Notes RBG Edinb. 46(1): 101–109 (1989).

TWO NEW SPECIES OF ABIES (PINACEAE) FROM WESTERN MEXICO

K. D. RUSHFORTH*

ABSTRACT. *Abies flinckii* Rushforth (section *Grandis* Engelmann emend. Farjon & Rushforth) & *A. colimensis* Rushforth & Narave (section *Oiamel* Franco emend. Farjon & Rushforth) are described from specimens collected on the Nevada de Colima in western Jalisco State, western Mexico.

INTRODUCTION

When preparing for a joint expedition to northeast and western Mexico in association with staff of the Instituto Nacional de Investigaciones sobre Recursos Bioticos (XAL) at Xalapa, Vera Cruz, Mexico, I was struck by the distinctive features of an *Abies* sheet (*McVaugh* 10120) at the BM from near to El Izote on the lower slopes of the Nevada de Colima, Jalisco State. During the expedition further collections were made from this locality and, with the study of other collections, show it to be a distinct new species in *Abies* sect. *Grandis* Engelmann emend. Farjon & Rushforth (1989). When visiting the Nevada de Colima, specimens of the other *Abies* taxon growing there, previously recorded as *A. religiosa* from sterile material (*Martinez* 1953), were collected in fruit which show it to be a new species in *Abies* sect. *Oiamel* Franco emend. Farjon & Rushforth (1989).

Abies flinckii Rushforth, **sp. nov.** Fig 1.

Syn.: *A. guatemalensis* var. *jaliscana* Martinez in Anales del Instituto de Biologia, 13: 2 (1948). Type: MEXICO, Jalisco, Las Mesas, circa de Cuale, xi 1947, *Gonzales s.n.* (*Martinez* 28500) (MEXU).

A. religiosa var. *emarginata* Loock & Martinez in Ant. Inst. Biol. Mex. 19: 1 (1948). Type: MEXICO, Michoacan, Mil Cumbres, 27 iv 1947, *Loock* 128 (*Martinez* 29000) (MEXU).

Abies guatemalensis Rehder affinis sed differens in strobilo maturo oblongo-conico, 12–16cm longo et 4–4.5cm lato, apice obtuse-acuta, bracteae manifeste exsertae et patentes, oblongo-obovatae, 2.5cm longae et 7mm latae (cuspide incluso), cuspide triangularis, 3–4mm longa et 7mm lata; folia longa et laxa, ad 7cm longa, pectinata; et ex *A. religiosa* (H.B.K.) Schlechtendal et Chamisso in amenta mascula longiora, 3–4cm longa (cf. 1–1.8cm) et 0.7cm lata et strobili immaturi virido-brunnei, rhachis strobilorum anguste-conica; folia longiora, apice emarginata.

Typus: MEXICO, Jalisco, Nevada de Colima, in and above the Pueblo of El Izote, 2350m, 9 xi 1984, *Rushforth* 621 (holo. XAL, iso. E).

Tree 20–35m tall, up to 1m bole diameter. *Bark* grey, smooth in young trees and on upper bole, scaly at base in old trees. *Shoots* slender, green when young, ripening to olive-brown but in exsiccata drying to red-brown, puberulous when young. *Branches* spreading, in old trees reclinate (spreading out, bending

*32 Park Lane, Fareham, Hants, PO16 7JX, UK.

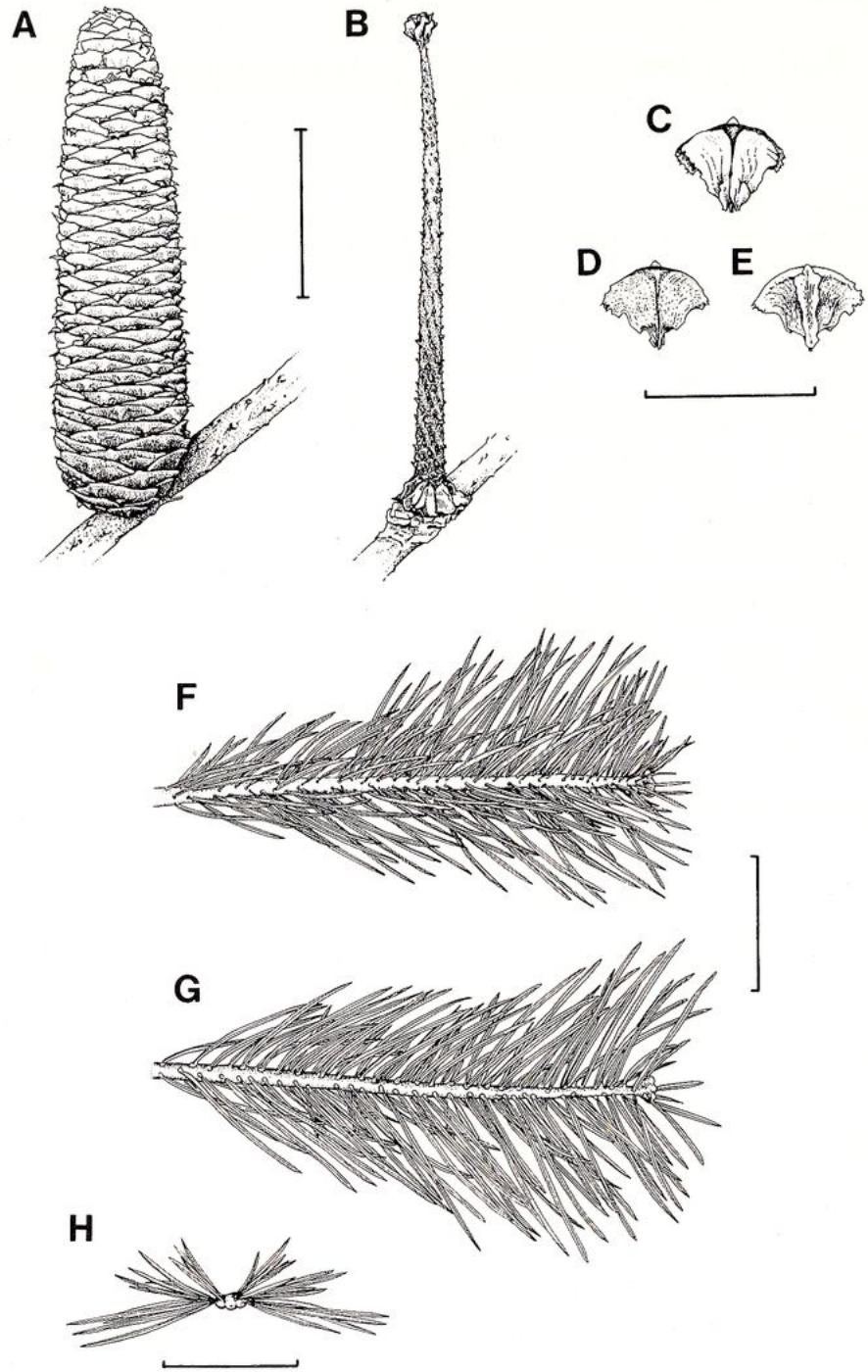

FIG. 1. *Abies flinckii* Rushforth. A, mature cone; B, cone rachis; C, ovuliferous scale with seeds, from above; D, ovuliferous scale without seeds, from above; E, ovuliferous and bract scales, from beneath; F, mature foliage from upper crown, from above; G, mature foliage from upper crown from beneath; H, TS of foliage arrangement. All drawn from *Rushforth* 621. Scales = 5cm.

down and level at the tips). *Vegetative buds* globose or conical with rounded or globose apex, thickly resinous, purple-grey, drying to grey in exsiccata, small, 2–4mm. *Leaves* pectinate below the shoot (slightly drooping at the tips) and widely parted with a broad open groove above on coning and vigorous shoots, pectinate or nearly pectinate above on seedlings and shaded shoots, in 2–3 rows, side leaves spreading or aligned slightly forwards; upper ranks pointing forwards at 45–60° to the shoot, lax, (2–)3.5–7 × 0.15–0.2cm (to 9cm long on shaded shoots and seedlings), upper rank of leaves half length of lower rank, mid-green above with a groove; base slightly twisted or straight; apex rounded, bluntly notched to sub-bifid, bifid on seedlings and epicormic shoots; stomata in a variable pale band in groove on upper surface or absent and on leaf underside in two pale white bands. *Mature cone* shortly stalked (1cm), oblong-conical, bluntly pointed at the apex, 12–16 × 4–4.5cm. *Rachis* narrowly conical, 0.8cm wide at base, 0.25cm at tip. *Ovuliferous scales* flabellate, 2.5–2.7 × 3–4cm (scales near apex of cone narrower), flange-like margins erose. *Bract scale* oblong-obovate, 2.5 × 0.7cm, exserted and spreading, cusp (in this instance the cusp is taken as the entire apical portion of the bract) triangular, 3–4 × 7mm at the base, acute. *Seed* 0.8–0.9 × 0.4cm, with wing 2–2.5 × 1.1–1.5cm, light brown. *Male cones* 3–4 × 0.7cm, male cone buds cylindric with a rounded apex, 7mm, resinous, scattered on underside of lower foliage.

Specimens examined: JALISCO: Nevada de Colima, in and above El Izote, 2350m, 09 xi 84, *Rushforth* 622 (XAL); ibid., *Rushforth* 622b (E); ibid., *Rushforth* 623 (XAL); ibid., *Rushforth* 624 (XAL); ibid., *Rushforth* 626 (XAL); ibid., above Jazmin, near El Izote, 2500m, 30 iii 1949, *McVaugh* 10120 (BM, MEXU); below El Chante and the saw mill Manantlan, 1300m, 17 iii 1974, *Styles* 91 (K); Talpa de Allende, on way to Cuale, 2050m, 08 xi 1984, *Rushforth* 603 (XAL, E); ibid., *Rushforth* 603b (E); ibid., *Rushforth* 606 (XAL, E); ibid., 1900m, *Rushforth* 617 (XAL); ibid., 1800–2250m, 19–21 xi 1952, *McVaugh* 14298 (MEXU); Santa Monica, 1950–2050m, 12–13 xi 1952, *McVaugh* 14113 (MEXU); Sierra de Minatlan, Haceradero, 1860m, 25 xi 1968, *Boutin & Brandt* 2512 (MEXU); Loma de la Raboncita, near the Hacienda de San Antonio, Municipio Sapotitlan, 1800m, 04 vii 1974, *Mancaro* 125 (MEXU); SINALOA: San Ignacio, s.d. *Ortega* 113 (K), ibid., Cerro de San Raphael, 2500m, *Gonzales Ortega* s.n. (MEXU) (these two specimens may belong to only one collection as the MEXU sheet is recorded as herbarium number 113); MICHOACAN: by km 10 on road Uruapan Tancitiro, 2250m, 23 ii 1974, *Styles* 14 (K); Municipio de Villa Modera, just before Saucers from Yuricostio, 2400m, 06 xi 1984, *Rushforth* 568 (XAL); ibid., 3km east of Saucers towards Yuriocostio, 2350m, 06 xi 1984, *Rushforth* 583 (XAL, E); Los Sauces, Municipio de Tacambaro, 1700m, 29 xii 1978, *Rzedowski* 36028 (MEXU); Las Mesas, Municipio de Villa Modera, 2500m, 23 x 1979, *Madrigal Sanchez* 3468 (MEXU); Baranca de Culabra, Tantucuaro, 2160m, 15 vii 79, *Madrigal Sanchez* 3349 (MEXU); Puertew Verde, El Varalosa, Municipio de Coalcomin, 2460m, 08 ii 1979, *Madrigal Sanchez* 3225 (MEXU); Mirador, Mil Cumbres, Municipio de Cuidad Hidalgo, 2520m, 06 vi 1979, *Madrigal Sanchez* 3325 (MEXU).

A. flinckii is a species native to sites which have a warm temperate or subtropical climate. In the wild it flushes and comes into flower in February/March and the cones ripen in November. It is recorded from the states of Michoacan, Sinaloa and Jalisco, where it is frequent on mesic sites between 1900m and 2400m. On the Nevada de Colima in Jalisco it occurs with *Tilia mexicana* Benth., several pine species including *Pinus pseudostrobus* Lindley, and at the lower altitudinal range of *Abies colimensis* Rushforth & Narave. Near Talpa de Allende it occurs on mesic sites with *Tilia mexicana, Fraxinus* sp., *Juglans* sp., *Pinus gordoniana* Hartweg, *P. devoniana* Lindley (= *P. michoacana* Martinez), *P. ?strobiformis* Engelmann, *P. lumholtzii* Rob. & Fern. and *Quercus* sp. In Villa Modera municipio of Michoacan State, associated plants recorded included *Styrax officinalis* L. var. *jaliscana, Arbutus*

xalapensis H.B.K., *Alnus* sp., several species of pine including *Pinus maximinoi* Moore, *Rhus* sp., *Ostrya* sp, *Cornus* sp., *Bocconia frutescens* L., *Phaseolus coccineus* L. and several species of *Quercus*.

Martinez (loc cit.) described specimens collected between Talpa de Allende and Cuale under *Gonzales (Martinez)* 28500 as *A. guatemalensis* var. *jaliscana*. The sterile foliage associated with this collection clearly belongs to *A. flinckii*. However, this name is not adopted because the cones on the four sheets at MEXU appear to be deformed and do not match those seen (from the edge of a baranca but out of reach!) on trees between Talpa de Allende and Cuale. They match material collected off the forest floor at the Nevada de Colima under *Rushforth* 622b (E) which has smaller cones with reflexed ovuliferous scales. This collection clearly belongs to *A. flinckii* and was of the current season's formation; however, it had evidently been broken off by a storm and had been on the ground for several weeks or months and is not typical of the mature cone. *Madrigal Sanchez* 3468 (MEXU) is mounted with a similar detached cone. *A. flinckii* cones only on the uppermost whorls of branches of mature trees, and as with other species of section *Grandis*, the cones break up as soon as they are ripe and therefore collecting fresh mature cones can be difficult. The type material of *A. flinckii* was collected from a tree felled a few days previously for timber, whereas presumably the cones collected by Gonzales were picked from the ground and had been there for some time which explains their reflexed ovuliferous scales and small size (6–9 × 2.5–3cm). One of the Gonzalez specimens is illustrated in Martinez (1953: 121). For comparison, *McVaugh* 10120 consists of a fertile shoot with an immature cone which was 8cm long when collected on the 30th March 1949.

Loock & Martinez (loc. cit.) described *A. religiosa* var. *emarginata* from specimens Loock collected at Mil Cumbres in eastern Michoacan. This appears to be conspecific with *A. flinckii*, but this name is not adopted as in the context of *Abies* as a whole it would be of no significant diagnostic value, as the majority of species have emarginate leaf apices. *Loock* 128 has slightly smaller cones (12.5–13.5 × 3–4cm) which had not disintegrated by April, suggesting some abnormality. Martinez (1953) records the trees at Mil Cumbres growing to 45m tall and up to an altitude of 3000m.

The citation of the two specimens from Sinaloa must be tentative. Both collections are sterile and were probably epicormic shoots. There are two specimens at Kew; *Ortega* 113—herbarium reference 0001288, has leaves to 5cm and thus within the range of *A. flinckii*, but the second sheet (reference 0001284) is a weaker shoot, with shorter foliage (as in the MEXU specimen). It is possible that these could belong to *A. durangensis* Martinez.

A. flinckii clearly belongs in section *Grandis* Engelmann emend. Farjon & Rushforth (1989) on account of the slender, conical cone rachis, the conical cone, the long, lax and generally pectinate leaves and the small resinous buds. It differs in having the bract scales distinctly exserted and in the longer cone. From section *Oiamel* Franco emend. Farjon & Rushforth (1989) it differs in the much longer male cones, the long and pectinate foliage with an emarginate or somewhat bifid leaf apex and in the cones which, when immature, are greenish-brown, not violet purple, and ripen to mid-brown. Liu (1971) treats *A. religiosa* var. *emarginata* as a synonym of *A. religiosa* and *A. guatemalensis* var. *jaliscana* as a synonym of *A. guatemalensis*, in each case without any distinction.

A. flinckii has been introduced into horticulture under *Rushforth* 621 and 617 but in the United Kingdom is tender. In horticulture, the Rushforth collections are usually given as KR numbers.

The species is named in honour of Karl Evert Flinck, of Bjuv, Sweden, in appreciation for his assistance with my trip to Mexico.

Abies colimensis Rushforth & Narave*, **sp. nov.** Fig. 2.

Abies religiosa (H.B.K.) Schlechtendal & Chamisso affinis sed differens in strobilo ovato-oblongo, flavo-viridi, 13–14cm longo et 7–8cm lato, bracteae exsertae et manifeste reflexae, laminis exsertis, 0.8–1cm longis, 0.9–1cm amplis et viridibus, cuspide parvulo, abrupto; semina granda, 1.3–1.4cm longa; folia longiora, stomatis plurimis facie superiore.

Typus: MEXICO, Jalisco, Nevada de Colima, beside the road to the summit from Cuidad Guzman, 3150m, 10 xi 84, *Rushforth* 647 (holo. E; iso. XAL, K, E).

Tree 15–30m tall by up to 1m trunk diameter. *Crown* conic, becoming columnar with rounded conic apex, dense. *Bark* at first smooth and silvery-grey, later becoming fissured into grey or grey-brown scaly plates. *Shoots* glabrous, or weak shoots sparsely and finely hairy, olive-green in first season, becoming reddish-brown or dark brown, and distinctly reddish brown in exsiccata. *Branches* ascending at top of tree, spreading in middle crown and reclinate in lower crown. *Vegetative buds* small, globose-conic, lumpy with triangular scales, thickly resinous, 2–3 × 2–4mm, resin greyish-white, drying amber. *Leaves* on coning shoots mainly parted below the shoot although with some pointing straight down; side leaves adpressed at base for 0.3–0.5cm, curved outwards and usually twisted to point slightly forwards; upper leaves pointing progressively further forwards and those above the shoot imbricate, straight, crowded along the shoot axis with a significant proportion adpressed with the abaxial surface uppermost, pointing forwards over the terminal buds; length (1.2–)2.5(–3.5) × 0.15cm; apex acute, pointed, somewhat tapered from base to tip; stomata in a broad pale band on upper surface (groove on fertile material only evident on drying and then often only extending for basal two thirds) and two bluish white bands on lower surface; upper surface glaucous or bluish-green; on sterile shoots of the lower crown foliage widely parted beneath shoot and drooping down at sides, 2–4(–5) × 0.15(–0.2)cm; fewer stomata in groove on upper leaf surface of seedlings; resin canals 2, marginal. *Cone* ovoid-oblong or barrel-shaped, blunt at apex, sessile, 13–14 × 7–8cm. *Rachis* cylindro-conical to stout conical, 1.1–1.3cm thick at base, 0.9–1cm at middle and 0.3–0.5cm near tip. *Ovuliferous scales* flabellate to cyathiform, thin, some slightly auricled, pale bluish-green, exposed portion drying to whitish-brown, concealed portions drying red-brown, densely hairy on exposed portion, 3–3.2 × 3.3–3.8cm. *Bract scale* exserted and reflexed, concealing approximately 65% of the cone surface, oblong-obovate, exposed portion largest, 3.4–3.8 × 0.9–1.1cm (length from base of ovuliferous scale), apex rounded, margin erose, yellow-green or pale green (drying to light brown) with a whitish stripe which ends in the short triangular cusp 1–2.5mm long. *Seed* 1.3–1.4 × 0.4–0.5cm, broadest at middle; wing obdeltoid (deltoid but attached

*Instituto Nacional de Investigaciones sobre Recursos Bioticos, Apartado Postal 63, 91000, Xalapa, Vera Cruz, Mexico.

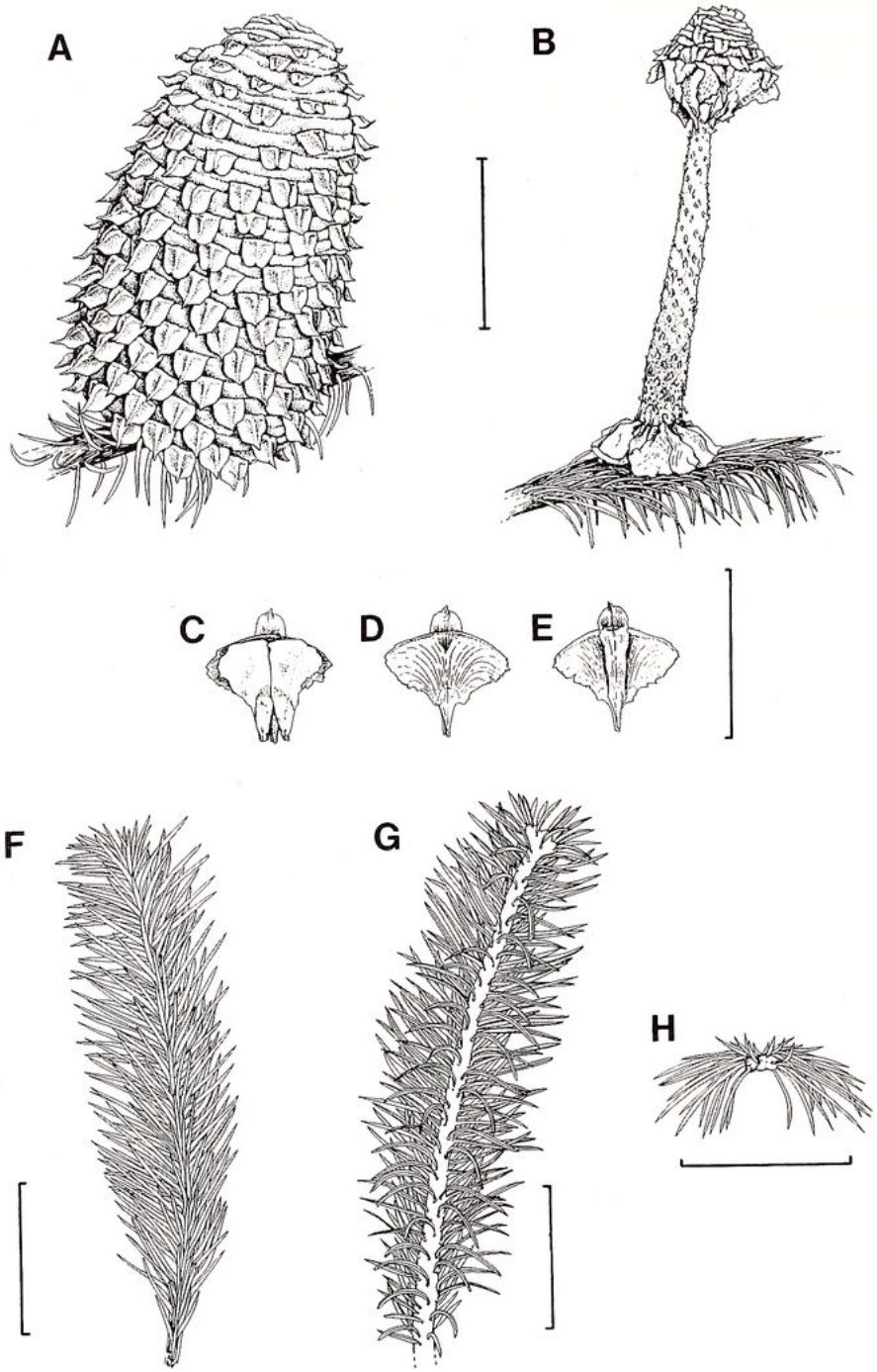

FIG. 2 *Abies colimensis* Rushforth & Narave. A, mature cone; B, cone rachis; C, ovuliferous scale and tip of bract scale with seeds, from above; D, ovuliferous scale and tip of bract scale without seeds, from above; E, ovuliferous and bract scales, from beneath; F, mature foliage from upper crown, from above; G, mature foliage from upper crown, from beneath; H, TS of foliage arrangement. All drawn from *Rushforth* 647. Scales = 5cm.

to seed at the narrowed end), 2.7–2.9 × 1.5–1.8cm (including seed), pale brown. *Male cones* not seen.

Specimens examined: JALISCO: Nevada de Colima, in and around El Izote, 2350m, 9 xi 1984, *Rushforth* 627 (XAL, E); ibid., 2400m, *Rushforth* 628 (XAL, E); ibid., *Rushforth* 629 (XAL); ibid., beside the road to the summit from Cuidad Guzman, 2750m, *Rushforth* 645 (XAL, E); ibid., 2800m, *Rushforth* 646 (XAL, E); Nevada de Colima, xi 1931, sine collector, no 31 (MEXU); Sierra de Minatlan, northwest of El Guisar, 2800m, 23 xi 1968, *Boutin & Brandt* 2561 (MEXU); north of La Joya, north and below Cerro Nevada (Nevada de Colima?), 3000m, 20 xi 1968, *Boutin & Brandt* 2325 (MEXU).

A. colimensis is only known for certain from the Nevada de Colima where it is recorded from the north and northeast flanks of the mountain between 2350 and 3150m. At the lower end of its altitudinal range it is mixed with *A. flinckii* although generally found on drier sites. At the top of its range it grows together with *Pinus ?hartwegii* Lindley but at the lower altitudinal end of the pine's range, which extends up the mountain to the tree line. The type specimen was collected in the narrow zone where both *A. colimensis* and *P. hartwegii* occur. Other species associated with it towards the lower half of its altitudinal range include *Quercus* sp., *Fuschia* sp., *Geranium deltoideum* Ryberg, *Lupinus* sp., *Arbutus xalapensis* H.B.K., *Pinus pseudostrobus* and *Ceanothus* sp. At the upper end of its range, associated plants include species of *Penstemon, Ribes, Lupinus, Salix, Symphoricarpus, Dahlia, Prunus* and *Salvia.*

Apart from the type, only *Rushforth* 646 includes any mature coning material and this comprises part of an old cone collected from beneath the tree. All other collections are sterile.

A. colimensis clearly belongs to section *Oiamel* Franco emend. Farjon & Rushforth in the general details of the foliage, cone, cone rachis and ecology. It differs particularly in the much larger cones and in the other characters enumerated.

I have not seen any collections of section *Oiamel* from Michoacan with good cones. Most collections (e.g. south of Patscuaro, *King & Soderstrom* 5206; Violla Escalente, San Gregorio, *Madrigal Sanchez* 3216; Pamatucuaro, *Madrigal Sanchez* 3116, all at MEXU) are weak sterile shoots from the lower crown. *Ibarra* 1234 (MEXU), from Cima del Cerro Cacique, Zitacuaro, does include a coning shoot with a few basal scales remaining of the cone, which imply a diameter of 4–4.5cm and ovuliferous scales less than 2cm wide. The foliage appears glaucous and similar in arrangement to *A. colimensis* but is significantly shorter, to 1.5–1.8cm. It thus appears to belong to *A. religiosa.* In the absence of good material from Michoacan, it is difficult to be precise as to whether *A. colimensis* is found there (or in eastern Jalisco).

Collections of *Abies* from Mexico State (such as from Villa Alpina, Municipio de Naucalpan, *B. Ratrada* 319 (MEXU), from Sierra de las Cruces, *Pringle* 4357 (BM, also at MEXU & E but with a poor cone) and from Parque Nacional Miguel Hidalgo y Costillo, *Madrigal Sanches* 3040 (MEXU)) are rather similar to *A. colimensis* in the shape of the reflexed, but noticeably smaller, bract scales (but in these the bract scales cover no more than a third of the cone surface) and in the foliage which is glaucous and arranged in a similar manner. However, they differ from *A. colimensis* in the following respects: cones oblong or cylindrical 10–11.5 × 4.5–5cm, purple when young (*Madrigal* 3040: Gordon (1875: 213) implies that they are green); foliage

shorter, generally to a maximum of 2.5cm (as opposed to a mean of 2.5cm), with only a few stomata on the upper surface. The trees on the Sierra de las Cruces (at least) also differ in the much narrower or spire-like habit. *Martinez* 284000 (MEXU, herbarium number 3201), from Desierto, Mexico Districto Federal, has a similar cylindrical cone but 15 × 4.5cm. *Itlis & Itlis* 1659 (BM), from La Cima, Mexico DF, has a smaller cone (9 × 3.5cm) with the apex of the bract truncate with a short abrupt cusp. This material from Mexico State and Mexico DF is clearly referable to *A. religiosa sensu lato* as presently understood. It has been treated as a species, *A. hirtella* (H.B.K.) Lindley (type: El Guardia, Mexico Districto Federal, n.v.), or as a variety of *A. religiosa,* var. *glaucescens* (Roezl) Carrière (type from the Sierra de las Cruces, n.v.).

Other collections of *A. religiosa,* including material from the Cofre de Perote, differ further from *A. colimensis,* and also from the above collections, in the erect bracts which taper into the cusp, the generally longer cones (10–16 × 4–6cm) with smaller and narrower scales, the smaller seeds with smaller wings, the subdistichous and dark green foliage with only a few stomata above, and larger buds (4–10mm).

These two groups of plants would appear to represent two different subspecific elements in *A. religiosa.* However, at present I am uncertain which, if either, is referable to *A. religiosa sensu stricto.*

A. religiosa was described from a specimen collected between Masantla & Chilpantzingo, Guerrero State, south Mexico (*Bonplanth* 4370). I have only seen a fragment of this at MEXU which consists of a number of detached needles without any shoot or other material, and which at MEXU is mounted on the same sheet as *Martinez* 284000 [sic] (herbarium number 3201) from Desierto, Districto Federal. The needles of *Bonplanth* 4370 differ from *A. colimensis* in being less than 2cm long; other differences might be evident on better material but I have not seen any other specimens from Guerrero. Humbolt, Bonplanth and Kunth described *A. hirtella* as differing from *A. religiosa* in the longer needles and more strongly hairy shoots.

Liu (1971) used the observation that in *A. vejarii* Martinez the leaves tend not to be twisted at base as the only substantive character to separate his section *Vejarianae* from section *Oiamel. A. colimensis* has this character on a proportion of the leaves on coning shoots, although not on sterile foliage from the lower crown. Liu's originally very dubious section is thus further compromised by *A. colimensis* which adds weight to the treatment of section *Vejarianae* as a synonym of section *Oiamel* by Farjon & Rushforth (1989).

The following characters of *A. colimensis* suggest some affinity to *A. procera* Rehder and *A. magnifica* Murray (especially var. *shastensis* Lemmon) of section *Nobilis* Engelmann (1878): very broad cones of a yellowy green coloration with large ovuliferous scales; stout cylindro-conical rachis; large reflexed bract scales, with a small abrupt cusp, covering a large proportion of the cone surface; leaves adpressed at the base and imbricate along the shoot; vegetative buds small, lumpy and resinous; silvery grey bark. Such apparent affinity may indicate a phylogenic relationship between sections *Oiamel* and *Nobilis.*

A. colimensis is in cultivation in southern England from seeds collected under the type number and promises to be hardy in the United Kingdom if rightly sited.

Acknowledgements

I am indebted to the Director of INIREB (XAL) and his staff for the considerable assistance they provided to me in our joint expedition to northeast and west Mexico; in particular I thank Graham Pattison, for organising transport, accommodation and itinerary, and Hector Narave Flores. I also thank Dr M. T. Cessman of the Herbario Nacional de Mexico (MEXU) for permitting me to consult and photograph *Abies* and *Picea* sheets, the Keepers of the herbaria at the British Museum (Natural History) and the Royal Botanic Gardens, Kew, for access to study specimens, the Regius Keeper and Dr C. N. Page of the Royal Botanic Garden, Edinburgh, and John Simmonds, Curator, and David Hunt, of the Royal Botanic Gardens, Kew, for encouragement, and also all the sponsors of my field trip to Mexico. I also record my thanks to Sue Oldfield for the excellent line drawings and Aljos Farjon for assistance with the latin diagnoses.

References

Englemann, G. (1878). A synopsis of the American firs (Abies) Link. *Trans. St. Louis Acad. Sci.* 3, 593–602.

Farjon, A. & Rushforth, K. D. (1989). A classification of *Abies* Miller (Pinaceae). *Notes RBG Edinb.* 46: 59–79.

Gordon, G. (1875). *The Pinetum*. London.

Liu, T. S. (1971). *A monograph of the Genus Abies*. Taipei, Taiwan.

Martinez, M. (1953). *Las Pinaceas Mexicanas*. Mexico.