EDINBURGH JOURNAL OF BOTANY 60 (1): 11–18 (2003)
DOI: 10.10M/S0960428603000027

TWO NEW SPECIES OF *LIMONIUM* (*PLUMBAGINACEAE*) FROM THE SULTANATE OF OMAN, ARABIA

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Hitherto the genus *Limonium* (*Plumbaginaceae*) was thought to be represented by eight species in Arabia. While preparing the account of *Limonium* for Volume 1 of the *Flora of Oman*, one of the present authors (S.A.G.) identified two new species from Oman, in addition to the three already known. The new species, *L. sarcophyllum* Ghaz. & J.R. Edm. and *L. milleri* Ghaz. & J.R. Edm., are described and illustrated, and the new combination *L. paulayanum* (Vierh.) J.R. Edm. & Ghaz. based on *Statice paulayana* Vierh. from Soqotra is published. A key is provided for all 10 species in Arabia.

Keywords. Arabian Peninsula, *Limonium*, Oman, *Plumbaginaceae*, Socotra, Soqotra, *Statice*.

Introduction

The genus *Limonium* was thought to be represented by eight species in Arabia: six on the Arabian Peninsula (excluding the two new species here described) and two on Soqotra. Based on information from Daoud (1985), Miller & Morris (1988), Western (1989), Mandaville (1990), Ghazanfar (1992, in press), Wood (1997), Chaudhary (1999), Collenette (1999) and Jongbloed *et al.* (2000), the mainland species hitherto recognized are: *L. axillare* (Forssk.) Kuntze, *L. carnosum* (Boiss.) Kuntze, *L. cylindrifolium* (Forssk.) Vierh. ex Cufod., *L. lobatum* (L.f.) Chaz., *L. pruinosum* (L.) Chaz. and *L. stocksii* (Boiss.) Kuntze. The Soqotran species are *L. sokotranum* (Vierh.) Radcl.-Sm. and *L. paulayanum* (Vierh.) J.R. Edm. & Ghaz. (*comb. nov*., this publication; Balfour, 1888). Until now three species have been recorded in Oman (Ghazanfar, 1992): *L. axillare* which occurs in SE Dhofar along the coast and at the edges of coastal marshes in sandy and saline habitats, but never far inland; *L. stocksii* which is found in the saline (sabkha) and coastal areas of the central desert and the drier areas of Dhofar; and *L. carnosum* which has been doubtfully recorded from the dry valleys of NW Oman. Elsewhere, *L. axillare* is distributed on mainland Yemen and Soqotra, Saudi Arabia, Kuwait, Bahrain, Egypt (by the Red Sea coast), Ethiopia and Pakistan, *L. carnosum* in Transcaucasia, Armenia (in these two regions from 1000 to 1500m a.s.l.; Rechinger & Schiman-Czeika, 1974),

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NW Iran, Iraq, Syria, Jordan, Saudi Arabia, Kuwait and United Arab Emirates (UAE), and *L. stocksii* in S Iran, Afghanistan, SW Pakistan (Baluchistan) (Edmondson, 1995) and the UAE. *Limonium carnosum* is doubtfully recorded from Oman, based on a very poor specimen (Wadi Ghor, *Lee-Oldfield* 14, K) which is very hard to identify. J.R.E. has collected this species in the UAE on a plain lying on the west side of Jebel Hafit, just south of Al 'Ayn, and it is likely to occur in Oman as the southern half of Jebel Hafit is in Oman.

The photograph on p. 605 of Collenette (1999) is probably of *L. carnosum*, showing the lax inflorescence and warty stems often found in that species, though it might possibly be *L. pruinosum* which also has distinct warty stems but more congested inflorescences. From the photograph it is not possible to tell whether the spikelets are 1-flowered (as in *L. pruinosum*) or 2-flowered (as in *L. carnosum*), or whether the calyx-veins are pilose (*L. carnosum*) or glabrous (*L. pruinosum*). *Limonium pruinosum* is native to Egypt, Palestine and Syria, and is recorded (though not illustrated) from Saudi Arabia by Collenette (1999), but not by Chaudhary (1999). We have not seen any specimens of *L. pruinosum* from Saudi Arabia or Oman.

The two new species described in this paper are somewhat intermediate between *L. axillare* and *L. stocksii*. Though species in the genus are known to be apomictic (Baker, 1950; Newton, 1980; Ingrouille & Stace, 1986), no experimental studies (emasculation, pollen or cytological work) have been carried out on any of the Arabian species. All living and herbarium Arabian material examined so far is bisexual, and no male sterile populations are known. In the absence of experimental evidence, the two new species are recognized purely on morphological grounds.

Key to the species of Limonium *in the Arabian Peninsula*

1a. Leaves cylindrical — **L. cylindrifolium**
1b. Leaves not cylindrical — 2

2a. Stems winged — **L. lobatum**
2b. Stems not winged — 3

3a. Stems and branches covered with wart-like tubercles — 4
3b. Stems and branches not as above — 5

4a. Inflorescence congested, axis appearing zig-zag; spikelets 1-flowered; calyx lobes with a distinct brown-red medial vein — **L. pruinosum**
4b. Inflorescence lax, axis not as above; spikelets 2-flowered; calyx lobes without a distinct brown-red medial vein — **L. carnosum**

5a. Inflorescence up to 30cm; calyx glabrous or with a few hairs at the base — **L. axillare**
5b. Inflorescence up to 8cm; calyx pubescent at least on the veins — 6

6a. Leaves linear-cylindrical. (Soqotra and Abd-el-Kuri) — **L. sokotranum**
6b. Leaves spathulate to obovate — 7

7a. Shrub to 80cm, profusely branched; leaves linear-spathulate, 1–3mm wide ___ **L. sarcophyllum**
7b. Shrub to 30cm, not profusely branched; leaves spathulate to obovate, 4–9mm wide ___ 8

8a. Calyx 3–4mm, distinctly infundibuliform. (Soqotra) ___ **L. paulayanum**
8b. Calyx 2–3mm, oblong and widening slightly at the top ___ 9

9a. Petals pink; calyx pilose on veins, base, and sometimes on margins; bracts glabrous, without broad white membranous margins ___ **L. stocksii**
9b. Petals white; calyx pilose on veins; bracts pubescent or glabrous, with broad white membranous margins ___ **L. milleri**

Limonium sarcophyllum Ghaz. & J.R. Edm., **sp. nov.**
A *L. carnoso* (Boiss.) Kuntze habitu fruticoso, caule folioso, inflorescentiis brevioribus et nervis calycis pilosis distincta, a *L. stocksii* (Boiss.) Kuntze foliis angustis spathulatis et habitu fruticoso differt, a *L. axillari* caule folioso, foliis angustis spathulatis, foliis basalibus nullis et inflorescentis minoribus distinguenda.
Type: Oman, Wadi Ras Shajar, c.2km from Bimah, coastal wadi, 7 xi 1993, *S.A. Ghazanfar* 2746 (holo. E).

Robust perennial shrub to 60cm. *Stems* glabrous, ascending to erect, branching from the base; basal part of the stems covered with remains of leaf bases. Bark of older stems white-grey. *Leaves* alternate, crowded, grey-green, sessile, somewhat fleshy, finely punctate and covered with crystals of excreted salt, without apparent veins; lamina 15–30 × 1–3mm, linear-spathulate, apex obtuse, base cuneate, expanding at the base, sheathing, persistent and becoming hard and woody after leaves fall. Inflorescence leafless, to 5cm, with flowers in one-sided spicate cymes, glabrous; bracts subtending the inflorescence 1–1.5mm, triangular, glabrous. Spike to 1cm, 2-flowered, one flowering before the other; bract subtending the spikelet ±1mm, broadly ovate, obtuse, glabrous, brown; outer bract subtending the flowers 3–3.5mm, naviculate, glabrous, brown with a narrow, white scarious margin; inner bract c.2.5mm, ovate, glabrous, pale brown. *Flowers* 4–5mm, pale-pink to pink, unscented. *Calyx* 3–3.5mm, pinkish-red, narrow campanulate, 5-lobed above; lobes 0.5mm, rounded at the apex, with white margins, 5-veined. *Petals* white to pale-pink to pink, oblong, a third longer than the calyx. *Stamens* equalling the corolla or slightly exserted; anthers 0.5mm. *Ovary* c.1mm, ovoid, 5-veined; styles 5. *Fruit* 1-seeded, glabrous, enveloped by the persistent calyx. **Fig. 1.**

Distribution and ecology. Endemic to Oman. The species is most abundant in northern Oman where it is found on the coast at the foot of the eastern Hajar mountains, forming the dominant coastal shrub. It is common between Dibab and Ras al Hadd, growing above the high tide mark, in pockets of sand and soil and amongst rocks and stones, with *Suaeda aegyptiaca* (Hasselq.) Zohary, and other coastal vegetation. It also occurs at the mouths of coastal wadis, in gravel and sand with *Acacia tortilis*

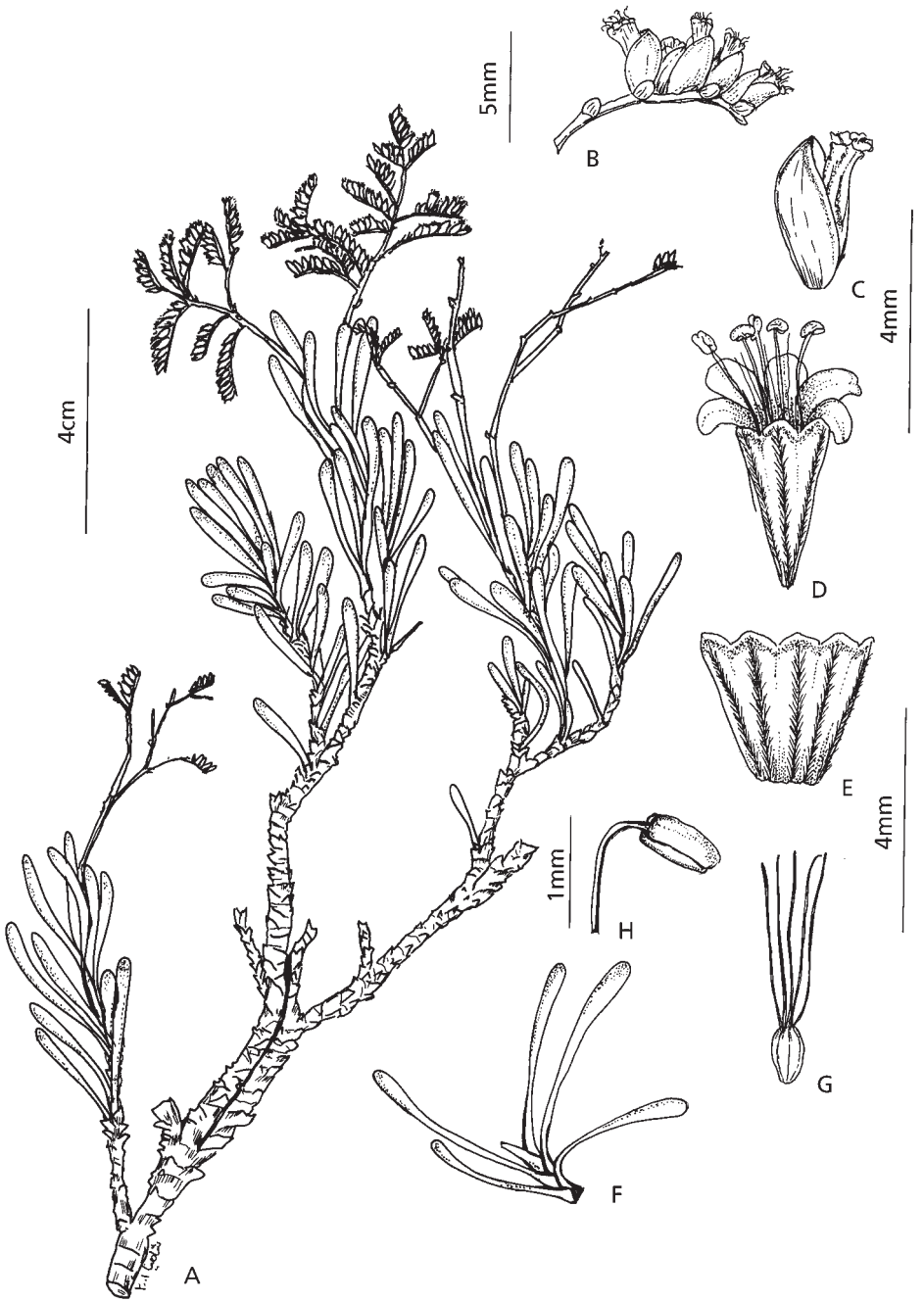

FIG. 1. *Limonium sarcophyllum*: A, habit; B, part of inflorescence; C, single spikelet with outer bract; D, flower; E, open calyx; F, leaves; G, ovary and styles; H, stamen. Drawn by S.A. Ghazanfar from *Ghazanfar* 2746.

(Forssk.) Hayne and *Ziziphus spina-christi* L. It is also found in Dhofar where it is recorded from a single location in Wadi Schuwaymiyah (see Fig. 3).

Altitude. Sea level to 20m.

Flowering and fruiting. More or less throughout the year.

Additional specimens examined. OMAN. Lone tree beach, between Bimah and Finns, c.2km from Umq turnoff, s.l., rocky beach, 26 i 1995, *S.A. Ghazanfar* s.n. (K); Wadi Ras Shajar, c.2km from Bimah, gravel wadi with rocky hillsides, 7 xi 1993, *S.A. Ghazanfar* 2748 (ON: Sultan Qaboos University Herbarium); Bimah, Sharquyah, 21°01′N, 59°07′E, s.l., 23 xii 1993, *I. McLeish* 3392 (E); Dhofar, Wadi Schuwaymiyah, NW of Schuwaymiyah, 100m, 17 ix 1989, *A.G. Miller & J.A. Nyberg* M9411 (E, ON).

Limonium milleri Ghaz. & J.R. Edm., **sp. nov.**
L. axillari (Forssk.) Kuntze affinis sed statura nana, nervis calycis pilosis, bracteis extra pubescentibus et petalis albidis differt; a *L. stocksii* (Boiss.) Kuntze foliis longiusculis cuneatis, corollis albidis et forma caespitosa distincta.
Type: Oman, Dhofar, Salalah to Thamrait, 1km S of Raven's Roost, low hills with *Euphorbia balsamifera* and low grassland, on exposed hilltops, c.800m, 8 ix 1985, *A.G. Miller* 7530 (holo. E, iso. K).

Woody-based perennial herb, 6–15cm, forming clumps. *Stems* glabrous, ascending to erect, sparsely branching from the base, covered with remains of leaf bases. *Leaves* alternate, grey-green, crowded in the basal part of the stems, sessile, without apparent midrib or lateral veins; lamina 8–35 × 4–9mm, spathulate, apex obtuse to acute, often with a small apical spicule, base cuneate, expanding at the base and sheathing the stem, persistent and becoming hard and woody after leaves fall. Inflorescence axis divaricate, to 7cm, with flowers in leafless, 3–7cm, one-sided spicate cymes. *Flowering spike* 7–10mm, spikelets 2-flowered; bract subtending the spikelet 1–1.5mm, broadly ovate, obtuse, glabrous, brown; outer bract subtending the flowers 3–3.5mm, suborbicular, brown with a broad scarious margin, pubescent or glabrous; inner bract c.2mm, narrow ovate, glabrous, pale brown, scarious towards the apex. *Flowers* c.4mm, white, fragrant. *Calyx* 3.5–4mm, pinkish, narrowly campanulate, 5-lobed above, with long white hairs on the veins and at base; lobes ±0.5mm, rounded at the apex with white margins, with 5 red veins. *Petals* white, oblong, slightly longer than calyx, falling early. *Stamens* equalling the corolla or slightly exserted. *Ovary* c.1mm, ovoid, 5-veined; styles 5. *Fruit* 1-seeded, glabrous, enveloped by the persistent calyx. **Fig. 2.**

Distribution and ecology. Endemic to Dhofar province, Oman, on exposed hills and grassland, in the *Euphorbia balsamifera* zone (Fig. 3).

Altitude. 600–1000m.

Flowering and fruiting. September, October.

Additional specimens examined. OMAN. Dhofar, 43km N of Salalah on Thamrait road, nr. Aqabat al Hatab, 17°19′N, 54°05′E, 600m, in rock crevices, 21 ix 1977, *A. Radcliffe-Smith*

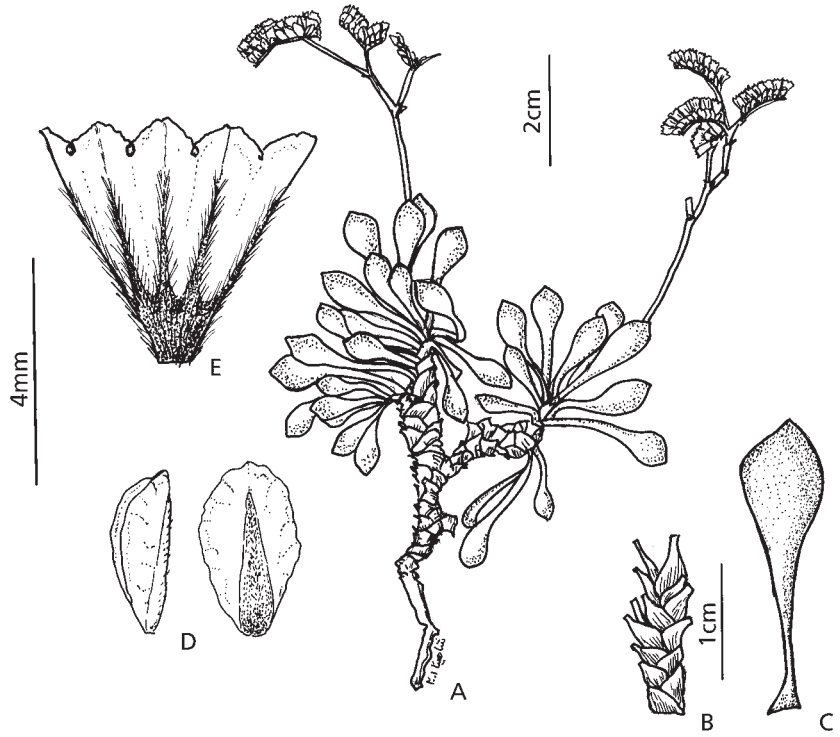

FIG. 2. *Limonium milleri*: A, habit; B, basal part of stem showing leaf bases; C, single leaf; D, outer bract; E, calyx. Drawn by S.A. Ghazanfar from *Miller* 7530.

5149 (K, ON); 3km N of police post on Salalah to Thamrait road, 17°25′N, 54°02′E, 9 i 1985, *I. McLeish* 456 (E); Salalah to Sarfait road, Aydem turnoff, dry rocky slopes with *Acacia etbaica* and *Dracaena serrulata*, 1000m, 14 ix 1989, *A.G. Miller & J.A. Nyberg* M9378 (E, K); Jebel Qara, Ashanhaib, c.40km NE of Salalah, 800m, 4 ix 1989, *A.G. Miller & J.A. Nyberg* M9077 (E); 7km along Ashanhaib to Zeak road, at wadi bottom in Nedj, 4 v 1989, *I.M. McLeish* 1113 (E); c.15km from Ayun village, dry gravel plain, 22 ix 2002, *S.A. Ghazanfar* 4149 (ON).

Limonium paulayanum (Vierh.) J.R. Edm. & Ghaz., **comb. nov.**
Basionym: *Statice paulayana* Vierh. in Österr. Bot. Zeitschr. LV(3): 89, tab. 9, figs 2 and 3 (1905). Type: Sokotra, Gubbet Shoab, Djbel Rahmen (672m), 1899, *Simony* 10/1 (?W); Beitr. zur Kenntnis der Fl. Sudarabians und der Insel Sokotra, Semha und Abd el Kuri, in Denkschr. Akad. Wiss. Mathm.-Nat. 78, tabs 9/2–3 (1907).
Syn.: *Statice axillaris* Balf.f., Botany of Socotra, in Trans. Roy. Soc. Edinb. 31: 148 (1888) non Forssk., Fl. Aegypt.-Arab. 58 (1775).

Balfour based his identification on *Balfour, Cockburn & Scott* 102, which was collected by a Mr Nimmo (from Bombay) apparently during a visit to Soqotra by the Indian Navy during 1834 and sent to Kew (Balfour op. cit. p. xvi). We have examined this specimen and consider it distinct from *L. axillare*.

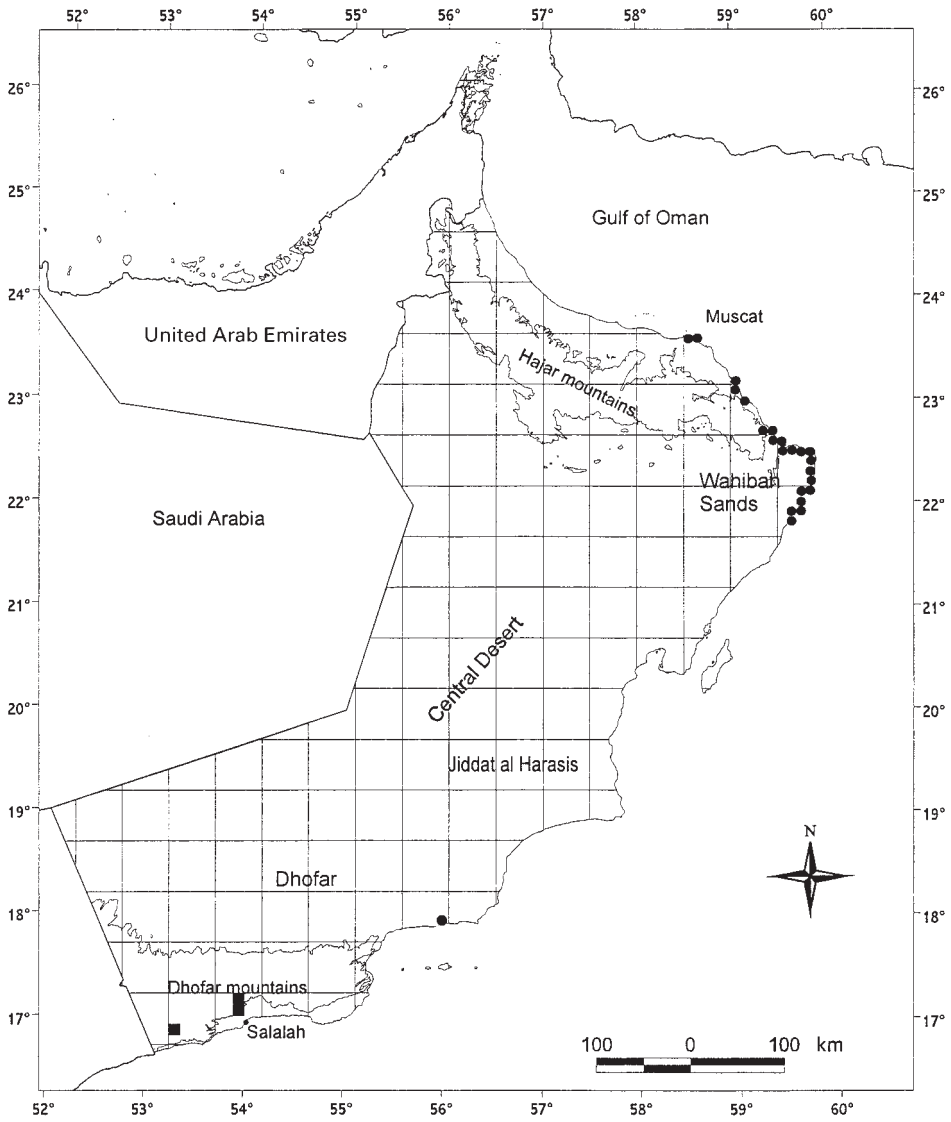

FIG. 3. The distribution of *Limonium sarcophyllum* (●) and *Limonium milleri* (■) in the Sultanate of Oman. Contours of the Hajar and Dhofar mountains at 500m; map grid 50 × 50km.

ACKNOWLEDGEMENTS

We are grateful to the Keepers of the herbaria of the Royal Botanic Gardens, Kew, Royal Botanic Garden Edinburgh, Institut für allgemeine Botanik, Hamburg and the Natural History Museum, London for loan of specimens. Shahina A. Ghazanfar is grateful to the Department of Plant Sciences, University of Cambridge and John

Edmondson to the Keeper of Liverpool Museum, for providing research facilities. We are also grateful to Mark Coode for correcting the Latin diagnoses.

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Received 10 September 2001; accepted after moderate revision 12 September 2002