescence axis, sometimes throughout the stem, uniseriate, 3 to 8 celled stalks with thick, smooth, cellulosic walls and multicellular clavate heads (Fig. 3. A, D & E).

(II) *A. braun-blanquetii* Rothm.

(a) Leaf

1 - *Intercostal region*: Upper epidermis: cuticle thin, irregularly striated; cells elongated, polygonal with sinuous anticlinal walls. Stomata very frequent, ovate mainly anisocytic, occasionally anomocytic. Glandular trichomes frequent only on the lower leaves, uniseriate, 3 to 5 - celled stalks with thin smooth cellulosic walls and unicellular to multicellular clavate heads. Covering trichomes very occasional, only on the lower leaves, uniseriate, 5 to 10 - cells with thick, smooth cellulosic walls (Fig. 1, C & Fig. 3, F).

Lower epidermis: cuticle thin, irregularly striated, striations occasionally radiating from the stomata; cells elongated, polygonal, with sinuous anticlinal walls. Stomata frequent, similar to those of upper epidermis. Glandular trichomes

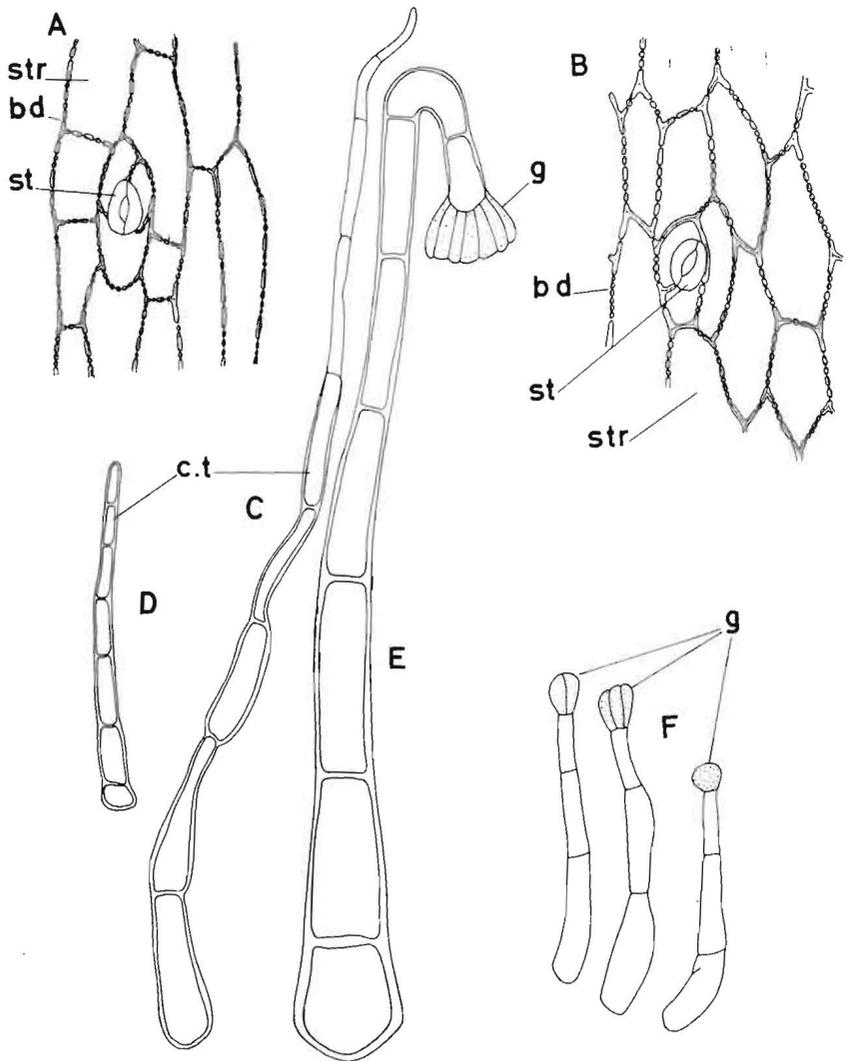


Fig. 1

A, stem of *A. meonanthum*, epidermis. B, stem of *A. braun-blanquetii*, epidermis. C, lower leaf of *A. meonanthum*, epidermal trichomes. D & E, stem of *A. meonanthum*, epidermal trichomes. F, lower leaf of *A. braun-blanquetii*, upper epidermis, trichomes.

A - F, X 250

bd, beading; c.t, covering trichomes; g, glandular trichomes; st, stomata; str, cuticular striations.

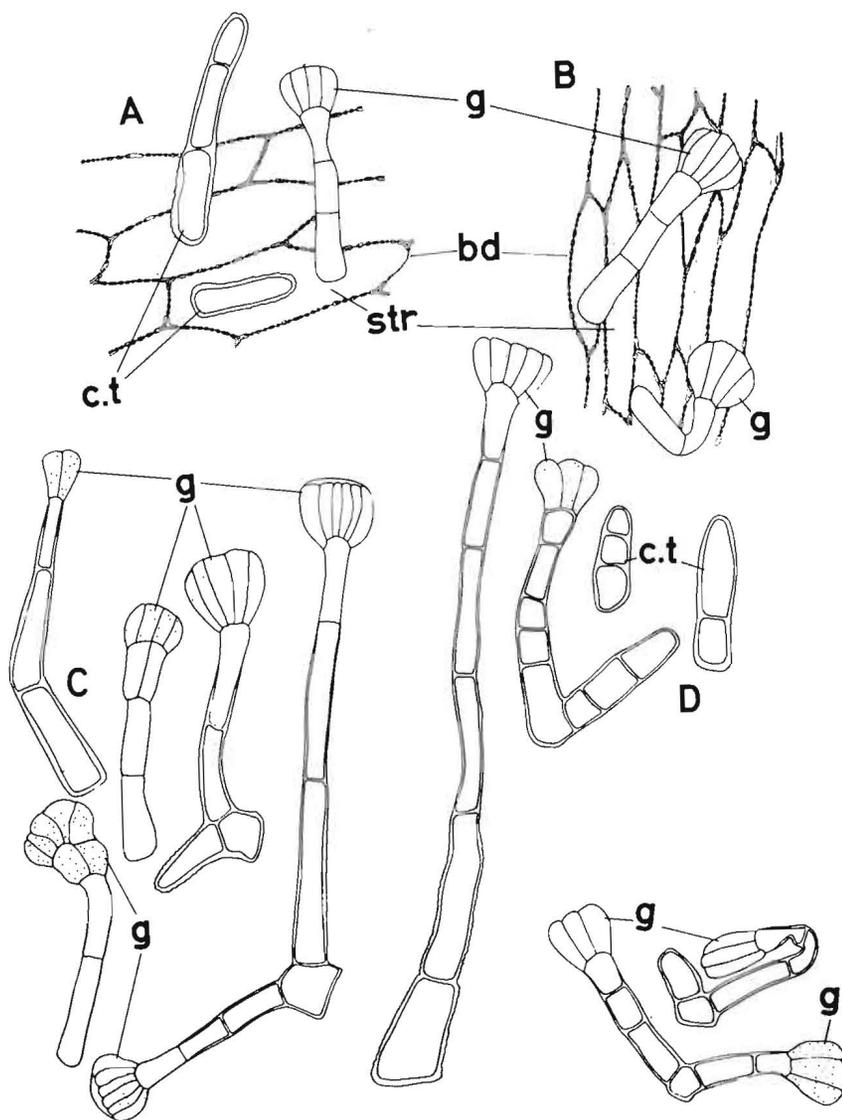


Fig. 2

A; Leaf of *A. meonanthum*, midrib, upper epidermis. B, leaf of *A. braun-blanquetii*, midrib, upper epidermis. c, leaf of *A. meonanthum*, midrib and petiole epidermal trichomes. D, leaf of *A. braun-blanquetii*, midrib and petiole epidermal trichomes.

A - D. X 250.

bd, beading; c.t, covering trichomes; g, glandular trichomes; st, stomata; str, cuticular striations.

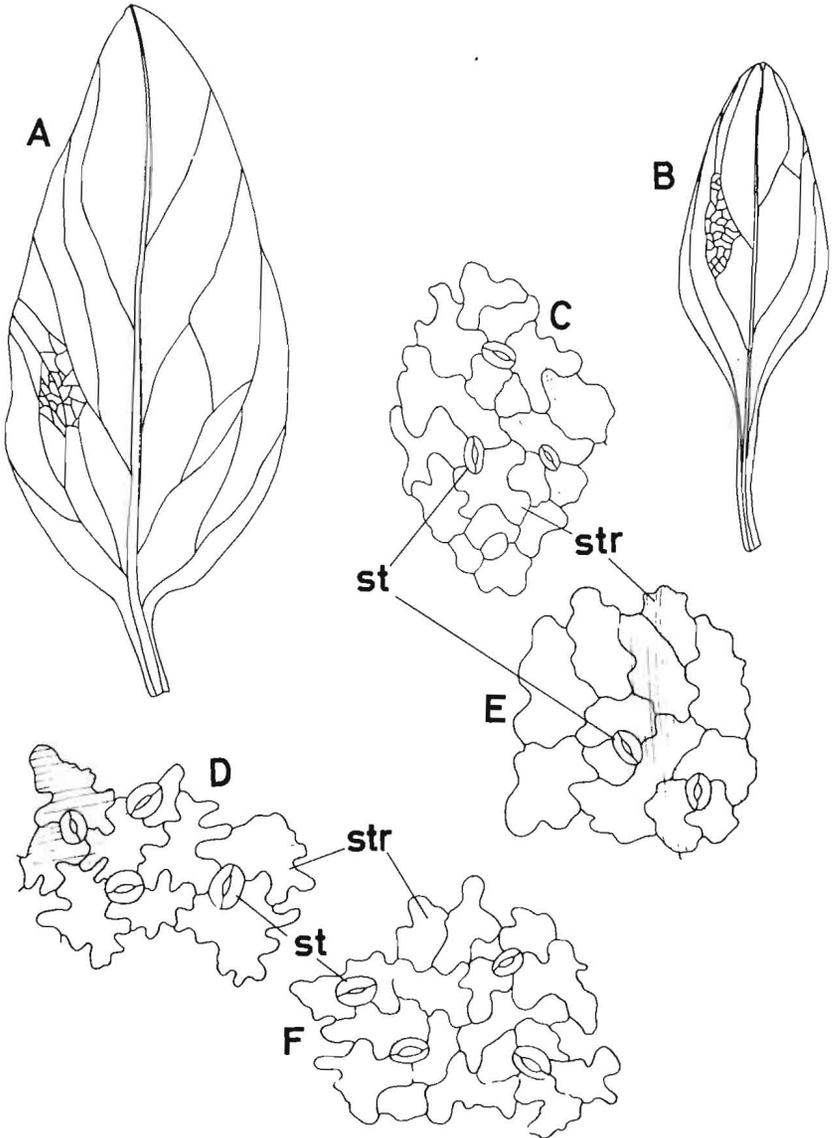


Fig.3

A, leaf of *A. meoanthum*. B, leaf, of *A. braun-blanquetii*, C, leaf of *A. braun-blanquetii*, lamina upper epidermis. D, leaf of *A. meoanthum*, lamina, lower epidermis. E, leaf of *A. meoanthum*, lamina upper epidermis. F, leaf of *A. braun - blanquetii*, lamina, lower epidermis.

A & B, X 2%, C-F, X 250.

st, stomata; str, cuticular striations.

frequent on the lower leaves, similar to those of the upper epidermis of lowest leaves (Fig. 1, F & Fig. 3, F).

2 - Midrib

Upper epidermis: cuticle thin, longitudinally striated; cells rectangular with thick, straight, beaded anticlinal walls. Stomata not observed. Glandular trichomes frequent, uniseriate, 2 to 5 celled stalks, commonly with thin, occasionally with thick, smooth cellulosic walls and multicellular clavate heads. Covering trichomes occasional, uniseriate, 2 to 3-cells with thick, smooth, cellulosic walls and blunt apices (Fig. 2, B & D).

Lower epidermis: cuticle and cells similar to those of the upper epidermis. Stomata occasional, ovate, anisocytic. Covering and glandular trichomes occur only on the lower leaves, similar to those of the upper epidermis of intercostal region of lowest leaves (Fig. 2, B & Fig. 3, F).

3 - Petiole

Epidermis: cuticle and cells similar to those of the midrib, upper epidermis. Stomata occasional only on the abaxial surface, anisocytic ovate. Glandular trichomes two types, first type frequent on the adaxial surface, similar to those of midrib upper epidermis of the upper leaves, second type frequent only on the abaxial surface of lower leaves, similar to those of the intercostal region, upper epidermis of the lower leaves. Covering trichomes two types, first type occasional on the adaxial surface, similar to those of the midrib upper epidermis of upper leaves, second type occasional, only on both surfaces of lower leaves, similar to those of the intercostal region upper epidermis of the lower leaves (Fig. 2 B & D).

(b) Stem

Epidermis: cuticle thin, longitudinally striated, cells elongated, polygonal or rectangular with thick, straight, beaded anticlinal walls. Stomata frequent, anisocytic ovate, Glandular trichomes occasional on the basal part of the stem, becoming very frequent on the inflorescence axis, uniseriate 3 to 8-celled stalks with thick, smooth cellulosic walls and bicellular or multicellular clavate heads. Covering trichomes very frequent only at the basal part of the stem, similar to those of the intercostal region, upper epidermis of the lower leaves (Fig. 3 b).

Discussion

Rothmaler (1956) recorded the occurrence of glandular trichomes on the inflorescence axis, occasionally throughout the stem of *A. meonanthum* Hoffmanns. & Link and *A. braun-blanquetii* Rothm. and classified them under one series (Meonantha) distinguishing between them only by the morphology of the inflorescence. However, Webb (1971) reported that the occasional plants of *A. braun-blanquetii* which Rothmaler distinguished as var. *orontium* Rothm., were hybrids with *A. meonanthum*. This present investigation shows *A. meonanthum* Hoffmanns., & Link and *A. braun-blanquetii* Rothm. to be so closely similar as to be identical. This conclusion is confirmed by reference to the presence of covering

and glandular trichomes at the stem bases and on the lower leaves and the inflorescence being densely covered with glandular trichomes. The upper epidermis of the leaf midribs and petioles bear glandular trichomes with 2 to 6-celled stalks which occasionally exhibit branching in both species. The palisade ratio is 2.3 to 8.3 for both species.

However, *A. meonanthum* Hoffmans. & Link may be distinguished by the trichome stalks of the upper epidermis of the leaf midribs and petioles comprising cells exhibiting warty, striated walls. Glandular trichomes with unicellular heads were not observed. A close study of the morphological characters of both species shows that the only distinction between them is the length of inflorescence and the size of flowers, *A. meonanthum* Hoffmanns. & Link has corollas about 15 to 22 mm long whereas in *A. braun-blanquetii* Rothm. corollas about 25 to 40 mm long. These characters support the classification of Rothmaler as separate species.

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تشریح مقارن لورقة وساق كل من انترهيم مينانثم وانترهيم براون - بلانكوييتيائي

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لقد تمت دراسة هستولوجية لسيقان وأوراق (١) انترهيم مينانثم و(٢) انترهيم برون - بلانكوييتيائي وأوضحت مقارنة صفاتها تشابهاً كبيراً بينها ولكن وجود شعيرات خلاياها ذات جدر مخططة تحمل نتوءات، وعدم وجود شعيرات ذات رأس وحيد الخلية في النوع الأول وكذلك الاختلاف في طول الحامل الزهري وحجم الأزهار لكلا النوعين، تؤيد الآراء التي تعتبر كلا من انترهيم مينانثم وانترهيم برون - بلانكوييتيائي نوعين منفصلين.