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# JOURNAL

OF THE

## ARNOLD ARBORETUM

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VOL. XX

JULY, 1939

NUMBER 3

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### THE FIRS OF MEXICO AND GUATEMALA

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*With a text figure*

FOR MORE than a century *Abies religiosa* (H.B.K.) Schlecht. & Cham. was supposed to be the only species of *Abies* growing south of the boundary of the United States, if we except the Rocky Mountain fir, *Abies concolor* (Gord.) Engelm., which was found in 1893 by T. S. Brandegee in northern Lower California. Recently, however, a new species was described from sterile material by Flous and Gaussen, representing the tree of the mountains of Oaxaca; cones of that species were collected last year by Dr. J. H. Faull, who also brought back from his last journey to Guatemala fruiting material of a fir which proves to be a distinct new species.

This material together with the specimens already in the Arnold Arboretum (A.A.) herbarium, the material from the Gray Herbarium (G.H.) and the National Herbarium (U.S.) and a specimen collected by G. U. Skinner from the Kew Herbarium, for the loan of which we are obliged to the curators of these herbaria, has enabled us to give the following account of the firs of Mexico and Guatemala. For assistance in the study of the internal structure of the leaves of the three following species, I am indebted to Dr. J. H. Faull.

***Abies religiosa*** (H.B.K.) Schlechtendal & Chamisso in *Linnaea*, **5**: 77 (1830). FIG. 1, A-D

*Pinus religiosa* Humboldt, Bonpland, Kunth, Nov. Gen. Sp. Pl. **2**: 4 (1817).—Parlatore in DC. Prodr. **16**<sup>2</sup>: 420 (1868).

*Pinus hirtella* Humboldt, Bonpland, Kunth, l. c. (1817).

*Abies hirtella* Lindley in Penny Cycl. **1**: 31 (1833).

MEXICO. N u e v o L e o n : Sierra Madre, 140 miles south of

Saltillo, *E. Palmer*, March 1880 (G.H.). S i n a l o a : without precise locality, *J. S. Ortega* 113 (U.S.). S a n L u i s P o t o s i : *Virlet*, Aug. 8, 1851 (Herb. Paris, ex Viguié & Gaussen); region of San Luis Potosi, 6000–8000 ft., *Parry & Palmer* 847 (ex Hemsley, Biol. Centr.-Am. Bot. **3**:190. 1882–6). H i d a l g o : Sierra de Pachuca, 9200 ft., *C. G. Pringle* 13802, Aug. 28, 1906 (G. H., U.S. with cones, A.A.); Mts. near Pachuca, *J. N. Rose & W. Hough* 4454, June 1, 1899 (U.S., with cone scales). J a l i s c o : Volcano of Colima, *M. E. Jones* 490, July 13, 1892 (U.S.). M e x i c o : Temascaltepec, Las Cruces, 3350 m., *G. B. Hinton* 3259, 2–7–1933 (A.A.); Sierra de las Cruces, 9000–11000 ft., *C. G. Pringle* 4357, Oct. 21, 1892 (A.A., U.S.); Mt. Popocatepetl, 8500–11500 ft., *Nelson & Goldman*, Jan. 7, 1894 (U.S. no. 1743094, with cone); *J. N. Rose & R. Hay* 6051, Aug. 7–8, 1901 (U.S.); *J. H. Faull* 13270, 13271, 13272, Dec. 13, 1938 (A.A.); "Ixtacchuatl" [ ? Ixtahuatlán] 10–12000 ft., *C. A. Purpus* 33, Jan. 1903 (U.S. with ♂ fls.); Acapulco, 7000 ft., *John A. Gamon* 14, March 14, 1921 (U.S.); Amacameca, *Geo. L. Fisher* 87, July 29, 1924 (U.S. with ♂ fls.); El Oro, alt. 2800 m., *Rangel* 6628, Nov. 1910 (U.S.); Ajusco, alt. 8500 ft., *J. H. Faull* 13103, Nov. 23, 1937 (A.A., with cone); Zempoala Nat. Park near Cuernavaca, elev. 8000 ft., *J. H. Faull* 13275, Dec. 1, 1938 (A.A.). P u e b l a : Manzanilla, vicinity of Puebla, *Bro. Arsène (Bro. Nicolas)* 6109, Nov. 17, 1911 (A.A., U.S.). V e r a C r u z : Mt. Orizaba, near Cordoba, 2700 ft., *Henry A. Seaton* 233, Aug. 20, 1891 (G.H., U.S.). Mt. Orizaba, *J. N. Rose & R. Hay* 5752, July 25–26, 1901 (U.S.); Tlacotalpan, *E. W. Nelson* 515, May 21, 1894 (U.S.).<sup>1</sup> W i t h o u t p r e c i s e l o c a l i t y : "Mexico," *Dr. J. Gregg* 663, 1848–49 (G.H.).

This species, the type of which was collected by Humboldt and Bonpland between Mazatlan and Chilpancingo, ranges from Nuevo Leon and Sinaloa to Jalisco and western Vera Cruz and occurs in the higher mountains at 2600 to 3350 m. altitude. It is easily distinguished from the two following species by the acute or acutish leaves and the large cone with exserted and reflexed bracts. The two vascular bundles of the leaves are close together while in the two following species they are more widely separated; the hypoderm is continuous or only slightly interrupted below the upper surface, less strongly developed below; there are always two subepidermal resin-canals along the lower surface near the margin of the leaf.

Viguié and Gaussen in their Revision du genre *Abies* (in Soc. Hist. Nat. Toulouse, **58**: 502–503; Trav. Lab. For. Toulouse, II, art. **1**: 324–325.

<sup>1</sup>The locality given by Nelson is close to the coast and it seems very doubtful if any species of *Abies* would grow there.



1929) cite among the synonyms *Abies glauca* Roehl, *A. glaucescens* Roehl, *A. Lindleyana* Roehl, *A. Tlapalcatus* Roehl and their subsequent combinations, but all these names are probably referable to *Pseudotsuga taxifolia* (Poir.) Britt., and are enumerated as doubtful synonyms of *Pseudotsuga Flahaultii* Flous (in Bull. Soc. Hist. Nat. Toulouse **71**: 92; Trav. Lab. For. Toulouse, Tome II, vol. IV, art. **2**: 60, 1936). Miss Flous' species is apparently only a slight form of the Rocky Mountain Douglas fir, *P. taxifolia* var. *glauca* (Beiss.) Schneid., considered a distinct species by Mayr and by Flous, a subspecies by Schwerin, a forma by Voss and published as a straight trinomial by Sudworth.

**Abies Hickeli** Flous and Gaussen in Bull. Soc. Hist. Nat. Toulouse, **64**: 24, fig.; in Trav. Lab. For. Toulouse, I, art. **17**: 1, fig. (1932).

FIG. 1, E-I

Arbor: ramuli rubro-brunnei, pulvinis linearibus sulcati, tenuiores, laterales praecipue in sulcis satis hirtelli, robustiores et fructiferi glabrescentes vel glabrae; gemmae ovoideae, obtusae, valde resinosae.

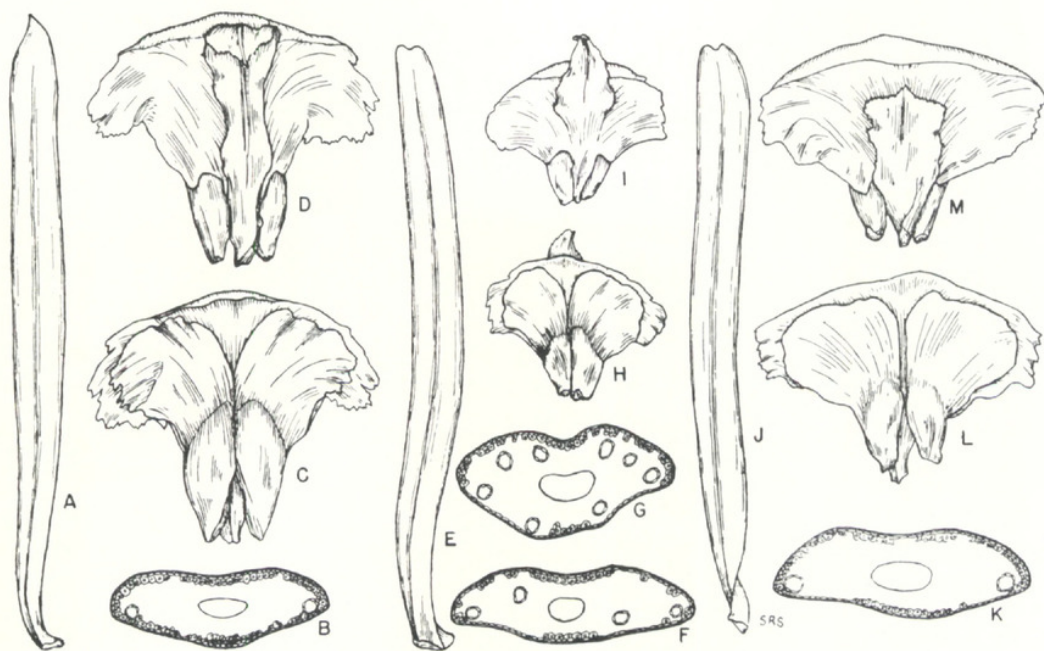


FIGURE 1. *ABIES RELIGIOSA* (HBK.) Schlecht. & Cham. A. Leaf,  $\times 3$ .— B. Cross-section of leaf,  $\times 15$ .— C. Scale with seeds, nat. size.— D. Scale with bract, nat. size. — *ABIES HICKELI* Flous & Gauss. E. Leaf,  $\times 3$ .— F. Cross-section of leaf from a sterile branch,  $\times 15$ .— G. Cross-section of leaf from a fertile branch,  $\times 15$ .— H. Scale with seeds, nat. size.— I. Scale with bract, nat. size. — *ABIES GUATEMALENSIS* Rehd. J. Leaf,  $\times 3$ .— K. Cross-section of leaf  $\times 15$ .— L. Scale with seeds, nat. size.— M. Scale with bract, nat. size.

Folia subdisticha, sub angulo fere recto patentia, linearia, 1.2–2.6 cm. longa et circiter 1.25 mm. lata, apice obtusa et emarginata, supra pallide viridia, sulcata, subtus cinereo-viridia, costa media leviter elevata, fasciis stomatiferis vix conspicuis e seriebus stomatum 7–8 compositis; canales resiniferi 4–8 (raro 10), 2–4 (raro 5) in folii facie inferiore subepidermales 1–4 (raro 5) in parenchymate partis superioris folii siti; hypoderma bene evolutum sed hic inde interruptum in foliis ramuli fertilis, minus conspicuum in eis ramuli sterilis; fascies fibro-vasculares 2, bene distincti. Strobili subsessiles, maturi oblongo-cylindrici, 6–7 cm. longi et 2.5–3.5 cm. diam., obscure brunnei, apice obtusi; bracteae oblongo-lanceolatae, circ. 2 cm. longae et 6–7 mm. latae, sensim in apicem acuminatum attenuatae, squamam multo superantes, erectae, incurvae et strobilo accumbentes vel leviter patentis, margine inaequaliter incisoserrulatae; squamae late cuneato-obovatae, 1.4–1.5 cm. altae et 1.8–2 cm. latae, margine extus hirtello-puberulae subito in stipitem circ. 4 mm. longum contractum, alis leviter recurvis et plus minusve auriculatis margine eroso-denticulatis. Semina 6–7 mm. longa, alis subrotundatis squamam fere aequantibus circ. 7 mm. longis et 8–9 mm. latis.

MEXICO. O a x a c a : Alt. 1650 m., *C. Conzatti* in 1900 (type in herb. Bonaparte, Lab. Bot. Lyon, sterile); Cerro de Yalina, alt. 3000 m., *C. Conzatti* 951, June 1899 (G.H.); San Juan del Estado, Distr. da Etla, *C. Conzatti*, Apr. 8, 1938 (sterile); Cerro San Felipe, Distr. dal Centro, alt. 2500–3000 m., *C. Conzatti*, Apr. 8, 1938 (sterile); Ixtepji, Sierra Juarez, Mt. San Felipe, alt. 2500 m., *J. H. Faull* 13268, 13269, Dec. 5, 1938 (with cones); Rancho Tablas, Distr. de Ixtlan, alt. 2500 m., *J. H. Faull* 13274, Dec. 7, 1938 (with cones) (all in herb. A.A.). ? V e r a C r u z : Orizaba, *Botteri* 225, about 1855 (G.H.).

This species was first described in 1932 by Flous and Gausson, based on a sterile branch collected by *C. Conzatti* in 1900. As complete material is now available, cones having been collected by Dr. *J. H. Faull* last year, a full Latin description is given above. The species is readily distinguished from *A. religiosa* by the emarginate leaves with 4–8 resin-canals, the smaller cones with oblong-lanceolate bracts exceeding the scales and directed upward and more or less incurved or sometimes slightly spreading, but never reflexed as in *A. religiosa*. From the following species which also has emarginate leaves, it differs in the smaller cone with exserted bracts and in the leaves with 4–8, rarely 10, resin-canals partly subepidermal and partly situated in the parenchyma near the upper surface of the leaf, and in the less copious hypoderm. The species seems to be restricted to the central mountains of Oaxaca occupying an area situated between that of *A. religiosa* and the following



species. The locality "Orizaba" of Botteri's specimen<sup>1</sup> seems doubtful, for two other collections cited above under *A. religiosa* from the Peak of Orizaba represent the latter species; it is unlikely that both species are growing on the Peak of Orizaba which is well within the range of *A. religiosa*, being in the same latitude as the stations in the District of Mexico and of Puebla. It is possible that part of the specimens collected by Botteri came from Oaxaca, for Hemsley mentions (Biol. Centr. Am. Bot. 4: 133) that a small collection of Mexican plants from Professor Sumichrast of Tehuantepec in Oaxaca, was presented in 1877 to Kew by De Candolle, which bears the same numbers for the same species as Botteri's. Tehuantepec is situated about 70 miles southeast of the mountains where *A. Hickeli* is found.

***Abies guatemalensis*, spec. nov.**

FIG. 1, J-M

*Abies*, sp. n. ? Hemsley, Biol. Centr.-Am. Bot. 4: 89 (1887), nom. nud.

Arbor ad 35 m. alta, trunco 60–90 cm. diam. (ex coll. A. F. Skutch) ramuli fusco-brunnei, pulvinis linearibus sulcati, steriles sat dense, fructiferi sparsius hirtelli; gemmae globoso-ovoideae, valde resinosae. Folia subdistichia, sub angulo fere recto patentia, inaequalia, linearia, 1.5–3 cm. longa et 1.25–2 mm. lata, apice obtusa et emarginata, supra laete viridia, nitidula, sulcata, subtus costa media elevata, marginibus recurvis, fasciis stomatiferis satis conspicuis e seriebus stomatum 8–10 compositis; canales resiniferi 2, subepidermales; hypoderma bene evolutum hic inde interruptum; fascies fibro-vasculares 2, approximati sed distincti. Strobili subsessiles, oblongo-cylindrici, 8.5–11.5 cm. longi et 4.5–5 cm. diam.; bracteae cuneato-obovatae, inclusae et dimidiam squamam aequantes, apice late truncatae et eroso-denticulatae, in medio paullulo vel vix productae; squamae transverse oblongae, circ. 3 cm. latae et 2–2.2 cm. altae, margine extus hirtello-puberuli, alis inaequaliter eroso-denticulatis, basi auriculata et in stipitem 5–6 mm. longum subito contractae; semina cuneato-obovoidea, 8–9 mm. longa, pallide brunnea, alis obovatis 1–1.5 cm. longis et 1.4–1.5 cm. latis.

GUATEMALA. Without special locality, *G. U. Skinner*, about 1850; Mts. above Sija (Totonicapam), *O. F. Cook* 33, May 24, 1906 (U.S., ♂ fls.); Cumbre del Aire, Dept. Totonicapam, alt. 10000 ft., *A. F. Skutch* 1279, Sept. 20, 1934 (sterile); Las Cumbres de Totonicapam, alt. 11000 ft., *J. H. Faull*, Dec. 25, 1936 (sterile); Las Cumbres del Aire, between Quezaltenango and Huehuetenango, alt. 11000 ft., *J. H. Faull*, Dec. 31, 1936 (A.A. with immature cones); Las Cumbres del Aire,

<sup>1</sup>Mateo Botteri collected 1193 numbers in southern Mexico about the year 1855, (see Bonplandia, 5: 72. 1857).

Huehuetenango, elev. 10000 ft., *J. H. Faull 13104*, Dec. 14, 1937 (type in A.A. with cones).

This species is readily distinguished from *A. religiosa* by the emarginate and pectinately arranged leaves, and from both preceding species by the bracts being only half as long as the scales, truncate at the apex and entirely hidden between the scales. In the pectinately arranged leaves and in their emarginate apex, it agrees with *A. Hickeli*, but differs from it in the broadly obovate bracts truncate at the apex and only about half as long as the scale, and in the leaves having only two resin canals. Both species, *A. Hickeli* and *A. guatemalensis* are easily distinguished, even without cones, from *A. religiosa* by the pectinately spreading emarginate leaves, while in the latter they are on the upper surface of the branch, directed forward and more or less appressed to the branch and always acute or obtusish at the apex, never emarginate.

*Abies guatemalensis*, which so far is known only from a restricted area near Lake Atitlan in the high mountain range along the western coast of Guatemala, marks the southernmost extension of the range of the whole genus, occurring as it does, between 14° and 15° N. lat., while in Asia and Africa, it does not even reach the Tropic of Cancer. The Guatemalan species seems to have been collected first by George U. Skinner<sup>1</sup> who sent a specimen from Guatemala to J. D. Hooker before 1866, which is cited by Parlatore under *Pinus religiosa* (l. c.).

The references to the occurrence of *Abies religiosa* in Guatemala by later authors are probably all based on this citation. Skinner's specimen in the Kew Herbarium which was kindly sent to me for examination, bears on the sheet besides *A. religiosa* on the original label, also the name *A. hirtella* and annotations by several authors, all doubting the identity of the specimen with *A. religiosa*. A note by J. D. Hooker says "leaves notched at apex" and a similar statement is made in an unsigned note. A note by Wm. R. McNab states that "this differs from *religiosa* in having only a few large hypoderm cells under the epidermis. I believe therefore that *hirtella* is distinct from *religiosa*." There are references by McNab to this specimen in a paper of his in *Proc. Roy. Irish Acad.* II, 2: 676 (1877) and in *Trans. Scott. Arb.* 8: 97 (1878). There is also a note "not *religiosa*, Dr. Mayr." These notes may have induced Hemsley to enumerate it as *Abies* sp. n. ? (l. c.). More recently, in 1934, it was again collected by A. F. Skutch, but also without cones. The real nature of the Guatemalan fir was not recognized until Dr. J. H. Faull collected for the Arnold Arboretum in 1936 excellent

<sup>1</sup>For a biographical sketch see *Trans. Soc. Bot. Edinb.* 9: 91-99 (1868) and *Gard. Chron.* 1867: 180-181.



material with mature cones which enabled us to recognize this fir as a new species.

**Abies concolor** (Gord.) Engelm. in Trans. St. Louis Acad. Sci. **3**: 600 (Syn. Am. Firs) (1878); repr. p. 8 (1878); in Trelease & Gray, Bot. Works Engelm. 345 (1887).

*Abies concolor* Lindley & Gordon in Jour. Hort. Soc. Lond. **5**: 210 (1850), nom. nud.

*Pinus concolor* Engelm. ex Lindley & Gordon, l. c. (1850), pro synon. praeced.

*Picea concolor* Gordon, Pinet 155 (1858).

*Pinus concolor* Engelm. herb. ex Parlatore, in DC. Prodr. **16**<sup>2</sup>: 426 (1868).

*Abies grandis* var. *concolor* A. Murray in Gard. Chron. n. ser. **3**: 105 (1875).

MEXICO. Lower California: San Pedro Martir, T. S. Brandegee, May 24, 1893 (A.A.); Vallecitos, Sierra San Pedro Martir, alt. 8060 ft., I. L. Wiggins & D. Demaree 4979, Sept. 21, 1930; trees mostly less than 10 ft. tall (G.H.).

This species is widely distributed throughout the Rocky Mountain region from Colorado to Oregon, south to New Mexico and southern California, but in Mexico it has been found only in northern Lower California on the San Pedro Martir Mountain where it was discovered in 1893 by T. S. Brandegee (cf. Zoe, **4**: 210. 1893); the specimens from the San Pedro Martir Mountain differ from typical *A. concolor* in the leaves being more or less curved, thicker, and only 1.5–3 cm. long.

As authors of the name *A. concolor* usually Lindley and Gordon are cited, but they published no description and only cited the unpublished *Pinus concolor* Engelm. as a synonym. The first, though rather brief description is given by Gordon under *Picea concolor*; he only says: "Leaves, long, linear, flat and much resembling those of *Picea grandis* but with both faces of the leaves of the same colour. Cones, cylindrical." Should this not be considered a sufficient description, the parenthetical author would be Parlatore.

HERBARIUM, ARNOLD ARBORETUM,  
HARVARD UNIVERSITY.



Rehder, Alfred. 1939. "The firs of Mexico and Guatemala." *Journal of the Arnold Arboretum* 20(3), 281–287. <https://doi.org/10.5962/bhl.part.21103>.

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**DOI:** <https://doi.org/10.5962/bhl.part.21103>

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