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ANATOMICAL STUDIES OF A NEW LIMONIUM FROM IRAN

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ABSTRACT. A new species of *Limonium* (Plumbaginaceae), *L. wendelboi* Bokhari, is described from Iran. It has affinities with *L. stocksii* (Boiss.) O. Kuntze but in both morphology and anatomy is a very distinct species. Brachysclereids and macrosclereids are present in the new species and have not previously been recorded in the genus.

Limonium wendelboi Bokhari, **sp. nov.** Fig. 1.

Affinis *L. stocksii* (Boiss.) O. Kuntze sed foliis multo majoribus, scapo valde ramoso, lamina folii et petiolo cellulis scleroticis filiformibus differt.

Suffrutex usque ad 40 cm altus, crebre ramosus. Folia surculis annui insidentia, 25–50 × 4–8 mm, oblongo-spathulata usque ad oblanceolato-spathulata, plana, glauca, succulenta, sine nervis distinctis, lamina basi sensim in petiolum longum attenuata, vagina petioli brunnea. Scapus teres, glaber, fere e basi valde paniculatim ramosus. Spicae ± scorpioideae in ramis apicalibus scapi ± confertim dispositae. Spiculae 1–2-florae, 5–7 mm longae, erectae. Bractea exterior purpureo-brunnea, 1.5 mm longa, ovato-triangularis, scarioso-marginata; bractea interior prima quam exterior 1.5-plo longior, oblongo-ovata, valde concava, scariosa, binervis; bractea interior secunda quam exterior 2.5-plo longior, late ovata, valde concava, scarioso-marginata. Calyx 4 mm longus, infundibuliformis, quinque-costatus secus costas pilosus; tubus quam limbus c. 1.5-plo longior; limbus albus, quinquelobatus lobis late rotundatis patentibus; nervi limbi fusco-brunnei ad medium limbi attingentes. Petala pallide rosea. Fl. 3–4.
Endemic. Habitat: on sandy soil and on gravelly soil near rocks.
IRAN. Bandar Abbas, Bushir to Bandar Lengeh, c. 31 km SE of Bol Askar, *M. H. Bokhari & P. Wendelbo* 283 (holotype GB; iso. Shiraz, E); ibid., c. 67 km SE of Bandar Taheri, *Bokhari & Wendelbo* 269 (GB, Shiraz).

L. wendelboi is a very distinct species allied to *L. stocksii* (Boiss.) O. Kuntze from which it differs in its much larger leaves, strongly branched scapes and presence of filiform sclereids in the petiole and lamina.

ANATOMY

Various anatomical features in *Limonium*, such as structure and sclereid characters in scape, petiole, and lamina, have been found to be taxonomically useful in the delimination of certain sections and subsections, and in separation of closely related species (Bokhari, 1970, 1973). A thorough anatomical study of the new species was therefore undertaken to obtain as much information as possible. The study was based on herbarium material only and techniques used were, with sometimes minor modifications, as described in Bokhari (1970). The slides used in the

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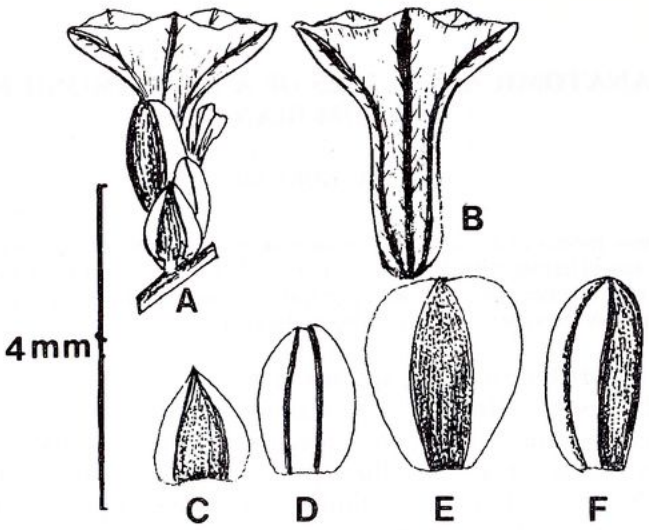

FIG. 1. *Limonium wendelboi*: A, spikelet; B, calyx; C, outer bract; D, first inner bract; E, second inner bract; F, second inner bract in lateral view.

investigation are preserved in the herbarium of the Biology Dept of Shiraz University.

LAMINA. There is no difference between the upper and lower epidermis: stomata and chalk glands are present in almost equal numbers on both, and the thick cuticle is similar. Stomata are mostly of anisocytic type (Plate 1F) but some actinocytic and paracytic stomata are found intermingled with them.

There is a 4–5-layered palisade tissue of closely packed cells on both sides of the leaf. Spongy tissue is also composed of 5–6 layers of cells with small intercellular spaces (Plate 1D). Sclereids are extensively developed in the lamina; they are of filiform type and are more or less parallel but obliquely oriented along the long axis of the lamina, as seen in longitudinal section (Plate 1A,B,C). Transverse sections show that in the middle of the lamina sclereids are confined to the palisade tissue (Plate 1D) but towards the margin some are also found in the spongy mesophyll.

PETIOLE. As in the other species of subsection *Sarcophyllae*, a transverse section in the middle region of the petiole shows three vascular bundles. There is a palisade-like photosynthetic tissue around the peripheral portion, and parenchymatous ground-tissue in the middle of the petiole. Sclereids are also of filiform type and are only confined to the palisade-like tissue (Plate 2G). Orientation of sclereids in the longitudinal section of the petiole is the same as in the lamina.

SCAPE. The anatomy of the scape generally agrees with the findings of Fraine (1916) and Bokhari (1973). It is terete in outline with a ring of vascular bundles surrounding a parenchymatous pith in which brachy- and macro-sclereids are present (Plate 2C,D,E & F). The vascular bundles are collateral and are partly embedded in a broad lignified fibrous zone (Plate 2F). Around the fibrous zone there is a palisade-like cortex of assimilatory function.

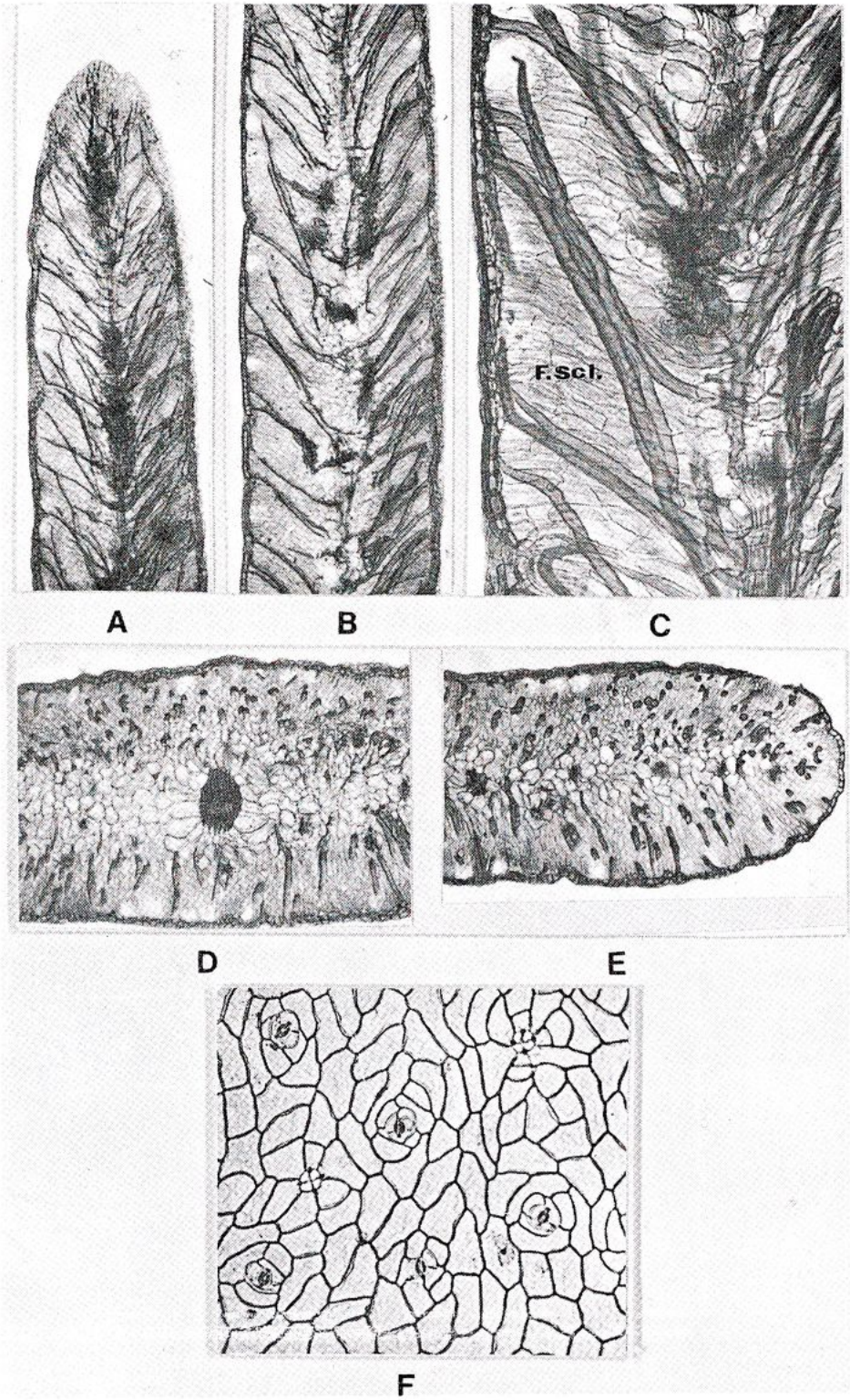

PLATE 1. *Limonium wendelboi*: A, LS leaf apex; B & C, LS middle of lamina; D, TS lamina in midrib region; E, TS margin of lamina; F, epidermis showing paracytic stomata. (F.Scl., filiform sclereids.) A, B, D & E × 50; C × 300; F × 100.

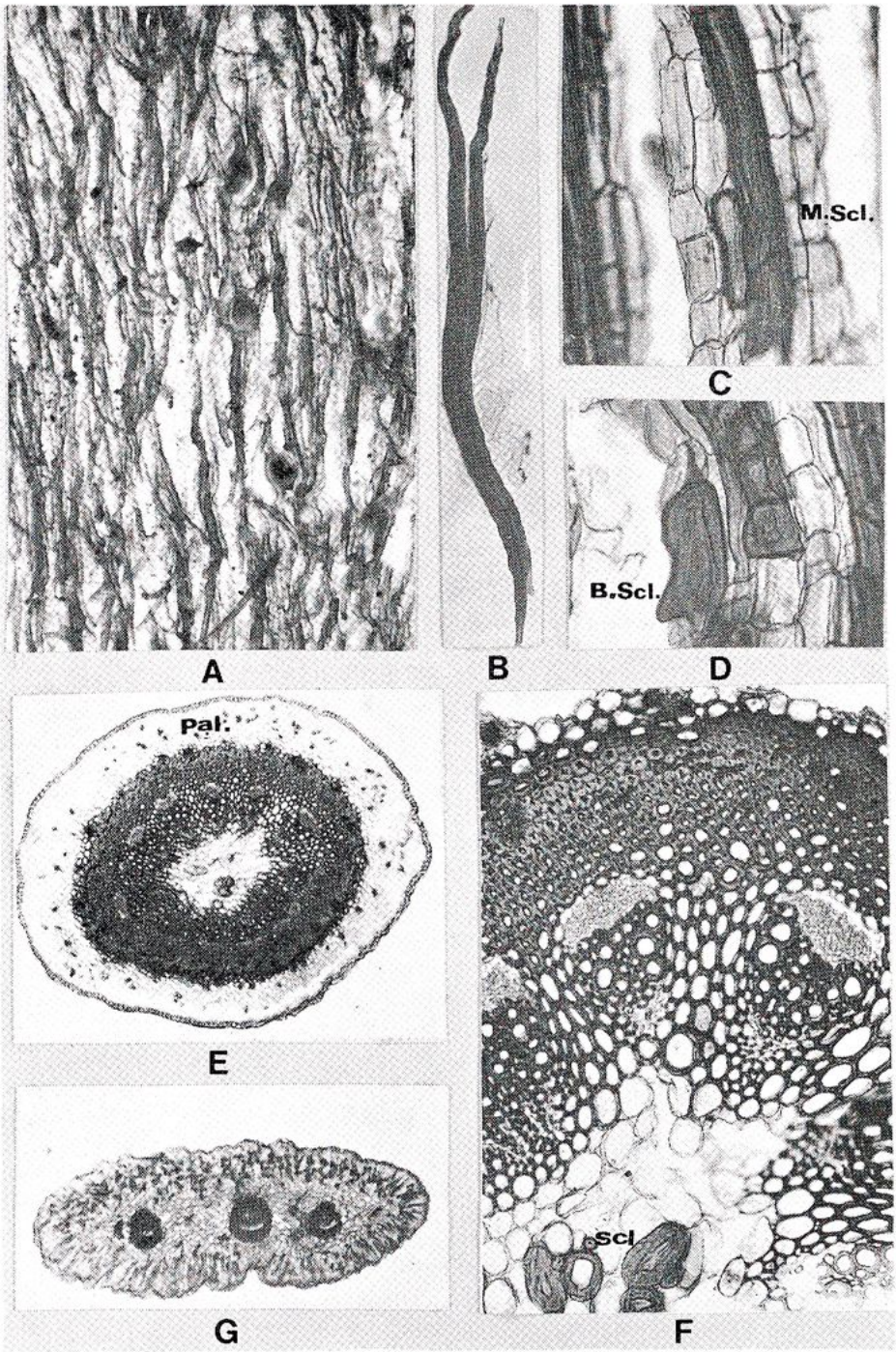

PLATE 2. *Limonium wendelboi*: A, part of cleared leaf showing filiform sclereids; B, filiform sclereid from a macerated leaf; C & D, macrosclereid and brachysclereid respectively in LS pith of scape; E & F, TS of central part of scape showing lignified zone, vascular bundles and sclereids in pith; G, TS of petiole. (B.Scl., brachysclereid; M.Scl., macrosclereid; pal., palisade; scl, sclereids.) A × 75; B, C, D & F × 300; E × 50; G × 25.

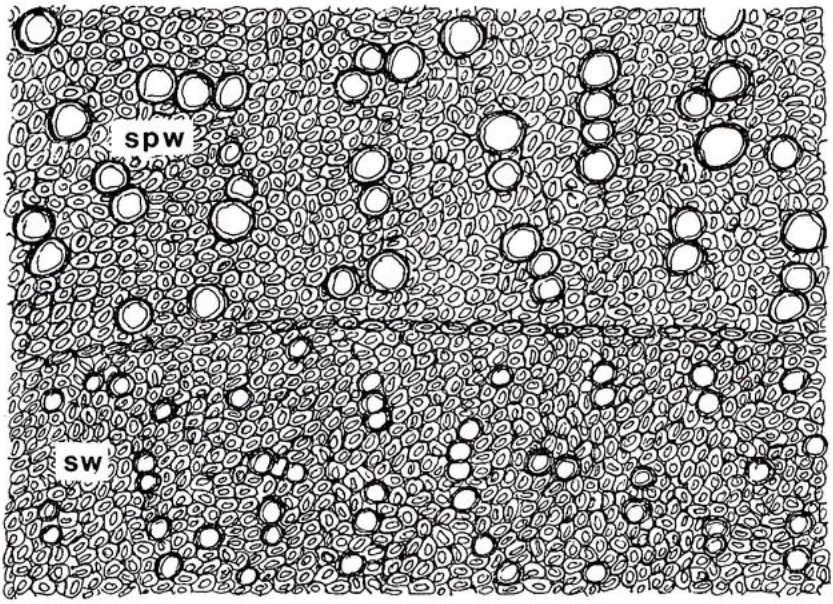

FIG. 2. *Limonium wendelboi*: TS of xylem of stem showing spring- and summer-wood — note extensive development of lignified fibrous tissue, and arrangement of vessels. (spw, spring-wood; sw, summer-wood.) × 220.

WOOD. Annual rings are present (Fig. 2). There is an extensive development of lignified fibrous tissue in both the spring- and summer-wood. The vessels in transverse section are rounded in outline and considerably larger in the spring-wood than in the summer-wood (Fig. 2). There is no regular arrangement of vessels: they may be scattered or in radial or tangential rows in both spring- and summer-wood.

DISCUSSION

L. wendelboi shows a number of extremely interesting anatomical characters. Brachy- and macrosclereids have not been reported from any other species of the genus, nor have sclereids in the pith of the scape; while filiform sclereids, extensively developed in the lamina of *L. wendelboi*, appear to have been recorded previously only in *L. cylindrifolium* (Forsk.) Cufod. (Bokhari, 1970) — a species which does not show any close morphological relationship with *L. wendelboi*. Distribution and type of sclereids in the petiole provides another anatomical character differentiating *L. wendelboi* from the morphologically allied *L. stocksii*: the new species has filiform sclereids confined to the peripheral palisade while *L. stocksii* has fusiform sclereids found only in the ground tissue.

L. wendelboi is a very distinct species, therefore, both on anatomical and morphological characters.

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