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THE PINES OF MEXICO

BY

GEORGE RUSSELL SHAW



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THE PINES OF MEXICO

INTRODUCTION

For several years Mr. E. W. Nelson, of the U. S. Department of Agriculture, in connection with his biological explorations in Mexico, has collected specimens of the Pines of that country. The very valuable material that he has brought together was gathered from various latitudes and altitudes throughout Mexico and in parts of Guatemala and in localities remote from the usual lines of travel. His collection, supplemented by that of his associate, Mr. E. A. Goldman and by that of Dr. J. N. Rose of the National Museum at Washington, and his assistants was sent to me for identification and has formed the basis of this paper. In order to study the trees as they grow naturally I have made four journeys to Mexico in company with Mr. C. G. Pringle of the University of Vermont.

A cursory examination of the specimens of Mexican Pines preserved in herbaria suggests a large number of species; the varied altitudes and climates of Mexico point to a like conclusion. Each excursion among the living trees; however, increased my suspicion that the numerous forms represent not many species, but several varieties of a few species. It was not until this suspicion became conviction that a consistent systematic arrangement of the Mexican Pines seemed possible to me.

Two characters of *Pinus* may require explanation. 1.—The conelet, or cone of the first year may be subterminal, lateral or pseudo-lateral on the branchlet. When the spring-shoot consists of one internode only the conelet is necessarily subterminal; when the spring-shoot consists of two or more internodes, the conelet may be subterminal or lateral or both. When a conelet is subterminal on the spring-shoot and a summer-shoot grows beyond it, the conelet becomes pseudo-lateral. A pseudo-lateral conelet is easily recognized as the leaves of the summer-shoot never attain normal length [Shaw, *Bot. Gaz.* XLIII, 205]. 2.—At the end of the growing season, buds enclosing staminate flowers are not sufficiently advanced in the Soft Pines to be recognized, but in the Hard Pines they are usually easily distinguished by their large size. The young male aments may either be concealed in the general outline of the bud, in which case they can be found by removing the basal perulae, or they form about the nodes of the bud characteristic enlargements which are constant for each species.

In the bibliography of the species references are mostly confined to descriptions accompanied by illustrations; the exceptions are Parlatores, Endlicher and Hemsley. The last author gives no descriptions but his work covers the whole of Mexico.

Each specimen of the National Museum collections bears the collector's label and on each sheet is stamped the Museum number. In referring to a specimen the collector's number is given followed by the Museum number in brackets.

DISTRIBUTION

The northern and central States of Mexico form a vast, arid, elevated table-land bordered by high mountains sloping abruptly to the coasts on the east and west and, on the south, into a country broken by mountains and valleys of various altitudes.

Only the lowlands of the coast and southern States up to altitudes of 1000 metres above the sea are tropical. On the slopes and table-lands between 1000 and 2000 metres the climate is subtropical. At 2000 to 3000 metres the climate is temperate with warm days and cool nights; this zone includes the general level of the great table-land and the slopes immediately above it. On the mountains above this table-land the average temperature decreases until, at the highest altitudes, the climate is boreal.

The vertical range of the Pines in Mexico is approximately between 1200 and 4500 metres above sea level. Each zone is represented by characteristic species. *P. Pringlei*, *P. Lawsoni*, and *P. oocarpa* are confined to subtropical regions; *P. teocote*, *P. patula*, *P. Greggii*, *P. Lumholtzii* and *P. ayacahuite* grow in temperate altitudes as well as the Nut-Pines, *P. cembroides*, *P. Pinceana* and *P. Nelsoni* which are found on the dry slopes just above the great table-land. Of the other Mexican species, *P. pseudostrabus* and *P. leiophylla* grow at both subtropical and temperate altitudes, while *P. Montezumae* is met at all levels except the tropical. The typical and most luxuriant form of this species is subtropical, while its hardiest form (*var. Hartwegii*) inhabits the highest altitudes where, at the timber line and for some distance below, it is the only Pine.

Northern Mexico has been invaded by a few species properly belonging to a more northern flora. *P. contorta* and *P. Lambertiana* occur in a single locality of northern California Baja, while *P. ponderosa* and *P. flexilis* grow as far south as the 23rd or 24th parallel of north latitude.

In Mexico no tropical Pine has yet been found, but in Honduras and eastern Guatemala the so-called Cuban Pine *P. caribaea* Morelet, indigenous also in Florida and the Bahamas, is abundant. The Mediterranean Pine, *P. halepensis* Miller is planted to a limited extent in the public parks of the large cities. *P. Pinea* L. is also said to be cultivated in Mexico but I have not seen it there.

Mexican Pines have not generally succeeded in cultivation. The species that are exclusively subtropical are too tender for southern England or northern Italy, but in the Botanical Garden at Buitenzorg, Java, the subtropical form of *P. Montezumae* has borne perfect fruit for many years. Of the temperate Pines the hardier forms of *P. Montezumae* have been grown under Lindley's names in the gardens about Lake Maggiore in northern Italy and in Devonshire and Cornwall in England. *P. ayacahuite var. Veitchii* seems perfectly hardy at Pallanza, Italy, and at Westonbirt, Gloucestershire. *P. patula* succeeds at Pallanza, at Bicton, Devonshire and at Fota, southern Ireland. From Bicton and Fota I have received branches and leaves of *P. Teocote* but no fruit. Considering the amount of seed distributed by Roezl and by Hartweg the results obtained are not encouraging except in regions of exceptionally mild climate.

MAP

In order to present a clear idea of the territory covered by the collections examined, the cities and towns mentioned in the text are approximately located on the map opposite.

The "Federal District" and the "Valley of Mexico" are limited areas within the State of Mexico; where these names occur on the collectors' labels they are changed to "Mexico" in the text.

U N I T E D S T A T E S



I	Carriere Gordon Parlatore	II		Carriere Gordon Parlatore	III		Carriere Gordon Parlatore		
		Roezl			Roezl				
A	A A A	1	aculcencis	1	F F	42	monte-allegri	13	C C
		2	amecaensis	2	F F	43	Muelleriana	43	A A
B	B B B	3	angulata	54	54 D	44	Nesselrodiana	41	K D
		4	Antoineana	4	N -	45	nitida	82	M D
C	C C C	5	aztecaensis	5	M D	46	Northumberlandiana	46	K D
		6	Besseriana	79	A A	47	ocampii	47	G D
D	D D D	7	Bothiana	7	K D	48	Ortgisiana	68	H D
		8	Boucheliana	8	K D	49	Papeleuil	49	F F
E	E E E	9	bullata	9	M D	50	Paxtonii	70	K D
		10	Carrierei	24	I D	51	Planchonii	24	D D
F	F F F	11	Cedrus	11	C C	52	popocatepetili	V	V E
		12	coarctata	12	K D	53	prasina	53	B K
G	G G D	13	Comonfortii	13	C C	54	protuberans	54	54 K
		14	Decalsneana	14	S D	55	Regeliana	55	55 K
H	H H D	15	Decandolleana	15	C C	56	resinosa	X	F F
		16	dependens	15	C C	57	Richardiana	20	S D
I	I I D	17	Doelleriana	24	H D	58	Rinzii	68	H D
		18	Don-Pedrii	V	V E	59	robusta	59	S F
K	K K K	19	elegans	19	K D	60	Rohanii	60	H -
		20	Endlicheriana	20	D F	61	rubescens	61	H D
L	L L -	21	Escandoniana	21	H K	62	rumellana	62	K D
		22	exserta	54	54 D	63	san-rafaeliana	63	K D
M	M M M	23	gracilis	13	C C	64	scoparia	X	F F
		24	grandis	24	K D	65	Soulangeana	65	K D
N	N N K	25	Haageana	24	K D	66	spinosa	66	K D
		26	hamata	26	T E	67	Standishii	67	F F
O	O O D	27	Hendersonii	41	M D	68	tenangaensis	68	K D
		28	heteromorpha	28	54 K	69	Thelemannii	24	K D
P	P P D	29	horizontalis	29	H D	70	Thibaudiana	70	G D
		30	Hoseriana	30	B K	71	Troubezoliana	71	H D
R	R R D	31	huisquilucaensis	13	C C	72	tzompolliana	72	B K
		32	inflexa	59	D D	73	valida	73	M D
S	S S D	33	iztacihuatli	33	F F	74	Van-Geertii	74	M D
		34	Jostii	34	M D	75	Van-Houttei	75	K D
T	T T E	35	Keteleri	35	M D	76	Veitchii	76	T E
		36	Lerdol	13	C C	77	verrucosa	15	C C
V	V V E	37	Lowii	37	D F	78	Verschaffeltii	78	R D
		38	magnifica	38	G D	79	Vilmoriniana	79	A A
X	X - -	39	michoacaensis	39	M D	80	Wilsonii	14	D D
		40	microcarpa	40	A A	81	zacatlanana	81	L D
		41	monstrosa	41	K D	82	zitacuarii	82	G D

ROEZL'S SPECIES

In the year 1857 there was published in the City of Mexico a "Catalogue de Graines de Conifères Mexicains," by B. Roezl & Cie., in which were described eighty-two new species of *Pinus*. The full significance of this large list is better understood by a study of the localities of the species; they were, with one or two exceptions, collected in the Valley of Mexico and on the neighboring mountains, a very limited area containing only a few species, each of which had received from earlier investigators one or more names. The obvious mercantile character of the Catalogue and the summary treatment the new species received at the hands of Parlatore, together with the slight success that has followed the cultivation of these Pines in Europe, have led to the neglect of Roezl's specimens and to the loss of many of them, and it is probably impossible today to find a complete authentic set. No trace of the collection consulted by Gordon (*Pinetum*, *Appx.* p. 71, foot note) can be found

In 1858 Schlechtendal (*Linnaea*, xxix, 331) translated Roezl's descriptions into Latin, making no attempt to decide their validity although expressing his doubts of the existence of so many Mexican species (p. 356). Gordon (*Pinetum*, *Appx.* 1862) retained a few of Roezl's species but reduced most of his names to synonyms. Gordon's determinations, which were accepted by Henckel & Hochstetter (*Syn. der Nadelh.*, p. 119, 1865), were embodied with slight change in the second edition of his *Pinetum* (1875).

Carrière (*Trait. des Conif.*) 1867 took issue with Gordon and undertook an independent study of the new species, resulting in the acceptance of most of them, in the reduction of a few to synonyms of others and in the creation of *P. Roezlii* Carr., to replace *P. resinosa* Roezl (not Aiton). Sénéclauze in the same year (*Les Conifères*) published all of Roezl's species.

Finally Parlatore (*DC. Prodr.* xvi, pt. 2; 1868) reduced the entire list to synonyms of seven previously described species, a judgment accepted by Hemsley (*Bot. Biol. Cent. Am.*, iii, 1883) and in the *Index Kewensis*, 1895.

Of the eight authorities cited three only, Carrière, Gordon and Parlatore attempted independently to determine the validity of Roezl's Pines. Of these Carrière was poorly equipped for such a task, being unable to recognize any of the established species, *P. teocote*, *P. leiophylla*, *P. Montezumae*, &c. Gordon's work was marred by his inability to recognize *P. pseudostrobus* which he confused with *P. patula*, and some forms of *P. Montezumae* which he referred to *P. pseudostrobus*. Parlatore's determinations, on the other hand, are remarkable for their accuracy. His collection at Florence, although not complete, is sufficiently so to test the admirable quality of his work.

It may be safely assumed that there is, in the entire list of Roezl's Catalogue, not a single valid species, the six or seven Pines they represent having been described by previous authors under sixteen specific names; therefore in order not to encumber the text with many useless synonyms, some of which cannot now be verified, Roezl's Pines and their determinations by Carrière, Gordon and Parlatore are given in a table on the opposite page.

TABLE

Column I. Species of various authors lettered in chronological order.

Column II and III. Roezl's species numbered in alphabetical order. Opposite each species and under each author is the number or letter indicating the determination of that author.

CONSPECTUS OF THE MEXICAN SPECIES

- A.** Fibro-vascular bundles of the leaves single; bracts subtending the leaf-fascicles inserted on prominent bases not decurrent on the branchlets; cones symmetrical, opening at maturity; seed-wing absent, or present and variable; walls of the tracheids of the medullary rays of the wood not dentate; cortex of young trees persistently smooth for many years.
Seed-wing wanting, umbo of the cone-scales dorsal.
Sheaths of the leaf-fascicles deciduous.
- Cones of few scales, sessile, subglobose. 1 cembroides.
- Cones of several scales, long-pedunculate, cylindrical. 2 Pinceana.
- Sheaths of the leaf-fascicles persistent. 3 Nelsoni.
- Seed-wing persistent on the nut, umbo of the cone-scales terminal, sheath of the leaf-fascicles deciduous.
- Stomata of the leaves ventral only, leaves serrate. 4 ayacahuite.
- Stomata of the leaves dorsal and ventral.
- Leaves entire, seed-wings rudimentary. 5 flexilis.
- Leaves serrate, seed-wings efficient. 6 Lambertiana.
- B.** Fibro-vascular bundles of the leaves constantly or irregularly double; bases of the bracts subtending the leaf-fascicles, decurrent on the branchlets; umbo of the cone-scales dorsal; walls of the tracheids of the medullary rays of the wood dentate; seeds winged.
Sheaths of the leaf-fascicles deciduous.
- Cones persistent, fructification triennial. 7 leiophylla.
- Cones deciduous, fructification biennial. 8 Lumholtzii.
- Sheaths of the leaf-fascicles persistent.
- Cones deciduous, dull or sublustrous.
- Cones 4-8 cm. in length.
- Resin ducts of the leaves mostly medial. 9 teocote.
- Resin ducts of the leaves mostly internal. 10 Lawsoni.
- Cones 6-30 cm. in length, usually much larger than in 9 and 10, resin ducts of the leaves medial.
- Cortex of young trees smooth. 11 pseudostrobus.
- Cortex of young trees rough.
- Prickle of the cone-scales weak and usually deciduous. 12 Montezumae.
- Prickle of the cone-scales stout and persistent. 13 ponderosa.
- Cones persistent, serotinous, lustrous.
- Base of seed-wing thickened, cones 5-10 cm. in length.
- Resin ducts of the leaves internal. 14 Pringlei.
- Resin ducts uniting hypoderm and endoderm. 15 oocarpa.
- Resin ducts medial.
- Leaves short, erect; cortex of young trees persistent, smooth and gray. 16 Greggii.
- Leaves slender, pendent; cortex of young trees deciduous, scaly and red. 17 patula.
- Base of seed-wing not thickened; cones 3-4 cm. in length, resin ducts in the leaves medial; leaves in fascicles of 2, 3-8 cm. long. 18 contorta.

1. PINUS CEMBROIDES ZUCC.

PINUS CEMBROIDES Zuccarini, *Abhand. Akad. Wiss. Muench.* i, 392 (1832).—Endlicher, *Syn. Conif.* 182 (1847).—Parlatore, *DC. Prodr.* xvi, pt. 2, 397 (1868).—Hemsley, *Bot. Biol. Cent. Am.* iii, 186 (1883).—Sargent, *Gard. & For.* iv, 352, fig. 59 (1891); *Silva N. Am.* xi, 47, t. 550 (1897); *Man. Trees N. Am.* 10, fig. 10 (1905).—Britton, *N. Am. Trees*, 14, fig. 8 (1908).
PINUS LLAVEANA Schiede, *Linnaea*, xii, 488 (1838).—Forbes, *Pinet. Woburn.* 49, t. 17 (1839).—Antoine, *Die Conif.* 36, t. 16, fig. 1 (1840).—Loudon, *Encycl. Trees and Shrubs*, 993, fig. 1858-1860 (1842).

PINUS OSTEOSPERMA Engelm., *Wislizenus' Tour Nor. Mex.* 89. (*Senate Doc.* 1848).

Leaves with deciduous sheaths, in fascicles of 3 or of 1-5, rarely exceeding 4 or 5 cm. in length, entire; stomata dorsal and ventral; resin ducts external. Conelets on short peduncles, subterminal, single or in clusters of 2-5, their scales tumid, transversely keeled, each armed with a minute dorsal prickle. Cones not exceeding 5-6 cm. in length, sessile or on short peduncles, symmetrical, globose or short-ovate, opening at maturity, early deciduous; their scales few, those at the base and apex sterile, much smaller than the few large central fertile scales; apophyses lustrous, pale ochre or reddish-orange, pyramidal, or protuberant and slightly reflexed, the umbo central. Seeds wingless, of a flaxen color when fresh. Branchlets slender, pale brown, more or less pruinose, the cortex persistently smooth for several years. Buds pale brown or gray-yellow, small, cylindrical, free from gum.

A low broad round-headed tree with a short trunk, growing on dry slopes and table-lands from the 20th degree of north latitude to Colorado and Utah.

Nelson, 4498, (398613) Miquihuana, Nuevo Leon; 6143 (347369) General Cepeda, Coahuila; 4556 (398619) El Salto, Durango; 6079 (398627) Sierra Madre, Chihuahua—*Nelson & Goldman*, 7457 (565528) La Laguna, California Baja.—*Rose, Painter & Rose*, 9093 (452573) Sierra de la Mesa, Hidalgo—*Pringle*, 2659, 4018, Carneros, Coahuila—*Palmer*, 82, 773, State of Durango—*Hartman*, 367, State of Sonora—*Brandege*, Laguna, California Baja—*Shaw*, San Lorenzo, Nuevo Leon; Sandia, Durango.

PINUS CEMBROIDES VAR. MONOPHYLLA Voss. *Mitt. Deutsch. Dendr. Gesell.* xvi, 95 (1907).

PINUS MONOPHYLLA Torrey, *Frémont's Rep.* 319, t. 4 (1845).—Parlatore, *DC. Prodr.* xvi, pt. 2, 378 (1868).—Lawson, *Pinet. Brit.* i, 65, fig. (1884).—Sargent, *Silva N. Am.* xi, 51, t. 551 (1897); *Man. Trees N. Am.* 12, fig. 12 (1905).—Britton, *N. Am. Trees*, 16, fig. 10 (1908).—Sudworth, *Forest Trees Pacif. Slope* 35, fig. 9 (1908).

PINUS FREMONTIANA. Endlicher, *Syn. Conif.* 183, (1847).

Leaves mostly single, occasionally in pairs.

Northern California Baja; common beyond the northern boundary in Utah, Arizona, Nevada and southern California.

PINUS CEMBROIDES VAR. EDULIS Voss, *Mitt. Deutsch. Dendr. Gesell.* xvi, 95 (1907).

PINUS EDULIS Engelmann, *Wislizenus' Tour Nor. Mex.* 88 (*Senate Doc.* 1848).—Parlatore, *DC. Prodr.* xvi, pt. 2, 398 (1868).—Hemsley, *Bot. Biol. Cent. Am.* iii, 186 (1883).—Sargent, *Silva N. Am.* xi, 55, t. 552 (1897); *Man. Trees N. Am.* 11, fig. 11 (1905).—Masters, *Jour. Linn. Soc.* xxxv, 587, fig. 2 (1904).—Britton, *N. Am. Trees*, 17, fig. 11 (1908).

Leaves stouter than those of the species, usually in fascicles of 2.

Near the northern boundary, and common in south western United States.

Goldman, 1246 (565151) San Pedro Martir Mts. California Baja.

PINUS CEMBROIDES VAR. PARRYANA Voss, *Mitt. Deutsch. Dendr. Gesell.* xvi, 95 (1907).

PINUS PARRYANA Engelmann, *Am. Jour. Sci.* ser. 2, xxxiv, 332 (1862).—Parlatore, *DC. Prodr.* xvi, pt. 2, 402, (1868).—Masters, *Jour. Linn. Soc.* xxxv, 586, fig. 1 (1904).

PINUS QUADRIFOLIA Sudworth, *Bull.* No. 14, *Div Forestry, U. S. Dept. Agric.* 17 (1897); *For. Trees Pacif. Slope*, 33, fig. 8 (1908).—Sargent, *Silva N. Am.* xi, 43, t. 549 (1897); *Man. Trees N. Am.* 10, fig. 9 (1905).—Britton, *N. Am. Trees*, 15, fig. 9 (1908).

Leaves often in fascicles of 4, stout.

Northern California Baja, and a few localities in California near the Mexican boundary.

Goldman, 1132 (565042) Hanson Laguna, California Baja.

The clearly defined characters of *P. Pinceana* and *P. Nelsoni* emphasize the close affinity and the uncertain characters of the four Nut-Pines *P. cembroides*, *P. edulis*, *P. monophylla* and *P. Parryana* and I find it impossible to separate these specifically, their cones being identical and the number of their leaves inconstant. The reduction of the four to one species by Voss seems therefore perfectly justified; it was first suggested by Engelmann in his *Revision of the Genus Pinus*.

According to Masters (*Jour. Linn. Soc.* xxxv, 586, 588) *P. edulis* may be distinguished from *P. cembroides* by the absence of dorsal stomata in the leaves of the latter. This character however fails in Mexican specimens, dorsal stomata being very common in the leaves of the typical *P. cembroides*.

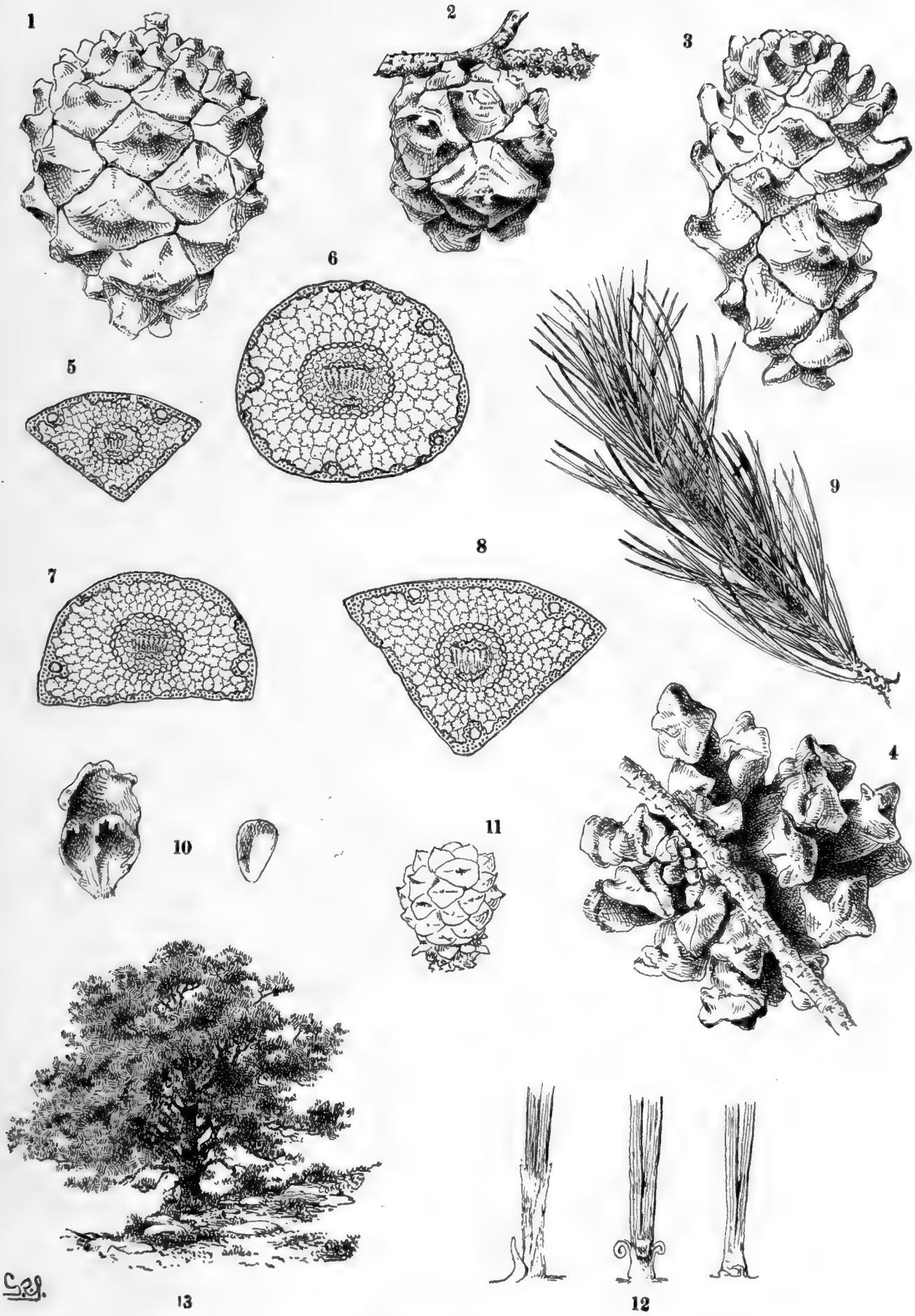
PLATE I.

Fig. 1, 2, 3, 4. Cones.

- " 5. Leaf-section of typical form, magn. 30 diam.
 " 6. Leaf-section of *var. monophylla*, magn. 30 diam.
 " 7. Leaf-section of *var. edulis*, magn. 30 diam.
 " 8. Leaf-section of *var. Parryana*, magn. 30 diam.

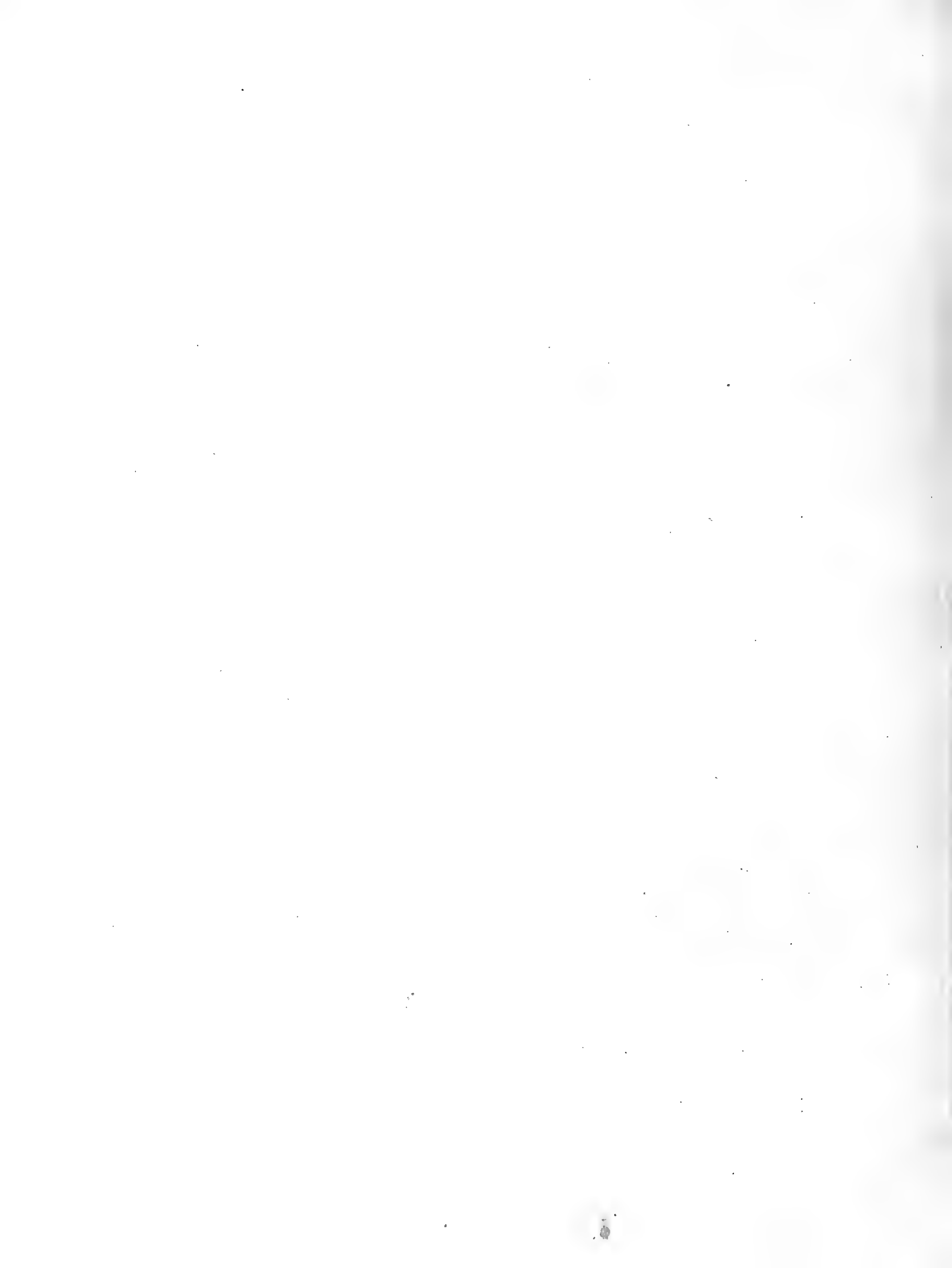
Fig. 9. Branch with leaves.

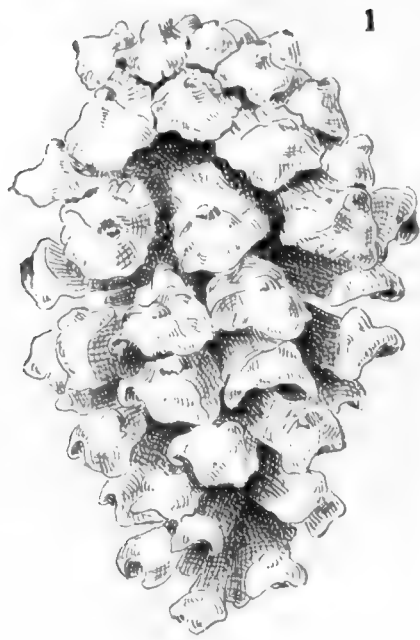
- " 10. Cone-scale and seed.
 " 11. Conelet magnified.
 " 12. Deciduous fascicle-sheath, magnified.
 " 13. Tree at Sandia, Durango.



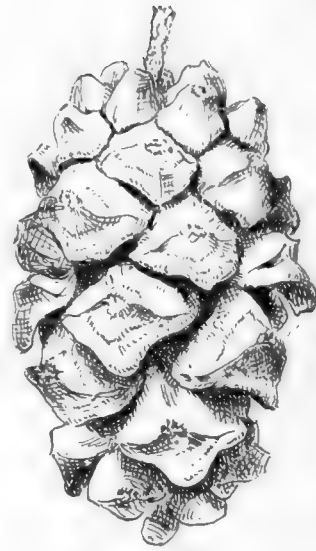
PINUS CEMBROIDES ZUCC.

Cor.

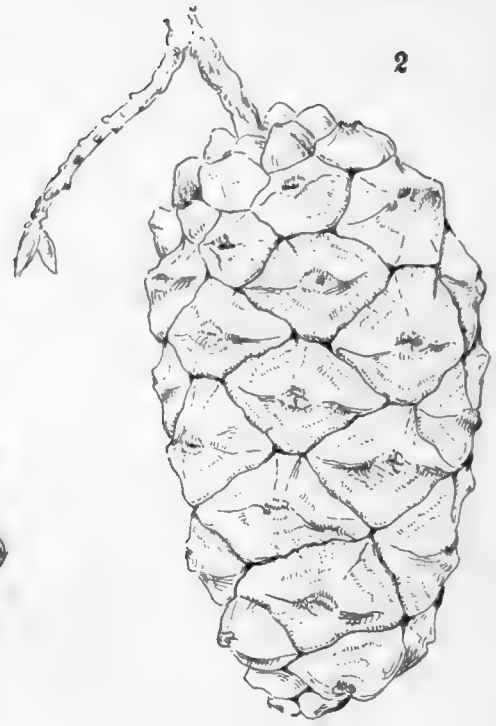




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3



2



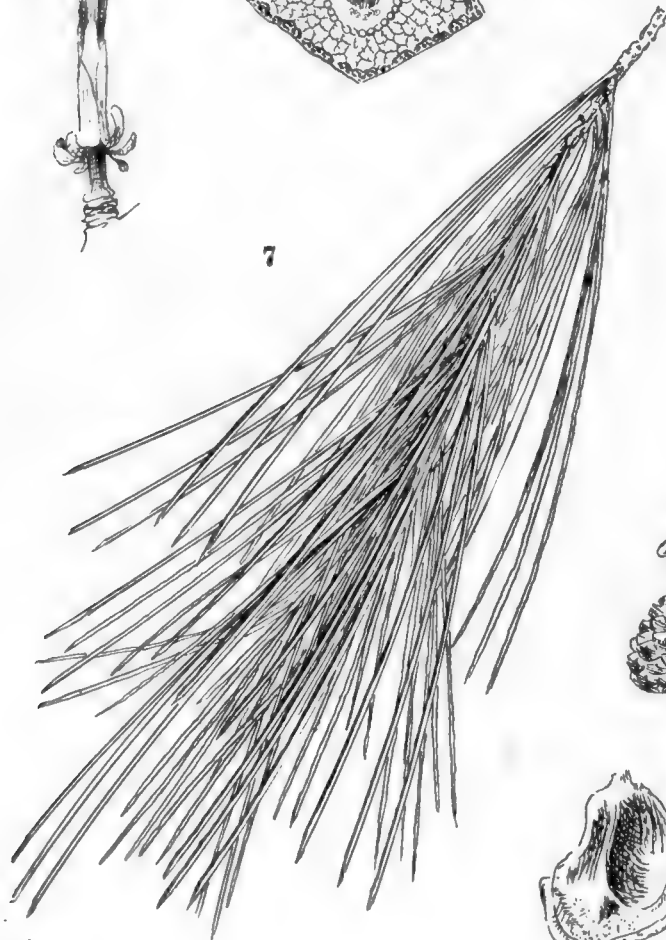
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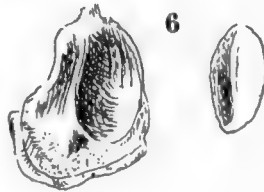
5



7



4



6

C. G. R.

PINUS PINCEANA GORD.

2. PINUS PINCEANA GORD.

PINUS PINCEANA Gordon, *Pinetum*, 204 (1858); ed. 2, 280 (1875).—Hemsley, *Bot. Biol. Cent. Am.* iii, 189, (1883).—Shaw, *Gard. Chron.* ser. 3, xxxviii, 122, fig. 42 (1905).

PINUS CEMBROIDES Gordon, *Four. Hort. Soc. Lond.* i, 236, fig. (not Zuccarini) (1846),

PINUS LATISQUAMA Engelmann, *Gard. Chron.* ser. 2, xviii, 712, fig. 125 (1882).—Watson, *Proc. Am. Acad.* xviii, 158 (1883).

Leaves with deciduous sheaths, in fascicles of 3, 12-16 cm. long, entire; stomata ventral and dorsal; resin ducts external. Conelets subterminal, long-pedunculate, single or in pairs, ochre-yellow, their scales tumid, transversely keeled, furnished with a minute dorsal prickle. Cones 6-9 cm. long exclusive of the long peduncle, pendent, symmetrical, cylindrical or long-ovate, opening at maturity, early deciduous; apophyses convex, transversely and prominently keeled, ochre-yellow or red-orange, their umbos central. Seeds wingless, their dorsal surface bearing a persistent membrane much darker than the pale brownish-yellow ventral surface. Branchlets long, slender, pendent, ashen-gray, their bark persistently smooth for many years. Buds pale brown, small, cylindrical, covered with gum.

A low tree with a short trunk, long, slender, pendent or subpendent branchlets and gray-green foliage. Along gulches on the slopes above the great table-land in northeastern Mexico between the 19th and 25th degrees of north latitude, associated with *P. cembroides*.

Nelson, 6140 (347366) General Cepeda, Coahuila—*Rose, Painter & Rose*, 9092 (452571-2) Sierra de la Mesa, Hidalgo—*Pringle*, 2293,—*Palmer* 1299,—*Shaw*, Carneros, Coahuila.

Ghiesbreght's specimen, No. 34, in the Herbarium of the Muséum d'Histoire Naturelle in Paris, was from Mezquitlan, Hidalgo. Ehrenberg's specimen, from which Gordon described the species, is accredited to Cuernavaca and must have been taken from a cultivated tree as Cuernavaca lies in a subtropical plain where Nut Pines do not grow spontaneously. The height of 60 ft. given in Gordon's description, is much greater than recent collectors have reported.

Gordon's *P. cembroides* has been considered by many authors identical with *P. edulis* Engelm. But the Volcano Orizaba is far removed from the habitat of *P. edulis* and the cone is clearly that of *P. Pinceana*. The loss of its peduncle, a common accident with specimens of *P. Pinceana*, led Gordon to believe the cone to be sessile. Specimens of normal development are easily distinguished from *P. cembroides* by the greater length of their leaves.

PLATE II.

- Fig. 1. Cone of Ghiesbreght 34.
 " 2. Cone from Carneros.
 " 3. Cone of Nelson 6140.
 " 4. Open cone and conelet.
 " 5. Conelet, magnified.

- Fig. 6. Cone scale and seed.
 " 7. Branchlets and leaves.
 " 8. Leaf-section, magn. 30 diam.
 " 9. Deciduous fascicle-sheath, magnified.

3. PINUS NELSONI SHAW

PINUS NELSONI Shaw, *Gard. Chron.* ser. 3, xxxvi, 122, fig. 49 (1904); xxxvii 306, fig. 127 (1905.)

Leaves with persistent sheaths, connate in fascicles of 3, 6-9 cm. long, serrate on the two dorsal margins; stomata dorsal and ventral; resin ducts external. Cones on long, stout curved peduncles, symmetrical, cylindrical, opening at maturity, early deciduous; apophyses deep orange-red, elevated in the middle to a sharp transverse ridge culminating in a dark indefinite umbo. Seeds wingless, pale ochre-yellow when fresh, with a faint reddish area at the apex. Branchlets long, slender, pliant, very tough, their bark persistently smooth and gray. Buds covered with resin.

A low bushy tree not exceeding 8-10 metres in height, with long, slender branches clothing the trunk to the ground and sparse gray-green foliage, growing in a limited area on the lower slopes of the north-eastern Sierras where it is associated with *P. cembroides*.

Nelson 4501 (398615) Miquihuana, Nuevo Leon—*Pringle*, 10016—*Shaw*, San Lorenzo, Nuevo Leon.

Seedlings raised in the Arnold Arboretum reproduce invariably the connate leaf-clusters. The ventral surfaces of the three leaves, forming each fascicle, are partly grown together and successfully resist the action of alcohol, turpentine or alkaline solutions, but are easily forced apart by rolling them between the fingers. A narrow portion of each ventral surface is free and contains a single row of stomata.

The branchlets continue their growth throughout the summer, and the female aments which, at the time of pollination were subterminal, had become, by reason of this growth, pseudolateral conelets in November when I saw them. The conelets, after pollination, continue to grow and attain, in November, considerable size. This peculiarity appears to be normal with this species and cannot be explained by unusual conditions of locality or season, for the conelets of *P. cembroides*, which grows side by side with *P. Nelsoni* at San Lorenzo, like those of all other Pines, had made no growth during the summer. When the cone falls its large curved peduncle remains on the tree for some years but the cone itself rapidly disintegrates.

The nuts are greedily eaten by macaws, and are found exposed for sale in the markets of Victoria, Tamaulipas and of Matehuala, San Luis Potosí.

PLATE III.

Fig. 1. Cone scale and seed.

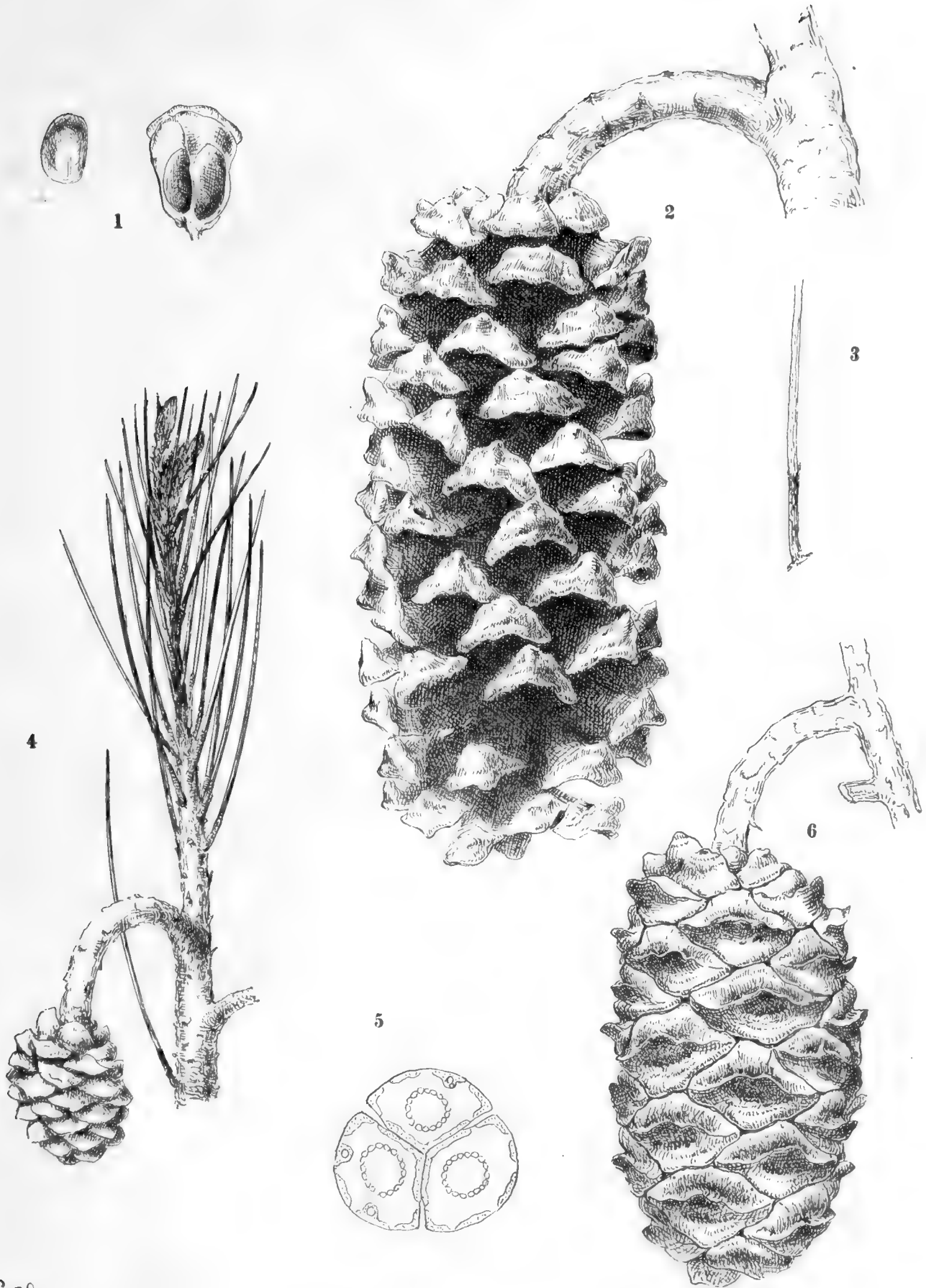
" 2. Open cone, San Lorenzo.

" 3. Persistent sheath, magnified.

Fig. 4. Branch, conelet and leaves.

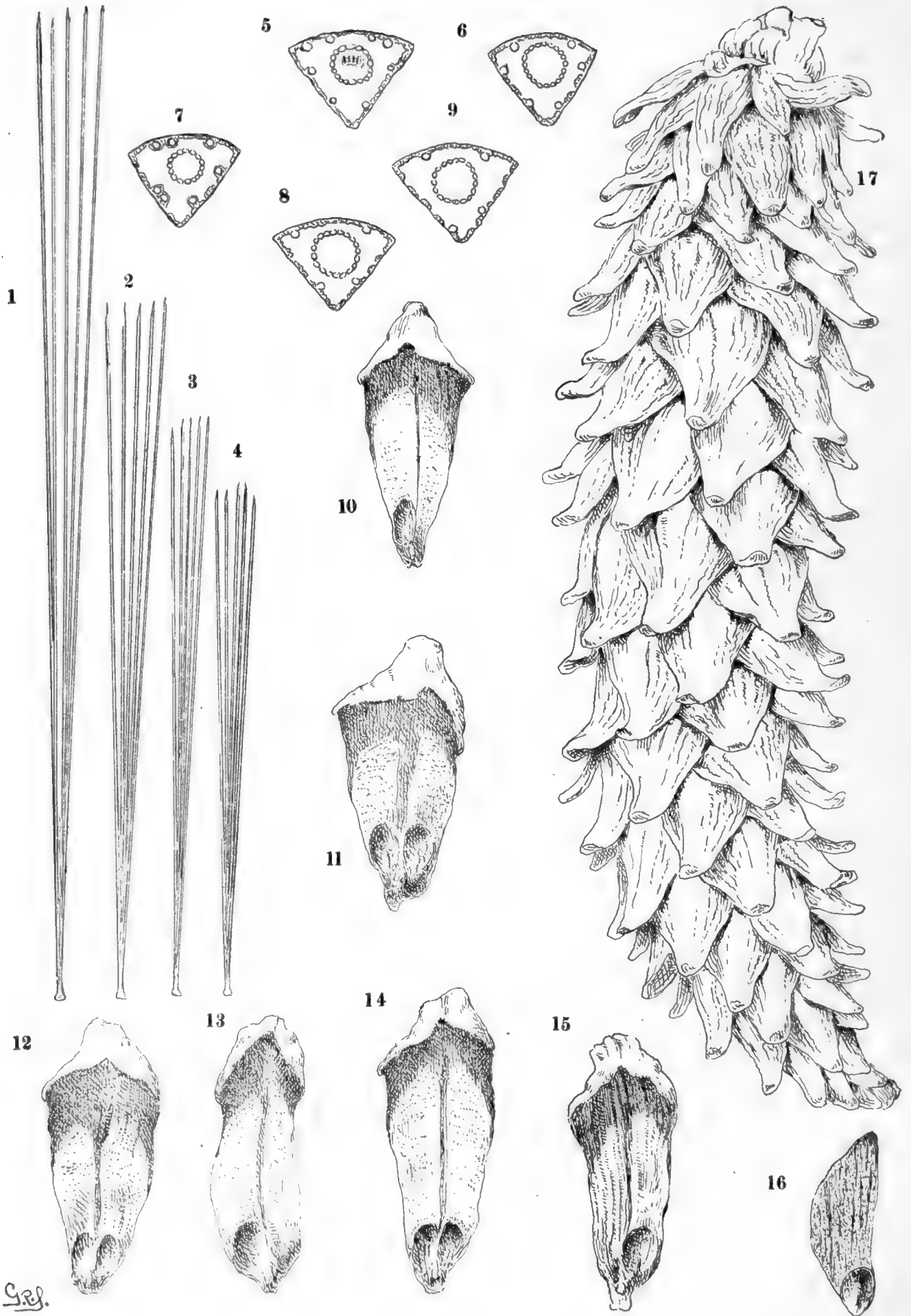
" 5. Leaf section, magn. 30 diam.

" 6. Closed cone, San Lorenzo.



C.R.S.

PINUS NELSONI SHAW



S. G. R.

PINUS AYACAHUITE EHRENB.

4. PINUS AYACAHUITE EHRENB.

PINUS AYACAHUITE Ehrenberg, *Linnaea*, xii, 492 (1838).—Loudon, *Encycl. Trees & Shrubs*, 1023, figs. 1920-1 (1842).—Endlicher, *Syn. Conif.* 149 (1847).—Parlatore, *DC. Prodr.* xvi, pt. 2, 406 (1868).—Masters, *Gard. Chron.* ser. 2, xviii, 492, fig. 83 (1882).—Hemsley, *Bot. Biol. Cent. Am.* iii, 186 (1883).—Lawson, *Pinet. Brit.* i, 9, fig. (1884).—Nicholson, *The Garden*, xxv, 193, fig. (1884).—Veitch, *Man. Conif.* ed. 2, 311, fig. (1900).

Leaves with deciduous sheaths, in fascicles of 5, 10-20 cm. long, serrate; stomata ventral; resin ducts external and varying in number from 2 to 8. Conelets in clusters of 2 or 3, on long stout peduncles, cylindrical, their scales thin and closely imbricated. Cones on long peduncles, pendent, 20-45 cm. long, straight or curved; apophyses dull, occasionally sublustrous, pale yellowish or reddish brown, often conspicuously corrugated, their apices reflexed, recurved or revolute in various degrees. Seeds variable in the size of both wing and nut. Branchlets pale brown, at first pubescent, becoming ashen-gray and glabrous; the cortex persistently smooth for many years.

A large tree growing at cool temperate altitudes from Central America to the borders of the United States.

Nelson, 982 (398556) west of Yalalag, Oaxaca; 2188 (398572) Chilpancingo, Guerrero; 2520 (398575) Miahuatlan, Oaxaca; 3186 (398592) San Cristobal, Chiapas; 3650 (398596) Chaucol, Guatemala; 7060 (399401) Omilteme, Guerrero—*Goldman* 988 (398797) San Cristobal, Chiapas.

The leaf-section of *P. ayacahuite* is variable. The weak hypoderm and few resin ducts of some leaves resemble those of *P. Strobus* L., others with conspicuous thick-walled hypoderm resemble the leaf-sections of *P. Lambertiana* Dougl. or of *P. flexilis* James. According to Engelmann some leaves bear dorsal stomata, but this is probably sporadic and unusual.

Plate IV represents the typical form of the species bearing seeds with long wings. They are all from Guatemala or from the southern Mexican States. The wing-imprint on the different cone-scales indicates considerable variation in length even among the southern forms.

PLATE IV.

- | | |
|---|------------------------------------|
| Fig. 1. Leaves of Nelson 7060. | Fig. 10. Cone scale of Nelson 982. |
| " 2. " " " 2520. | " 11. " " " " 7060. |
| " 3. " " " 3186. | " 12. " " " " 3186. |
| " 4. " " " 2188. | " 13. " " " " 2188. |
| " 5. Leaf-section of Nelson 2520 magn. 30 diam. | " 14. " " " " 2520. |
| " 6. " " " " 7060 " " " | " 15. " " " " 3650. |
| " 7. " " " " 2188 " " " | " 16. Seed of Nelson 3650. |
| " 8. " " " " 982 " " " | " 17. Cone of Nelson 3650. |
| " 9. " " " " 3186 " " " | |

PINUS AYACAHUITE VAR. VEITCHII N. VAR.

PINUS VEITCHII Roehl, *Cat. Grain. Conif. Mex.* 32 (1857).

PINUS BONAPARTEA Roehl, *Gard. Chron.* 358 (1858).—Gordon, *Pinetum*, 218 (1858).

PINUS LOUDONIANA Gordon, *Pinetum*, 230 (1858)

Differing from the species by the comparatively short and broad seed-wings and larger nuts. Mountains of the central states of Mexico.

The Washington collections contain no specimen of this variety, but there is in the herbarium of the Arnold Arboretum a cone from the ridge connecting the Volcanos Popocatepetl and Iztacihuatl, collected by Mr. Pringle; another cone, found on the road between the town of Uruapan and Mt. Tancitaro, was given to me by the late Dr. Altamirano. There are also a few cones in the Arnold Arboretum collection from Pallanza, Italy, where this Pine is cultivated as *P. Veitchii* Roehl. Cones grown in the Arboretum at Westonbirt, Gloucestershire, England, sent by Dr. Augustine Henry, also have large nuts and broad short wings. In all these specimens the proportion of wing to nut is nearly the same as that in the seeds of *P. Lambertiana* Dougl. The color of the seed-wing is of no value for determining the varietal forms of *P. ayacahuite*. For the wing of Mr. Pringle's cone is dark and opaque, while that of the Westonbirt cones is translucent with dark, opaque striations. The same variation also obtains in southern specimens, the wing of Nelson 3186 being dark and opaque, and that of Nelson 3650 being translucent and striated with dark lines.

The two cones shown on Plate V are very different in outline but are alike in the excessive prolongation and revolute form of their apophyses. The Westonbirt cones, on the contrary, bear scales that are somewhat reflexed but not revolute and are considerably thicker. The significance of the cone variations of *P. ayacahuite* may however become better understood with the accumulation of more material; at present these variations do not appear to be geographical or to be related in any way to variations of the seed or of the leaf.

P. Bonapartea is evidently, from Gordon's description, the same form as the variety *Veitchii*. The peculiar characters ascribed to it by Gordon (leaves sometimes in fascicles of more than 5) and by Engelmann (leaves with numerous resin ducts and thick-walled hypoderm) are by no means confined to Roehl's species. My specimen of the variety *brachyptera* bears some fascicles of more than 5 leaves, and leaves of any of the forms of *P. ayacahuite* may contain a strongly developed hypoderm and numerous resin ducts; indeed it is the occurrence of these and other characters among southern, middle and northern forms alike that makes the separation of the Mexican White Pine into two or more species impossible.

PLATE V.

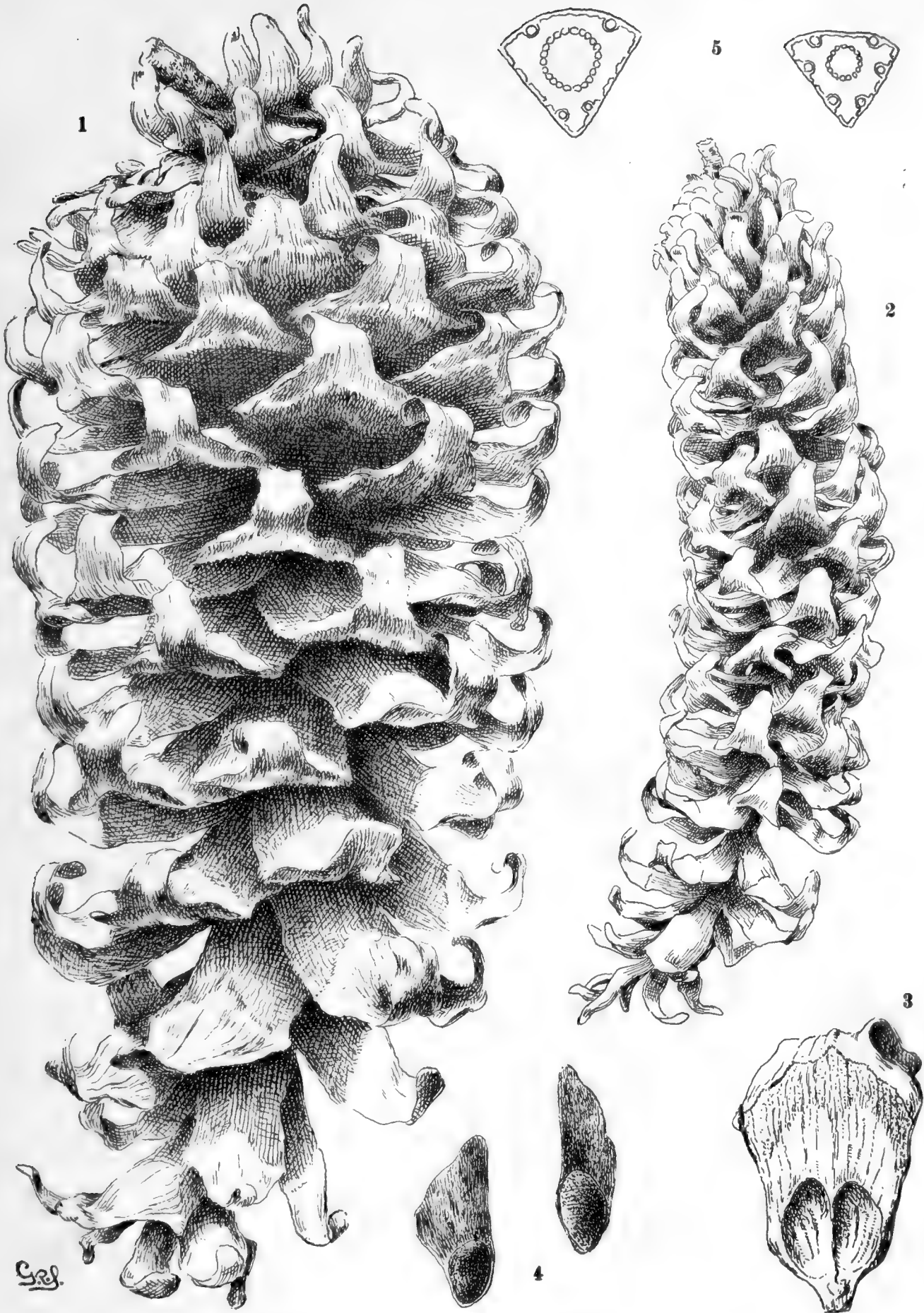
Fig. 1. Cone from Popocatepetl.

" 2. Cone of Dr. Altamirano, 1-3 nat. size.

" 3. Scale of same, natural size.

Fig. 4. Seeds from cone 1.

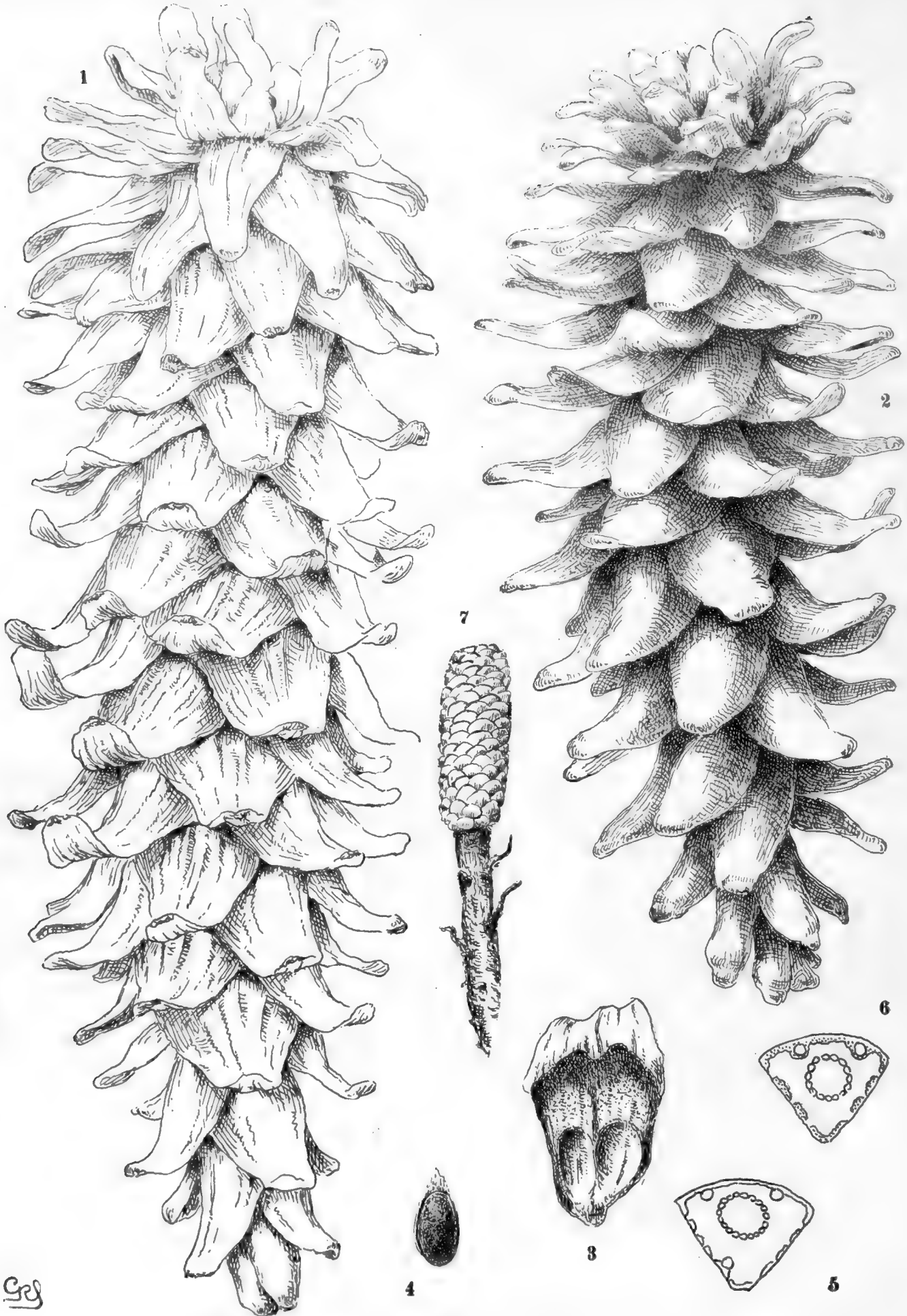
" 5. Sections of leaves, magn. 30 diam.



PINUS AYACAHUITE VAR. VEITCHII SHAW.

Gr.





PINUS AYACAHUITE VAR. BRACHYPTERA SHAW.

PINUS AYACAHUITE VAR. BRACHYPTERA N. VAR.

PINUS STROBIFORMIS Engelmann, *Wislizenus' Tour Nor. Mex.* 102 (*Senate Doc.* 1848).

Differing from the species by its short ineffective seed-wing and large nut.
Northern States of Mexico.

Nelson 4555 (398618) El Salto, Durango; 4915 (No Museum number) Mt. Mohinora, Chihuahua; 6043 (398625) Sierra Madre, Chihuahua.—*Shaw*, Sandia, Durango.

By the courtesy of Dr. Trelease, Wislizenus' specimen from which Engelmann established the species *P. strobiformis* was sent to the Arnold Arboretum for comparison with the cones of the Nelson collection and with other material at hand. Wislizenus' cone is identical with that of Nelson 4915 and with one of my cones from northern Durango. At the time when Engelmann wrote the Botanical Appendix to Wislizenus' Tour he was not acquainted with Ehrenberg's species; in his *Revision of the Genus Pinus* (1880) Engelmann abandoned the name *strobiformis*.

Reviewing the characters of *P. ayacahuite*, the number of leaves in the fascicle is almost invariably 5; exceptions are very rare and, in my experience, confined to young trees; the difference in the hypoderm and in the number of the resin ducts may be found in other species; these differences do not appear to be correlated with other characters in a manner that can be utilized either for the separation of *P. ayacahuite* into two or more species or for the determination of varietal forms. The same is true of the size and shape of the cones and the degree of protuberance or curvature of their scales.

The remarkable variations in the length of the seed-wing of *P. ayacahuite* are valuable for determining the relative importance of this character. It is evident that the diagnostic value of the seed-wing must depend, not on its dimensions, but on its construction. Eliminating the question of length there is no difference between the seed-wings of *P. ayacahuite*, *P. Lambertiana* and *P. flexilis*, therefore *P. flexilis* is here associated with the White Pines where Engelmann placed it, and the similarity of its cone-scales and its leaf-section to those of *P. Lambertiana* confirms this conclusion.

PLATE VI.

Fig. 1, 2. Cones from N. Durango.
" 3. Scale of cone 1.
" 4. Seed of cone 2.

Fig. 5. Leaf-section, magn. 30 diam.
" 6. Leaf-section of Nelson 4555, magn. 30 diam.
" 7. Conelet.

5. PINUS FLEXILIS JAMES.

PINUS FLEXILIS James, *Long's Exped.* ii, 34 (1823).—Nuttall, *N. Am. Sylva*, iii, 107, t. 112 (1849).—Parlatore, *DC. Prodr.* xvi, pt. 2, 403 (1868).—Hemsley, *Bot. Biol. Cent. Am.* iii, 187 (1883).—Lawson, *Pinet. Brit.* i, 33, fig. (1884).—Sargent, *Silva N. Am.* xi, 35, t. 546 & 547 (1897); *Man. Trees N. Am.* 7, fig. 5 (1905).—Britton, *N. Am. Trees*, 11, fig. 6 (1908).—Sudworth, *Forest Trees Pacif. Slope*, 27, figs. 5, 6 (1908).

Leaves in fascicles of 5 not exceeding 8 or 9 cm. in length, entire, their stomata dorsal and ventral. Cones 10–25 cm. long, their scales straight or reflexed and of varying thickness; seed wings short and ineffective.

In a limited area of northern Mexico, and common along the Rocky Mountains as far north as southern Alberta.

Nelson, 6136 (347362) General Cepeda, Coahuila.

PINUS FLEXILIS VAR. REFLEXA Engelm., *Rothrock Wheeler's Rep.* vi, 258 (1878).

PINUS REFLEXA Engelm., *Bot. Gaz.* vii, 4 (1882).—Mayr, *Fremdl. Wald. Eur.* 388 (1906).

PINUS STROBIFORMIS Sudworth, *Bull. No. 14, Div. Forestry U. S. Dep. Agric.* 17 (not Engelm.), (1897).—Sargent, *Silva N. Am.* xi, 33, t. 544 & 545 (1897); *Man. Trees N. Am.* 6, fig. 4 (1905).—Britton, *N. Am. Trees*, 11, fig. 5 (1908).

PINUS AYACAHUITE VAR. STROBIFORMIS Lemmon, *Cone-Bearing Trees Pacif. Slope*, 4 (1892).

Cone scales often thin, reflexed. Leaves entire or serrulate with or without dorsal stomata.

There are no specimens of this form in the Nelson & Rose collections. Mr. Pringle found it in northern Chihuahua in 1887. The variety is intermediate between *P. flexilis* and *P. ayacahuite*, but all the cones that I have seen resemble those of *P. flexilis* in size and in general appearance.

6. PINUS LAMBERTIANA DOUGL.

PINUS LAMBERTIANA Douglas, *Trans. Linn. Soc.* xv, 500 (1827).—Lambert, *Gen. Pin.* ed. 3, 1, 57, t. 34 (1832); ed. 1, iii, text and plate (1837).—Loudon, *Arb. et Frut. Brit.* 2288, fig. 2205 (1838); *Encycl. Trees & Shrubs*, 1019, fig. 1912 (1842).—Forbes, *Pinet. Woburn.* 77, t. 30 (1839).—Antoine, *Die Conif.* 41, t. 19 (1840).—Parlatore, *DC. Prodr.* xvi, pt. 2, 406 (1868).—Hemsley, *Bot. Biol. Cent. Am.* iii, 187 (1883).—Lawson, *Pinet. Brit.* i, 47, fig. (1884).—Brandege, *Zoë*, iv, 201 (1894).—Sargent, *Silva N. Am.* xi, 27, t. 542 & 543 (1897); *Man. Trees N. Am.* 5, fig. 3 (1905).—Britton, *N. Am. Trees*, 9, fig. 4 (1908).—Sudworth, *Forest Trees Pacif. Slope*, 23, figs. 3, 4 (1908).

Leaves in fascicles of 5, not exceeding 10 cm. in length, their stomata dorsal and ventral. Cones 25–45 cm. long, their scales straight and thick; seeds large, with rather short broad wings.

Western United States from southern Oregon to southern California, occurring in Mexico at one station only, where it was first discovered by Mr. Brandege.

Goldman, 1219 (565125) San Pedro Martir Mts. California Baja.

7. PINUS LEIOPHYLLA SCHL. & CHAM.

PINUS LEIOPHYLLA Schlechtendal & Chamisso, *Linnaea*, vi, 354 (1831); xii, 490 (1838).—Lambert, *Gen. Pin.* ed. 3, i, 38, t. 21 (1832); ed. 1, iii, text & pl.—Forbes, *Pinet. Woburn.* 74, t. 28 (1839).—Antoine, *Die Conif.* 39, t. 18, f. 2 (1840).—Loudon, *Encycl. Trees & Shrubs*, 1011, fig. 1893 (1842).—Endlicher, *Syn. Conif.* 155 (1847).—Parlatore, *DC. Prodr.* xvi, pt. 2, 401 (1868).—Hemsley, *Bot. Biol. Cent. Am.* iii, 187 (1883).—Shaw, *Gard. Chron.*, ser. 3, xxxvi, 175, fig. 69 (1904).

Leaves with deciduous sheaths, in fascicles of 5 or of 3 and 4, from 10–14 cm. long; resin ducts medial, occasionally internal, the two fibro-vascular bundles distinct, contiguous or merged in one. Conelets subterminal, on long peduncles, single or in clusters of 2–7, subglobose, their scales armed with a conspicuous, sometimes stout and persistent prickle, conelets of the second year somewhat larger. Cones maturing the third year, not exceeding 7 cm. in length, ovate or ovate-conical, subsymmetrical, more or less reflexed, persistent for many years, often serotinous, their apophyses thin or somewhat tumid, of a dull yellowish or dark brown color, the umbo central showing clearly the limits of the growth of the first two years. Branchlets more or less pruinose, the decurrent bases of the bracts deciduous at the end of the first season; the bark at first thin, separating in deciduous scales, red, becoming very coarse and rough at an early age.

A tree of varying size with short gray-green foliage, persistent, often very abundant cones, growing at subtropical and warm temperate altitudes in eastern, western and southern Mexico. It has not been found south of the State of Oaxaca nor on the north eastern Sierras.

Nelson, 986 (398559) La Parada, Oaxaca; 1487 (398562) Oaxaca Valley, Oaxaca; 6558 (398628) Mt. Patamban, Michoacan.—*Nelson & Goldman* (396794–5) Volcan Iztacihuatl.—*Goldman* 5 (303991) Valparaiso, Zacatecas.—*Rose*, 2990 (301945) West of Bolaños, Jalisco; 3027 (301984) Bolaños to Guadalajara, Jalisco.—*Rose & Hough*, 4294 (346239) Las Vigas, Vera Cruz.—*Rose & Hay*, 5536 (395298) Ajusco, Mexico; 5968 (395759) Contadero, Tlaxcala; 6234 (396143) Volcan Popocatepetl.—*Rose & Painter*, 7153 (450779, 451636) Eslava; Mexico.—*Rose, Painter & Rose*, 8482 (451974) Encarnacion, Mexico.—*Pringle*, 6180, Sierra Ajusco, Mexico; 8182, Las Vigas, Vera Cruz.—*Shaw*, Cuernavaca, Morelos; Ferraria de Tula, Jalisco; Nanacamilpa Tlaxcala; Contreras, Eslava and Ajusco, Mexico.

Pinus leiophylla is abundant in the Federal District and grows quite near the City of Mexico, although its triennial fructification appears to have escaped the notice of the earlier collectors. The species is very prolific, and branches bearing cones in all stages of their growth are common.

PINUS LEIOPHYLLA VAR. CHIHUAHUANA N. VAR.

PINUS CHIHUAHUANA Engelm., *Wislizenus' Tour Nor. Mex.* 103 (*Senate Doc.* 1848).—Parlatore, *DC. Prodr.* xvi, pt. 2, 397 (1868).—Hemsley *Bot. Biol. Cent. Am.* iii, 186 (1883).—Toumey, *Gard. & For.* viii, 22, fig. 3 (1895).—Sargent, *Silva N. Am.* xi, 85, t. 566 (1897); *Man. Trees N. Am.* 14, fig. 13 (1905).—Britton, *N. Am. Trees*, 18, fig. 12 (1908).

Differing from the species by its stouter leaves usually in fascicles of 3 and 4, the leaves of the type being almost invariably in fascicles of 5.

Growing beyond the northern boundary of Mexico, in southern Arizona and New Mexico, and extending southward along the north western Sierras to the Territory of Tepic and the State of Zacatecas, where it merges into the typical form.

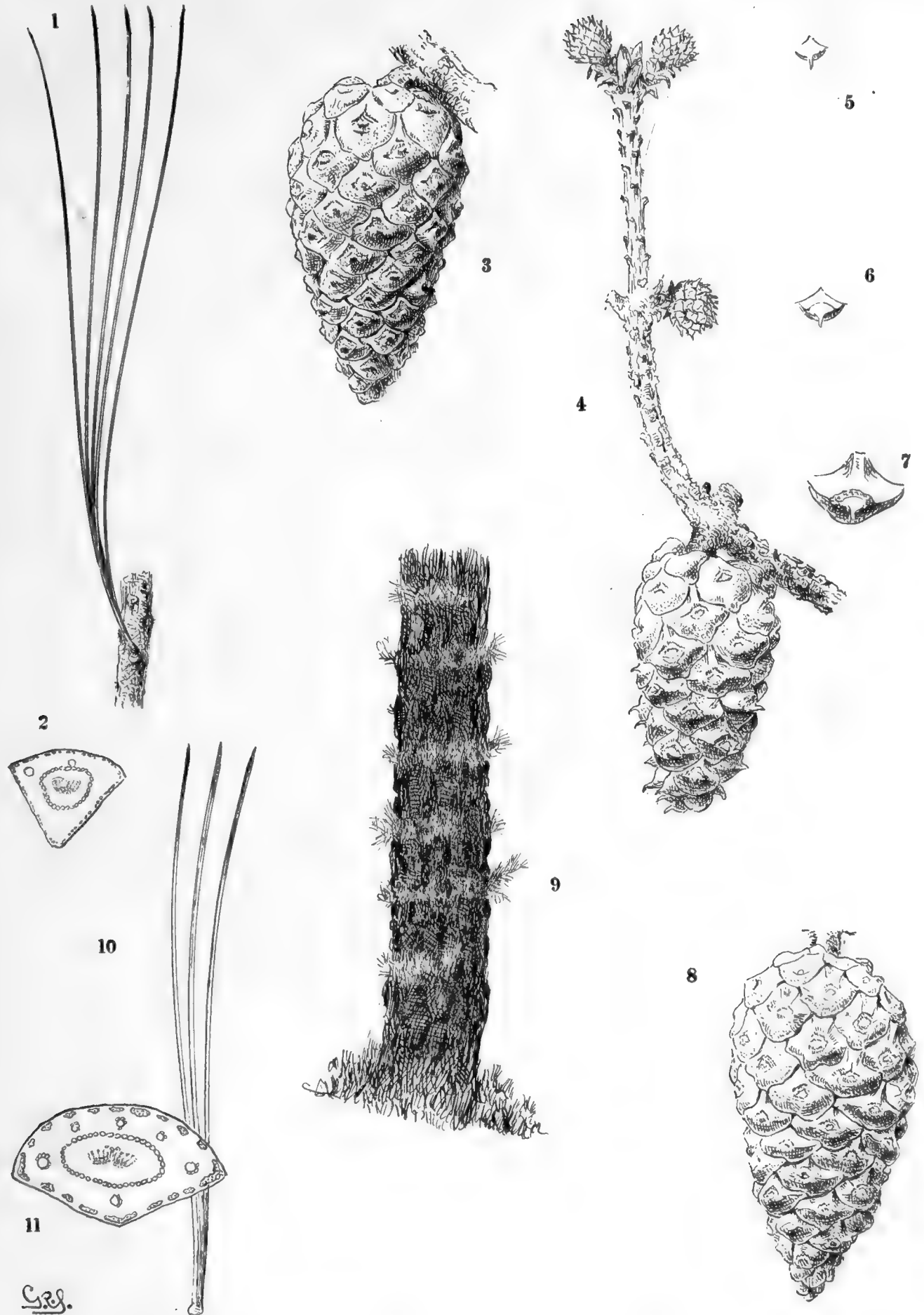
Nelson, 4558 (398620) El Salto, Durango; 6013 (398624) Sierra Madre, Chihuahua.—*Rose*, 3587 (302564) 3588 (302565) Mesquitez, Jalisco; 2123 (301027) Santa Teresa, Tepic; 2377 (301289), 2378 (302735) Sierra Madre, Zacatecas; 2405 (301315) San Juan Capistrano, Zacatecas; 2742 (301671-2) Plateado, Zacatecas.—*Palmer*, 83, 775, Durango.—*Shaw*, Sandia, Durango.

The species and the variety are alike except for the stouter and fewer leaves of the latter. Both sprout freely along the trunk. When a tree is felled the stump in a few years becomes completely concealed by the numerous shoots that grow from it.

Some cones of this species resemble in size and general appearance those of *P. teocote* var. *macrocarpa*, but the triennial cone and early deciduous fascicle sheaths of *P. leiophylla* form a combination of characters not found in any other known species of Pine. Triennial cones occur in two species of *Pinus* only, *P. leiophylla* and the Mediterranean *P. Pinus* L.

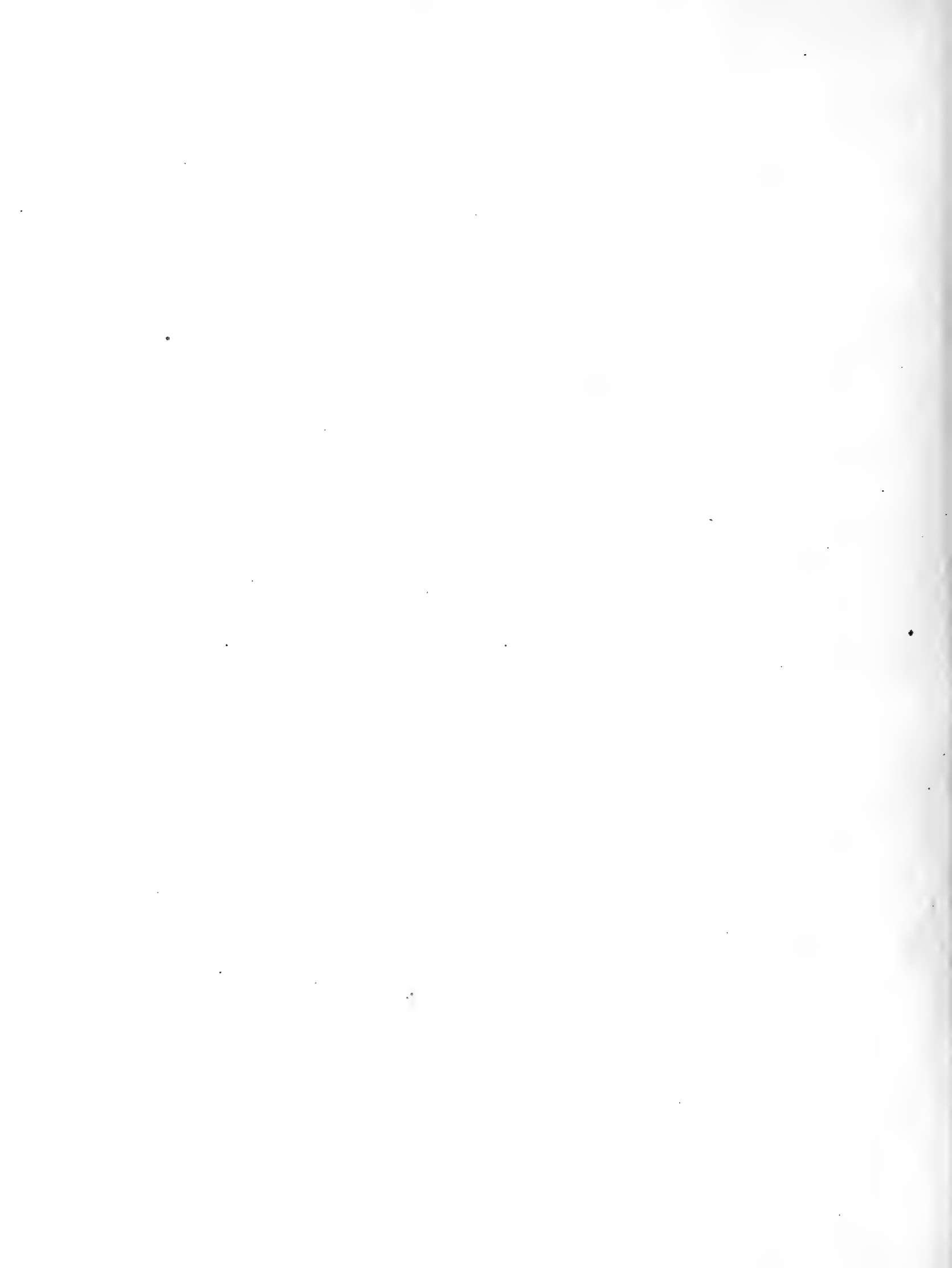
PLATE VII.

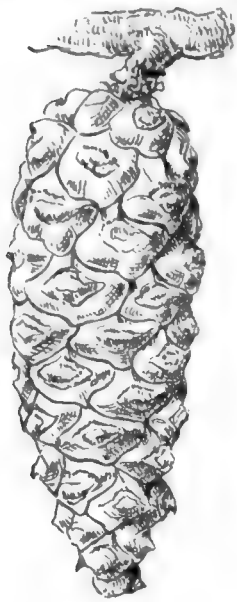
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|---|--|
| Fig. 1. Leaves of the species. | Fig. 7. Cone-scale of third year, magnified. |
| " 2. Leaf-section, magn. 30 diam. | " 8. Cone. |
| " 3. Cone. | " 9. Trunk of tree with sprouts. |
| " 4. Branch showing triennial fructification. | " 10. Leaves of var. <i>chihuahuana</i> . |
| " 5. Cone-scale of first year, magnified. | " 11. Leaf-section of same, magn. 30 diam. |
| " 6. Cone-scale of second year, magnified. | |



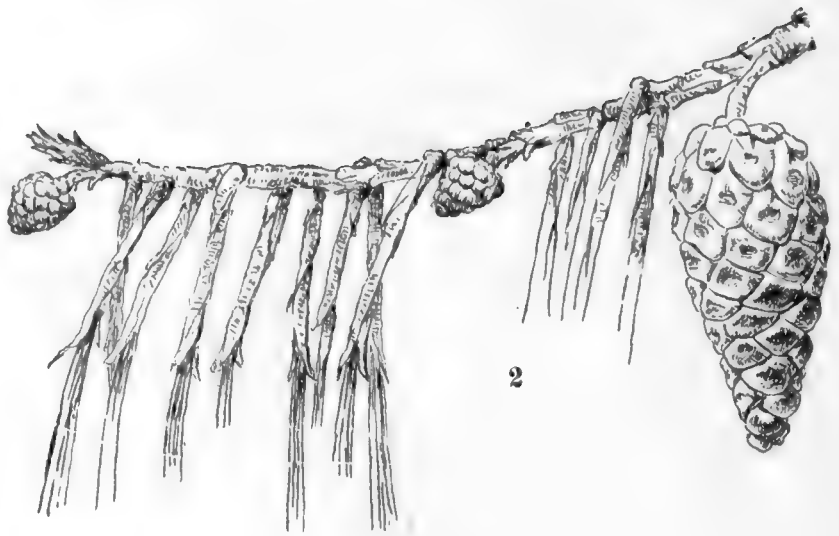
C.R.G.

PINUS LEIOPHYLLA SCHL. & CHAM.

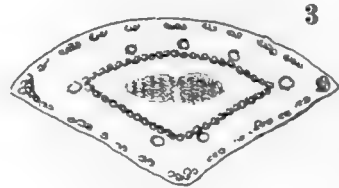




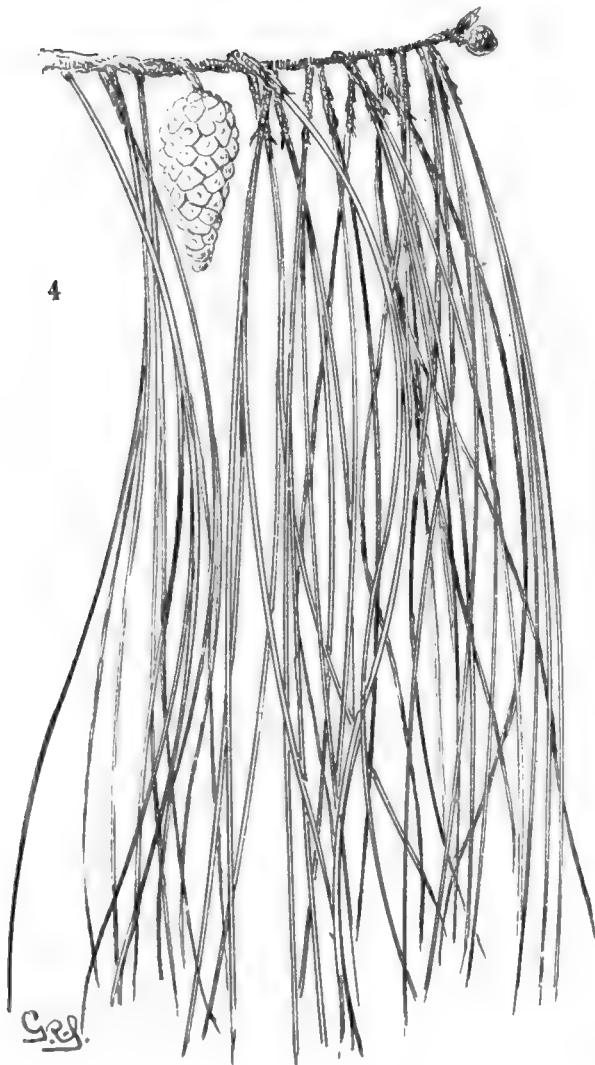
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Gr.



5

PINUS LUMHOLTZII ROB. & FERN.

8. PINUS LUMHOLTZII ROBINS. & FERN.

PINUS LUMHOLTZII Robinson & Fernald, *Proc. Am. Acad.* xxx, 122 (1894).—Shaw, *Sargent Trees & Shrubs*, ii, 55, t. 125 (1907).

PINUS PATULA Seemann, *Bot. Voy. Herald*, 336 (not Schl. & Cham.), (1852-7).—Hemsley, *Bot. Biol. Cent. Am.* iii, 189 (in part), (1883).

Leaves with deciduous sheaths, in fascicles of 3, 20-30 cm. long, pendent, serrate; resin ducts medial and internal, rarely external, the two fibro-vascular bundles contiguous, often merged in one. Conelets subterminal, occasionally also lateral on young trees, long-pedunculate, ovate-conical, their lustrous brown scales terminating in a small prickle deciduous from the mature cone. Cones usually about 5, rarely 7 cm. long, symmetrical, pendent on slender more or less curved peduncles, ovate-conical, opening at maturity, early deciduous, their apophyses tumid at the margins, the general surface flat, of a dull pale brown color, the umbo large and conspicuous. Branchlets lustrous chestnut-brown, more or less pruinose, the decurrent bases of the bracts deciduous; the bark at first thin, separating in deciduous scales, becoming in a few years coarse and thick. Buds of the same lustrous chestnut-brown as the branchlets and fascicle-sheaths.

A broad round-headed tree with slender subpendent branchlets and bright green, absolutely pendent leaves, growing on the western and north western Sierras from south western Jalisco to the latitude of the City of Chihuahua.

Hartman, 541 (type), Coloradas, Chihuahua.—*Nelson*, 4112 (398609) Mascota, Jalisco.—*Rose*, 2194 (301104) Santa Teresa, Tepic; 2989 (301944, 302738) west of Bolaños in Tepic; 3083 (302044) Bolaños to Guadalajara, Jalisco; 3586 (302563) Mesquitec, Zacatecas.—*Pringle*, 10014, Etzatlán, Jalisco.—*Shaw*, Etzatlán & Tula, Jalisco.

Specimens of this beautiful weeping Pine were first gathered by Seemann No. 1961, and are in the Herbarium of the Royal Gardens at Kew, where they were referred to *P. patula*, the weeping Pine of eastern Mexico, but *P. Lumholtzii*, in addition to its deciduous sheath, bears much smaller cones than *P. patula*. The leaves of *P. patula* droop in a graceful curve, those of *P. Lumholtzii* are so absolutely pendent that they seem to spring from the underside only of the branchlets. The specimens from which the species received its name were collected by Dr. Hartman, who accompanied Lumholtz on his scientific expedition to Mexico. This Pine was first found near Tutuaca, directly west of the City of Chihuahua, and is reported by travellers to grow in south-western Jalisco, which is probably near the southern limit of its range.

PLATE VIII.

Fig. 1. Cone of Rose 2989.

" 2. Branch, conelets and cone.

" 3. Leaf-section, magn. 30 diam.

Fig. 4. Branch and pendent leaves, 1-2 nat. size.

" 5. Tree at Tula.

9. PINUS TEOCOTE SCHL. & CHAM.

PINUS TEOCOTE Schlechtendal & Chamisso, *Linnaea*, v, 76 (1830); xii, 487 (1838).—Lambert, *Gen. Pin.* ed. 3, i, 37, t. 20 (1832).—Loudon, *Arb. et Frut. Brit.* iv, 2266, fig. 2173 (1838); *Encycl. Trees & Shrubs*, 991, figs. 1851-4 (1842).—Antoine, *Die Conif.* 35, t. 16, fig. 3 (1840).—Endlicher, *Syn. Conif.* 156 (1847).—Parlatore, *DC. Prodr.* xvi, pt. 2, 396 (1868). Hemsley, *Bot. Biol. Cent. Am.* iii, 189 (1883).

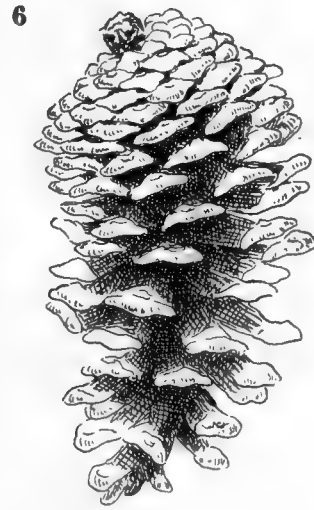
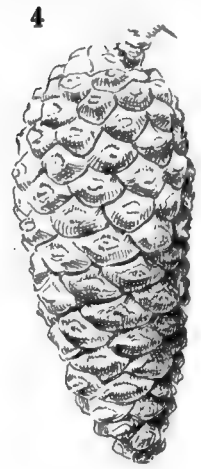
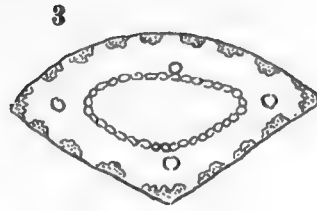
Leaves with persistent sheaths, in fascicles of 3, occasionally 4 or 5, 10-20 cm. long, serrate, usually stout; resin ducts medial, sometimes internal; outer walls of endoderm cells thickened; fibro-vascular bundles two, approximate or contiguous. Conelets subterminal rarely lateral, single or in pairs, pedunculate, their scales dull or sublustrous brown, transversely keeled, armed with a small dorsal prickle. Cones usually not exceeding 6 or 7 cm. in length, symmetrical or nearly so, ovate or narrow cylindrical, patulous or reflexed on short peduncles, opening at maturity, soon deciduous, their scales numerous, small, tumid at the margins, flat or slightly raised, rarely protuberant in the centre, more or less faintly carinate, dull or sublustrous brown, the umbo often ashen-gray. Branchlets somewhat pruinose, pale brown, the decurrent bases of the bracts deciduous; bark at first thin, deciduous and red, but accumulating in a few years and becoming rough and thick. Buds rather large, cylindrical, more or less resinous; male aments, when present, forming long cylindrical enlargements at their base.

A tree 20-30 m. high, with bright green leaves and compact habit growing at temperate altitudes in the southern, central, western and north-eastern Sierras, associated with *P. patula* and *P. leiophylla*.

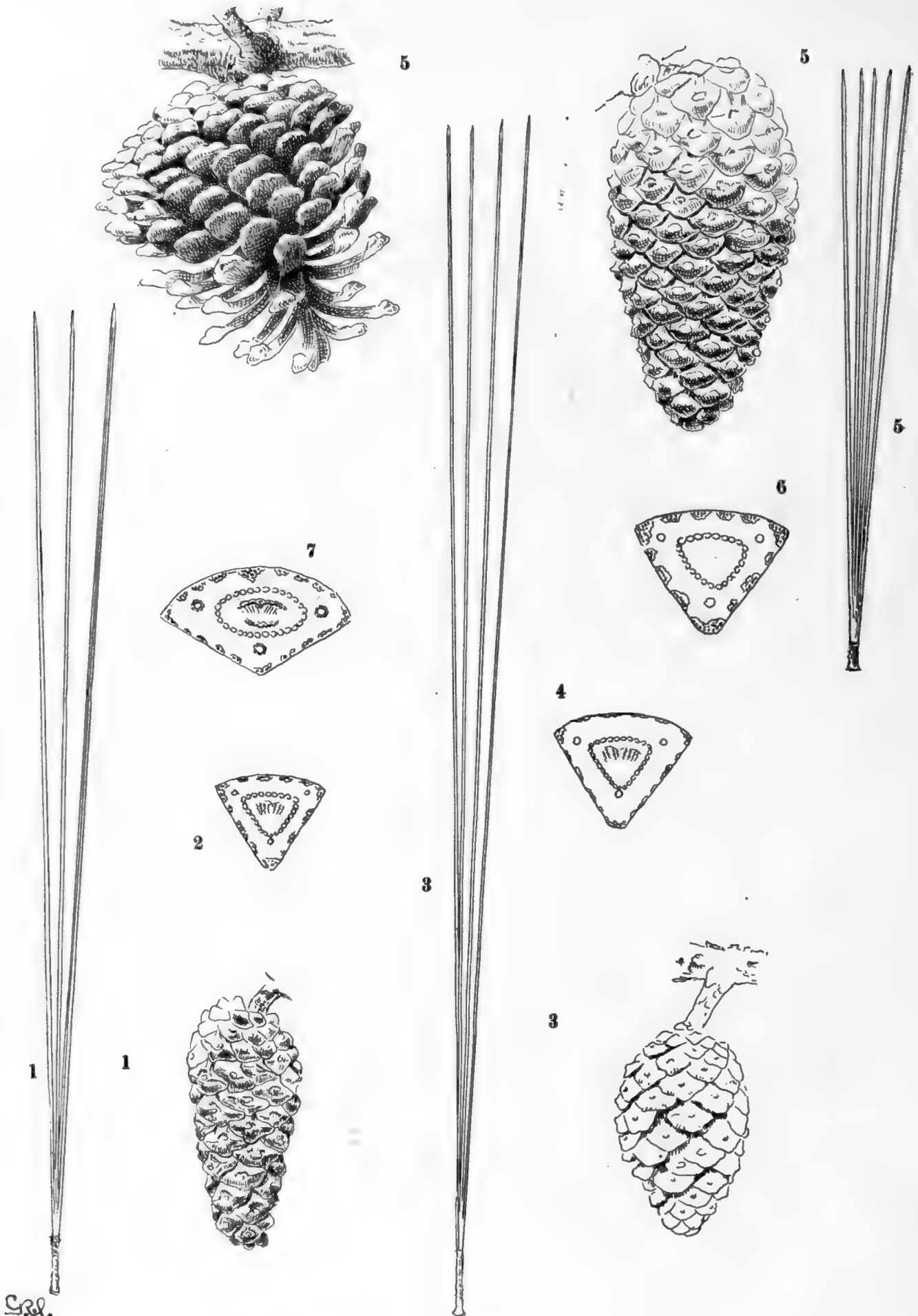
Nelson, 3 (398546) Salazar, Mexico; 8 (396789) Jesus Maria, San Luis Potosí; 981 (398555) Yalalag, Oaxaca; 987 (398560) La Parada, Oaxaca; 2187 (398571) Sierra Madre, Chilpancingo, Guerrero; 2536 (398580) Miahuatlán, Oaxaca; 3778 (398601) Pinabete, Chiapas; 3933 (398603) Pinal des Amoles, Querétaro; 4500 (398614) Miquihuana, Nuevo Leon.—*Goldman*, 1 (303987) Valparaiso, Zacatecas; 960 (398795) Teopisca, Chiapas; 987 (398796) San Cristobal, Chiapas.—*Rose*, 2130 (301035) Santa Teresa, Tepic, 2741 (301669-70) Plateado, Zacatecas.—*Rose & Hough* 4293 (346238) Las Vigas, Vera Cruz.—*Rose & Painter*, 7216 (450796) Ajusco, Mexico; 7014 (450583) Salazar, Mexico.—*Pringle*, 1964, Monterey, Nuevo Leon; 6243, San Felipe, Oaxaca; 6800, Ajusco, Mexico.—*Shaw*, Honey, Hidalgo; Nanacamilpa, Tlaxcala; Contreras, Mexico.

PLATE IX.

- | | |
|-----------------------------------|-----------------------------------|
| Fig. 1. Cone from Nanacamilpa. | Fig. 6. Cone of Nelson 4500 |
| " 2. " " Contadero. | " 7. Leaves and conelet. |
| " 3. Leaf-section, magn. 30 diam. | " 8. Leaf-section, magn. 30 diam. |
| " 4. Cone from Salazar. | " 9. Bud bearing male aments. |
| " 5. Seeds. | " 10. Tree at Las Vigas. |



PINUS TEOCOTE SCHL. & CHAM.



PINUS TEOCOTE SCHL. & CHAM.

PINUS TEOCOTE VAR. MACROCARPA. N. VAR.

PINUS LEIOPHYLLA Bentham, *Pl. Hartw.* 58 (in part), (1842).

Cones considerably larger than those of the typical form; leaves in fascicles of 3, 4 or 5.

Nelson, 3218 (398593) San Cristobal, Chiapas.—*Pringle*, 10013, 10018, Eslava, Mexico.—*Shaw*, Nanacamilpa, Tlaxcala; Contreras, Mexico.

The variety *macrocarpa* is illustrated by the cone of Lambert's plate of *P. teocote*, which, as stated by Schlechtendal in *Linnaea* xii, 488, is larger than the typical *teocote* cone. Most of the specimens labelled *Hartweg* 441 (*Pinus leiophylla*, foliis longioribus, Bentham, *Pl. Hartw.* 58) belong here as well as a specimen at Kew labelled *Pinus intermedia* Roehl. This variety may easily be confused with some forms of the variable *P. Lawsoni*, between which and *P. teocote* it seems to be intermediate; so far as I know however, this variety does not grow in subtropical regions and its leaf anatomy corresponds with that of *P. teocote*.

The variations in the length and thickness of the leaf of *P. teocote* are illustrated by figs. 1 to 4 on Plate X. There is also some variation in the length of the cone, and occasionally a cone is found with protuberant apophyses (Plate IX, fig. 2).

The typical form of the species is usually very easily recognized by its small cone and is like no other Mexican Pine.

"Ocote," from which the name of this species is derived, is apparently used by the Mexicans as the common name of all Pitch Pines and of their wood. Small bundles of kindling-wood are offered for sale in the markets of Mexican cities under the name "ocote." This kindling-wood is obtained by slashing the standing tree and, after allowing time for the resin to accumulate over the wound, by repeating the process at intervals. The chips are tied into small bundles and are retailed in the markets for one centavo each. Trees badly disfigured by the ocote gatherers are frequently seen.

PLATE X.

Fig. 1. Nelson 2187. Cone and leaves.

" 2. Leaf-section, magn. 30 diam.

" 3. Nelson 3778. Cone and leaves.

" 4. Leaf-section, magn. 30 diam.

VAR. MACROCARPA.

Fig. 5. Pringle 10013. Cone and leaves.

" 6. Leaf-section, magn. 30 diam.

" 7. Leaf-section of Nelson 3218, magn. 30 diam.

10. PINUS LAWSONI ROEHL.

PINUS LAWSONI Roehl, ex *Gordon Pinetum*, Appx. 64 (1862).—Hemsley, *Bot. Biol. Cent. Am.* iii, 187 (1883).

PINUS ALTAMIRANI Shaw, *Sargent Trees & Shrubs* i, 209, t. 99 (1905).

Leaves with persistent sheaths, in fascicles of 3, often of 4 or 5, not exceeding 24 cm. in length, serrate; resin ducts mostly internal, those in the angles of the leaf often medial; outer walls of endoderm cells not thickened, the 2 fibro-vascular bundles contiguous. Conelets on reflexed peduncles, subterminal, rarely also lateral, single or in pairs, their lustrous brown scales armed with a small prickle. Cones variable in size, usually 5–6 rarely exceeding 7 cm. in length, unsymmetrical, rarely symmetrical, reflexed on a pliant peduncle, ovate or elongate-conical, opening at maturity, deciduous, their apophyses usually dull yellowish brown, unequally developed, sometimes protuberant on some of the scales; umbo large, often salient and very conspicuous, its epiderm deciduous. Branchlets covered with a conspicuous white bloom, the decurrent bases of the bracts deciduous. Cortex at first thin, deciduous and red, soon becoming dark and more persistent.

A tree 20–25 m. high with glaucous-green foliage, growing only at subtropical levels and associated with *P. Pringlei* and *P. oocarpa*. The geographical range of the species is not yet accurately determined, but it is apparently confined to the southern and central western States.

Nelson, 1760 (398563) Reyes, Oaxaca; 2181 (398569) Chilpancingo, Guerrero; 2537 (398581), 2538 (398582), 2540 (398584) Miahuatlan, Oaxaca.—*Rose & Hough*, 4639 (346620) Las Sedas, Oaxaca.—*Pringle*, 10017, Uruapan, Michoacan.—*Shaw*, Uruapan, Jesus del Monte & Huingo, Michoacan; Cuernavaca, Morelos; Las Sedas, Oaxaca.

Among the Pines, with which it is associated *P. Lawsoni* is conspicuous by its glaucous foliage. Its deciduous cone with its pliant peduncle cannot be confused with the persistent cone of *P. Pringlei*. In herbarium specimens normal cones are easily recognized, but an occasional cone may be found which resembles that of *P. teocote* var. *macrocarpa*. The scales of the latter are, however, usually smaller and more numerous. The resin-ducts of the leaf of *P. Lawsoni* are usually internal, while those of *P. teocote* and its variety are usually medial, but this character is not wholly reliable. I have so far found that the endoderm cells of the leaves of *P. teocote* show thickened outer walls, while in those of *P. Lawsoni* there is no perceptible difference between the outer and inner walls of the endoderm. In the localities where I have met them *P. teocote* and its variety *macrocarpa* grow at higher levels and are never associated with *P. Lawsoni*.

There are misleading statements in Gordon's description. The leaves are never entire, nor does the species grow on the higher mountains of Mexico. The resemblance of its cone to that of *P. sylvestris* L. is of a kind that diminishes with a better knowledge of the two species.

PLATE XI.

Fig. 1, 2, 3, 4. Cones from Huingo.

“ 5. Cone of Nelson 2538.

“ 6. Cone from Uruapan.

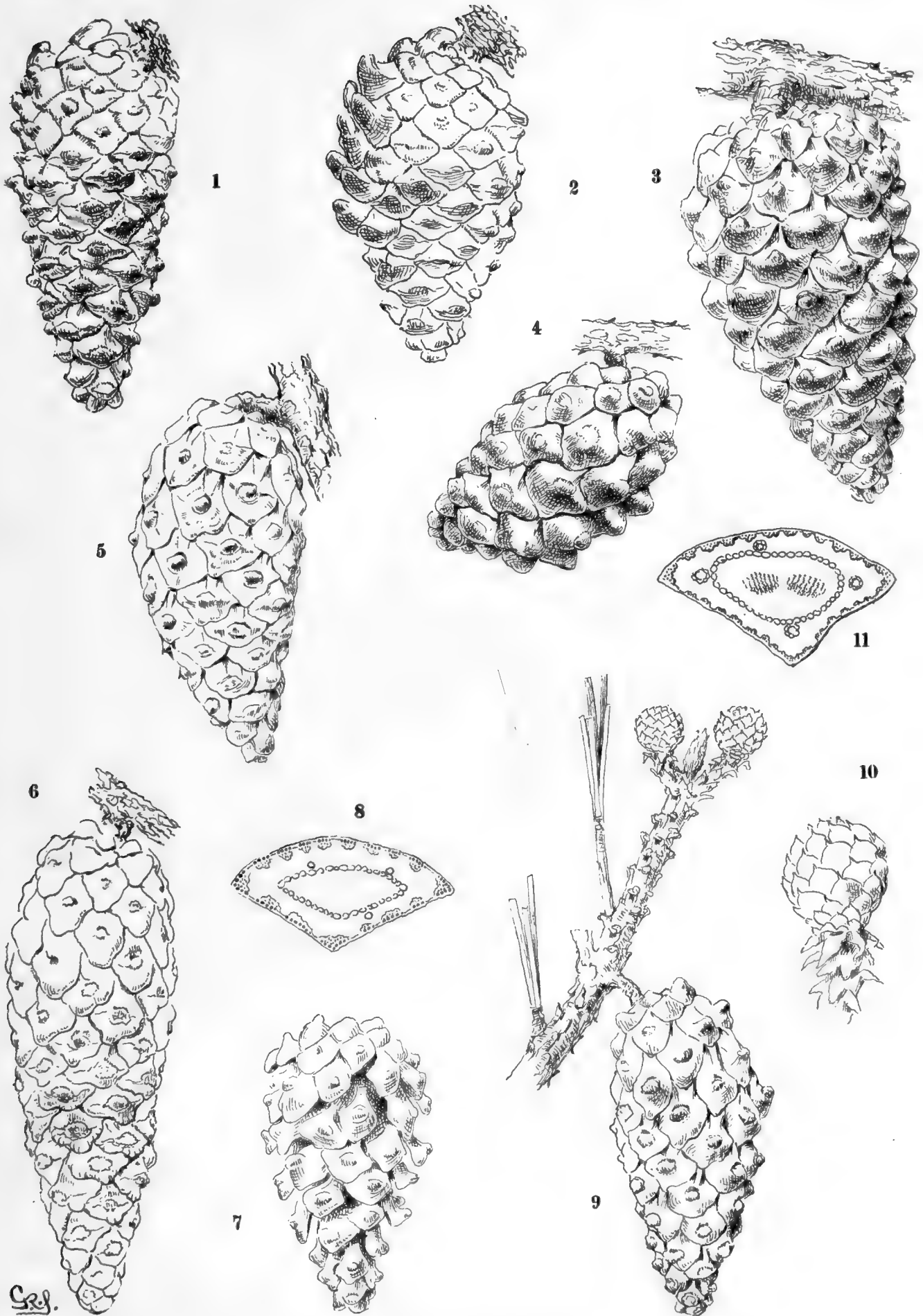
“ 8. Cone from the Kew Herbarium.

Fig. 8. Leaf-section, magn. 30 diam.

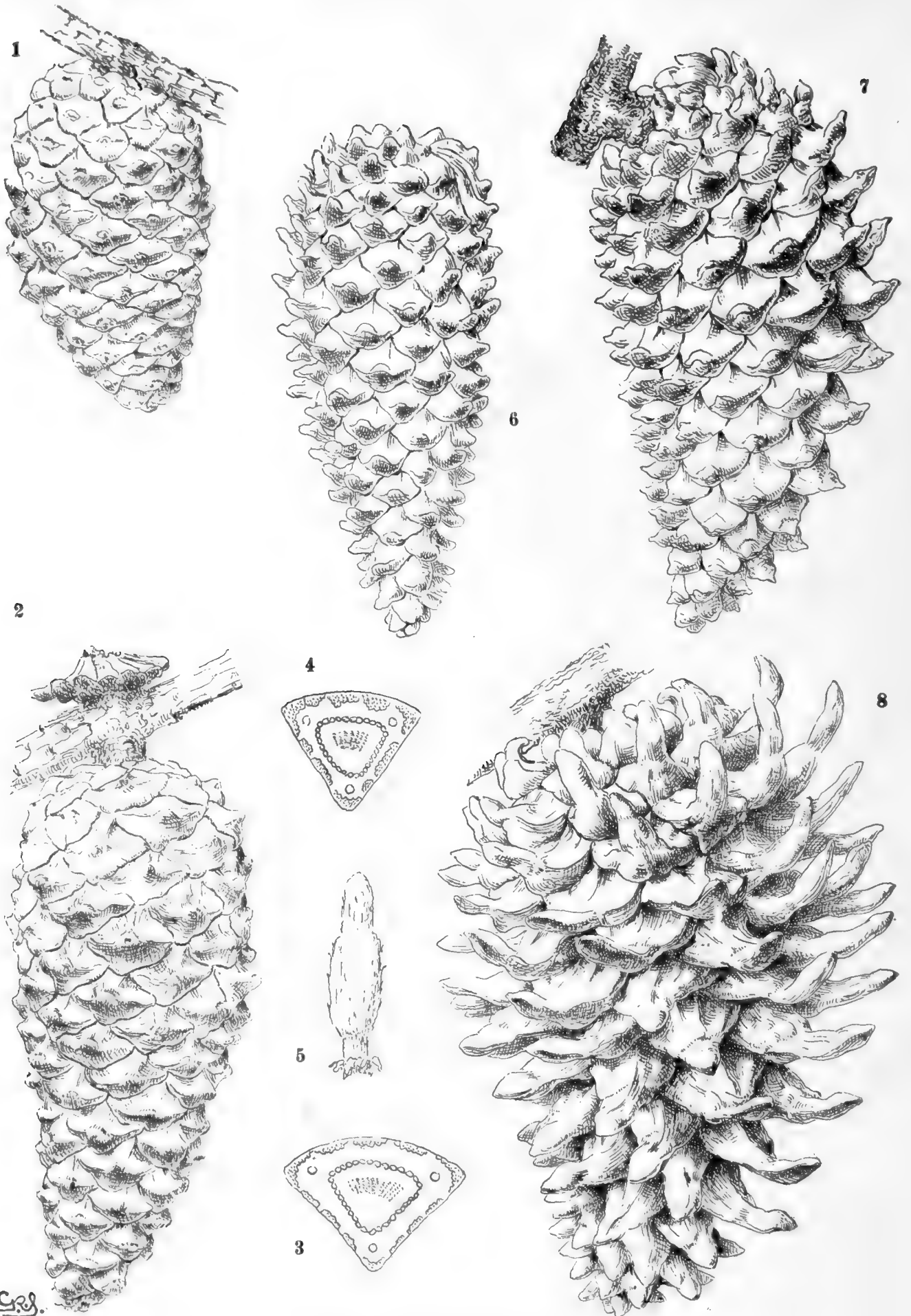
“ 9. Cone and conelets from Uruapan.

“ 10. Conelet, magnified.

“ 11. Leaf-section from Uruapan, magn. 30 diam.



PINUS LAWSONI ROEZL.



PINUS PSEUDOSTROBUS LINDL.

11. PINUS PSEUDOSTROBUS LINDL.

PINUS PSEUDOSTROBUS Lindley, *Bot. Reg.* xxv, Misc. 63 (1839).—Loudon, *Encycl. Trees & Shrubs*, 1008, fig. 1888 (1842).—Endlicher, *Syn. Conif.* 156 (1847).—Parlatore, *DC. Prodr.* xvi, pt. 2, 401 (1868).—Hemsley, *Bot. Biol. Cent. Am.* iii. 189 (1883).

PINUS ORIZABAE Gordon, *Jour. Hort. Soc. Lond.* i, 237, fig. (1846).—Endlicher, *Syn. Conif.* 156 (1847).

Leaves with persistent sheaths, in fascicles of 5, 15–30 cm. long, serrate, usually slender; resin ducts medial, outer walls of the endoderm cells thick, the two fibro-vascular bundles contiguous. Conelets subterminal, long-pedunculate, single or in clusters of 2 or 3, their scales armed with a small, ultimately deciduous prickle. Cones ovate or oblong, variable in size, 7–14 cm. in length, subsymmetrical or oblique, opening at maturity, early deciduous, the peduncle and a few basal scales usually temporarily persistent on the tree, their apophyses flat, or protuberant in various degrees. Branchlets slender, usually conspicuously pruinose, the decurrent bases of the bracts clearly defined but not persistent, and becoming merged in the smooth bark of the young trees. Buds orange-yellow, the male aments forming cylindrical enlargements just above their base.

A large tree with a trunk diameter of nearly 2 meters, of very rapid growth in youth, and producing very long straight internodes, slender verticillate branches and drooping leaves. Bark smooth at first, becoming very rough in old age.

Everywhere in Mexico, where subtropical or warmer temperate conditions prevail, and ranging as far south as Nicaragua.

Nelson, 2521 (398576) Miahuatlan, Oaxaca; 3185 (398591) San Cristobal, Chiapas; 6588 (399175) Mt. Patamban, Michoacan; 6888 (398633–4) Mt. Tancitaro, Michoacan.—*Goldman*, 20 (324783) Huauchinango, Puebla.—*Pringle*, 2109, Guadalajara, Jalisco; 8090, Jalapa, Vera Cruz; 8787, Eslava, Mexico.—*Shaw*, Contreras, Mexico; Tres Marias, Morelos.

PINUS PSEUDOSTROBUS VAR. APULCENSIS, N. VAR.

PINUS APULCENSIS Lindley, *Bot. Reg.* xxv, Misc. 63 (1839).—Loudon, *Encycl. Trees & Shrubs* 1014, fig. 1899 (1842).—Endlicher, *Syn. Conif.* 153 (1847).

Cone differing from that of the species by a greater or less prolongation of the apophyses. Growing with the type.

Nelson, 985 (398558) La Parada, Oaxaca; 2539 (398583) Miahuatlan, Oaxaca.—*Pringle*, 8788, Eslava, Mexico.

The variety *apulcensis* is easily recognized by the peculiar development of the apophyses of the cone, which may attain remarkable prominence. It is least prominent in Pringle's specimen from Eslava, where the variety passes into the species; Nelson No. 2539 is an intermediate form, while the cone of his No. 985 shows this variation in a most marked degree. In the Mexican collection of the Paris Museum there is a beautiful cone of this variety from the Cofre de Perote, Vera Cruz, collected by Hahn in 1866, with conspicuous protuberances on all the scales.

PLATE XII.

Fig. 1. Cone from Tres Marias.

“ 2. Cone from Contreras.

“ 3, 4. Leaf-sections, magn. 30 diam.

“ 5. Bud bearing male aments.

VAR. APULCENSIS.

Fig. 6. Cone of Pringle 8788.

“ 7. Cone of Nelson 2539.

“ 8. Cone of Nelson 985.

PINUS PSEUDOSTROBUS VAR. TENUIFOLIA, N. VAR.

PINUS TENUIFOLIA Bentham, *Pl. Hartw.* 92 (1842).—Endlicher, *Syn. Conif.* 155 (1847).—Parlatore, *DC. Prodr.* xvi, pt. 2, 400 (1868).—Hemsley, *Bot. Biol. Cent. Am.* iii, 189 (1883).

Cones ovate or long-ovate, their peduncles persistent on the cones; hypoderm of the leaves remarkably developed, extending from the epiderm to the endoderm and forming partitions across the green tissue.

Abundant in the western and south western states at subtropical altitudes, and extending into Central America as far as north western Nicaragua (Seemann in *Pim & Seemann Dottings on the Roadside*, 55).

Hartweg, 620, (type) Guatemala.—*Nelson*, 2535 (398579) Miahuatlan, Oaxaca; 3128 (398589) San Cristobal, Chiapas; 4118 (398611) La Laguna, Jalisco.—*Goldman*, 997 (398800) Ixtapa, Chiapas.—*Rose*, 1671 (300527) Colomas, Sinaloa; 2263 (301176-7) State of Durango; 3025 (301982) Boloñas to Guadalajara, Jalisco.—*Shaw*, Coru and Uruapan, Michoacan; San Felipe, Oaxaca.

The peculiar hypoderm of the variety *tenuifolia* is least conspicuous in *Hartweg*, No. 620, and in *Rose*, No. 1671. The character may be followed through various stages until it reaches its greatest development in *Rose*, 3025. At Uruapan, where this form is abundant, trees at the base of the mountains, in all other respects like those higher up the slope, bear leaves without the peculiar hypoderm. *Nelson*, No. 6888, with a *tenuifolia* cone has leaves with the normal section of the species. These exceptions, together with the unreliability of the persistent cone-peduncle, make it impossible to find specific characters for Bentham's *P. tenuifolia*. Its habit and bark are identical with those of *P. pseudostrobus*.

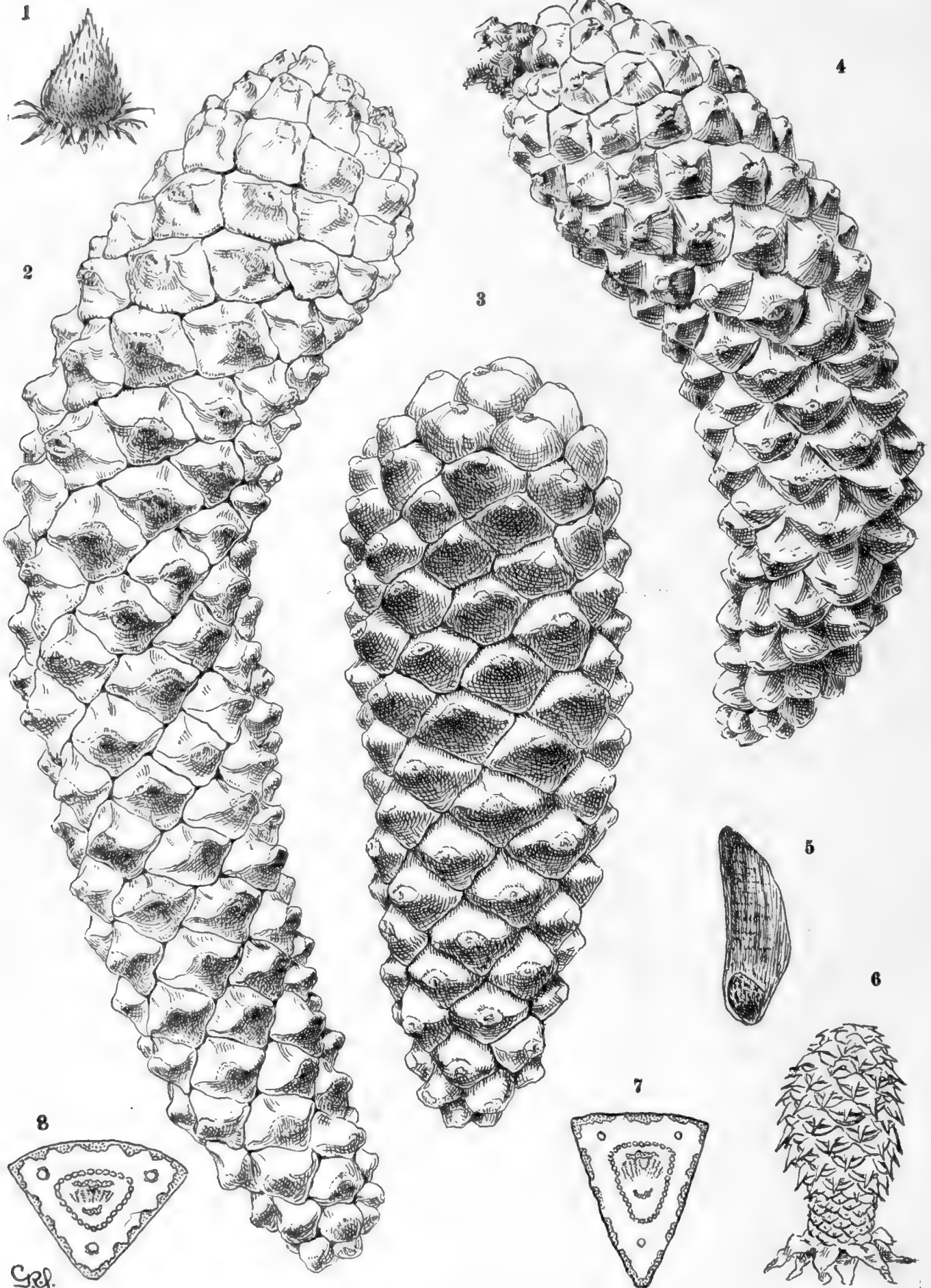
In all the forms the striking character is the habit of the young tree, with its straight, slender, tapering stem of long internodes, its smooth bark, slender branches and drooping leaves. The persistent smooth bark of the branches separates this species from those forms of *P. Montezumae* which bear cones and leaves similar to those of *P. pseudostrobus*.

PLATE XIII.

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| Fig. 1. Cone of Nelson 3128. | Fig. 6. Cone and leaves of Rose 3025. |
| " 2. Leaf-section, magn. 30 diam. | " 7. Leaf-section, magn. 30 diam. |
| " 3. Cone of Nelson 2535. | " 8. Leaf-section of Hartweg 620, magn. 30 diam. |
| " 4. Leaf-section, magn. 30 diam. | " 9. Tree at Uruapan. |
| " 5. Leaf-section of Rose 1671, magn. 30 diam. | |



PINUS PSEUDOSTROBUS VAR. TENUIFOLIA SHAW.



PINUS MONTEZUMAE LAMB.

12. PINUS MONTEZUMAE LAMB.

PINUS MONTEZUMAE Lambert, *Gen. Pin.* ed. 3, i, 39 t. 22 (1832); ed. 1, iii, text and plate (1837).—Schlechtendal, *Linnaea*, xii, 489 (1838).—Loudon, *Arb. et Frut. Brit.* iv. 2272, fig. 2185 (1838); *Encycl. Trees and Shrubs*, 1004, fig. 1884 (1842).—Antoine, *Die Conif.* 38, t. 17, fig. 1 (1840).—Endlicher, *Syn. Conif.* 154 (1847).—Parlatore, *DC: Prodr.* xvi, pt. 2, 398 (1868).—Hemsley, *Bot. Biol. Cent. Am.* iii, 188 (1883).

PINUS DEVONIANA Lindley, *Bot. Reg.* xxv, Misc. 62 (1839).—Loudon, *Encycl. Trees & Shrubs*, 1001, fig. 1878 (1842).

PINUS RUSSELLIANA Lindley, *Bot. Reg.* xxv, Misc. 63 (1839).—Loudon, *Encycl. Trees & Shrubs*, 1003, fig. 1879 (1842).

PINUS MACROPHYLLA Lindley, *Bot. Reg.* xxv, Misc. 63 (1839).—Loudon, *Encycl. Trees & Shrubs*, 1006, fig. 1885 (1842).

PINUS FILIFOLIA Lindley, *Bot. Reg.* xxvi, Misc. 61 (1840).—Loudon, *Encycl. Trees & Shrubs*, 1008, fig. 1889 (1842).

PINUS GRENVILLEAE Gordon, *Jour. Hort. Soc. Lond.* ii, 77, fig. (1847).—*Gard. Chron.* ser. 2, xv, 112, fig. 22 (1881).

PINUS GORDONIANA Hartweg, *Jour. Hort. Soc. Lond.* ii, 79, fig. (1847).

PINUS WINCESTERIANA Gordon, *Jour. Hort. Soc. Lond.* ii, 158, fig. (1847).

Leaves in fascicles of 3–8, 10–45 cm. long, serrate; resin-ducts medial; outer walls of the endoderm cells thick. Conelets subterminal, single or in clusters of 2–5, pedunculate, dull pale brown, deep brown, dull black or blue, their scales armed with usually reflexed prickles. Cones 6–25 cm. long, sessile or pedunculate, symmetrical, subcylindrical or tapering, often curved, opening at maturity, deciduous, their peduncles and a few basal scales often temporarily persistent on the tree after the fall of the cone: apophyses flat, pyramidal, tumid, or somewhat protuberant and reflexed, dull yellowish or reddish brown, fuscous brown or nearly black, the prickles occasionally persistent. Branchlets somewhat pruinose, the decurrent bases of the bracts prominent, persistent, and covered with an early-deciduous epiderm. Buds large, bright ochre yellow, the male aments not apparent from the outline of the bud.

A tree 15–20 metres high, varying in appearance with the length and thickness of its leaves, and growing at all levels where Pines are found in Mexico and in the northern states of Central America. The northern limit of its distribution is near the boundary between the states of Durango and Chihuahua.

Nelson, 980 (398554) Yalalag, Oaxaca; 1762 (398565) Reyes, Oaxaca; 2522 (398577) Miahautlan, Oaxaca; 3285 (398594) Teneapa, Chiapas; 3680 (398599) Huehuetenango, Guatemala; 3729 (398602) Volcan Santa Maria, Guatemala; 4117 (398610) La Laguna, Jalisco; 6573 (398630) Mt. Patamban, Michoacan; 6958 (398636) Jorullo, Michoacan. *Goldman*, 11 (303998) Valparaiso, Zacatecas; 845 (398791) Comitán, Chiapas; 903 (398793) Juncana, Chiapas; 950 (398794) Teopisca, Chiapas; 1044 (347473) La Razon, Chiapas.—*Rose*, 2122 (301024–5–6) Santa Teresa, Tepic; 2777 (301709) Plateado, Zacatecas; 3005 (301961) Bolaños, Jalisco.—*Rose & Hay*, 5781 (395568) Mt. Orizaba; 5403 (395162) Tlalpujahuá, Michoacan.—*Pringle*, 10140, Sandia, Durango.—*Shaw*, Uruapan, Michoacan; Cuernavaca, Morelos.

PLATE XIV.

- Fig. 1. Bud with male aments.
 " 2. Cone from Cuernavaca.
 " 3. Cone of Nelson 2522.
 " 4. Cone of Nelson 6573.
 " 5. Seed from Uruapan.

- Fig. 6. Conelet, magnified.
 " 7. Leaf-section from fascicle of 7 leaves, magn. 30 diam.
 " 8. Leaf-section, magn. 30 diam.

PINUS MONTEZUMAE VAR. LINDLEYI Loudon, *Encycl. Trees & Shrubs*, 1004, fig. 1883 (1842).

PINUS LINDLEYANA Gordon, *Pinetum*, 229 (1858).

Cones 10–15 cm. in length, their apophyses flat or somewhat pyramidal; leaves 15–25 cm. long, often very slender; conelets dark brown or nearly black.

Nelson, 276 (347471, 398549) Mt. Orizaba, Puebla; 1486 (398561) Valley of Oaxaca; 2180 (398568), 2189 (398573) Chilpancingo, Guerrero; 3935 (398604) Pinal des Amoles, Querétaro; 6599 (398631) Mt. Patamban, Michoacan; 6899 (398635) Mt. Tancítaro, Michoacan.—*Rose & Hough*, 4292 (346236–7) Las Vigas, Vera Cruz.—*Rose & Painter*, 7015 (450584) Salazar, Mexico; 7952 (451572) Toluca, Mexico.—*Shaw*, Toro, Mexico; Tres Marias, Morelos; Nanacamilpa, Tlaxcala.

The characteristic cone of this variety is pale brown with a conspicuously dark umbo; the apophyses are comparatively small and numerous, often rectangular in outline and very like those of the variety *Hartwegii*, but brown not black. At Toro, on the Ajusco mountains, the two forms grow together with many intermediates, and the evidence at this place is conclusive that they are of one species.

The leaves of *var. Lindleyi* are often slender and drooping, like those of *P. pseudostrobus*. Without sufficient material to determine the character of the bark and in the absence of characteristic cones the two are not easily separated. Gordon, in his determinations of the Roezl species, confused this form of *P. Montezumae* with *P. pseudostrobus*.

PLATE XV.

Fig. 1. Cone from Salazar.

“ 2. Leaves of Nelson 2180.

“ 3. Leaf-section, magn. 30 diam.

“ 4. Cone from Toro.

Fig. 5. Cone of Nelson 6599.

“ 6. Leaves of same.

“ 7. Leaf-section, magn. 30 diam.

“ 8. Leaf-section of Nelson 6899, magn. 30 diam.

PINUS MONTEZUMAE VAR. RUDIS *N. VAR.*

PINUS MONTEZUMAE Gordon, *Jour. Hort. Soc. Lond.* i, 234, fig. (1846).—*Gard. Chron.* ser. 3, viii, 466, figs. 91–94, 96 (1890); xv, 273, figs. 29–32 (1894); xxv, 146, fig. 53 (1899).

PINUS RUDIS Endlicher, *Syn. Conif.* 151 (1847).

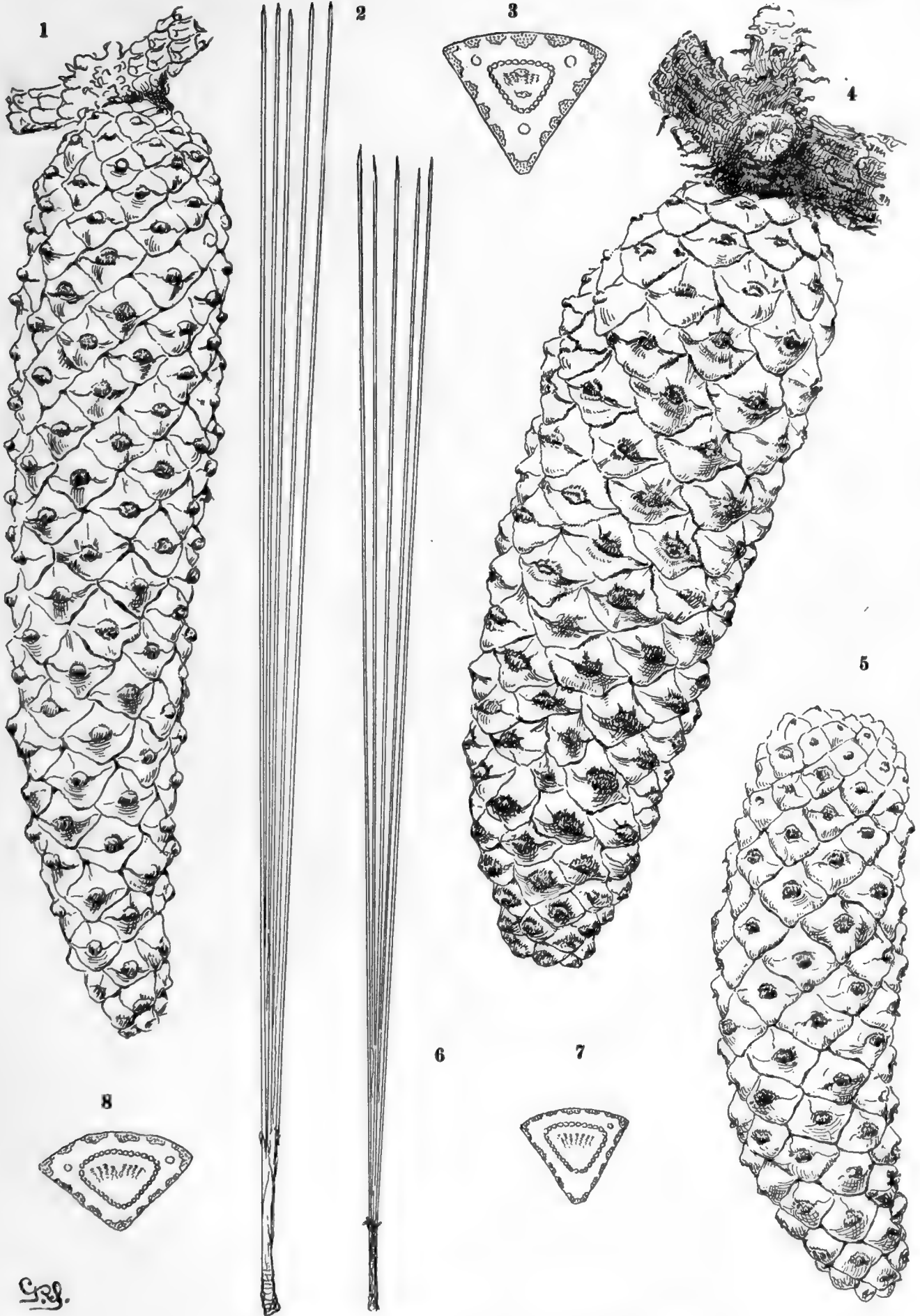
PINUS EHRENBERGII Endlicher, *Syn. Conif.* 151 (1847).

PINUS HARTWEGII Parlatore, *DC. Prodr.* xvi, pt. 2, 400 (in part) (1868).

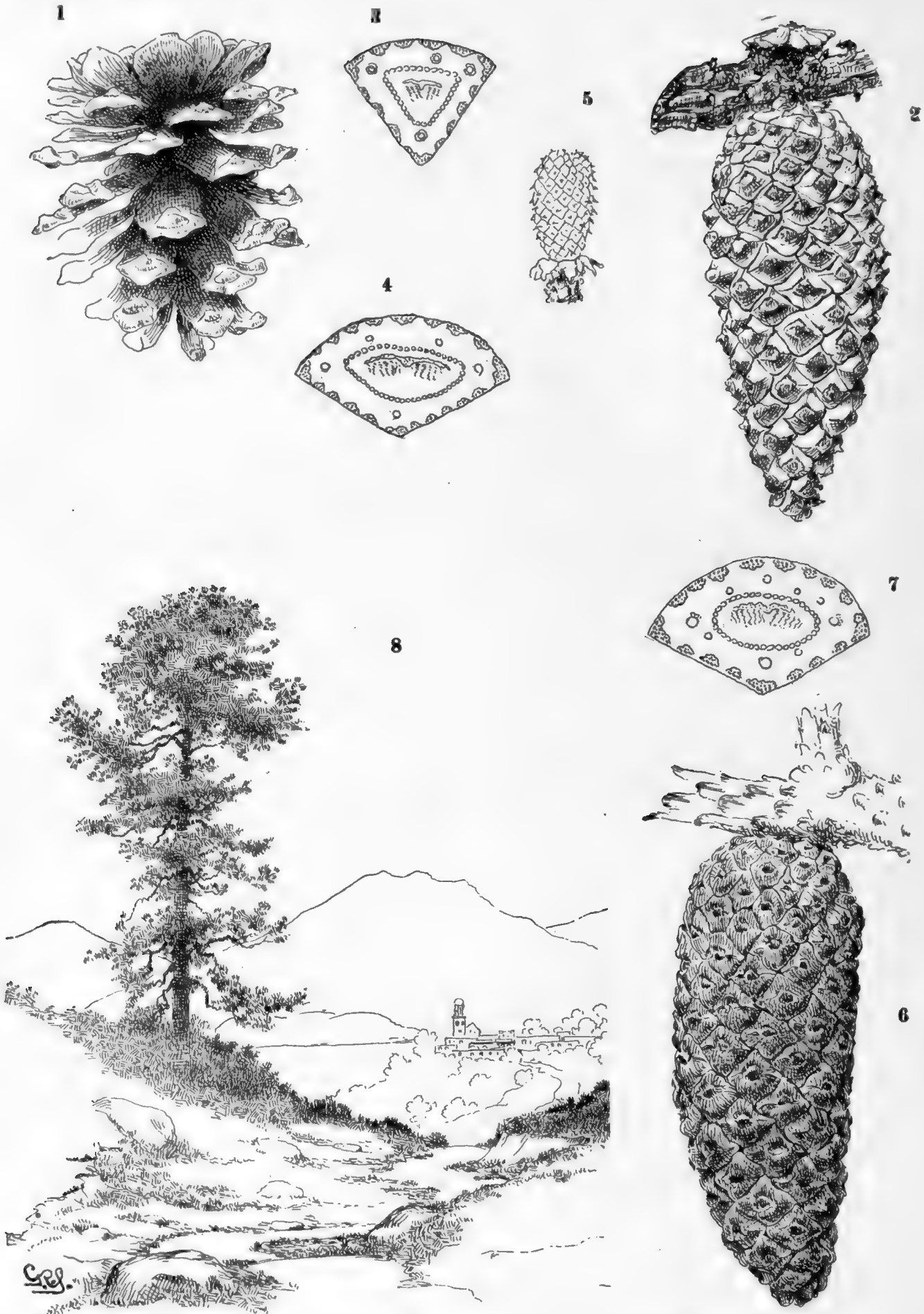
Cones 6–10 cm. long, dull, sometimes lustrous brown; leaves 10–15 cm. in length; conelets blue or blue black.

Low temperate altitudes intergrading with the varieties *Lindleyi* and *Hartwegii*.

Nelson, 3939 (398607) Encarnacion, Hidalgo; 4504 (398617) Miquihuana, Nuevo Leon; 4567 (398621) El Salto, Durango; 4916 (398623, 347470) Mt. Mohinora, Chihuahua; 6137 (347363) General Cepeda, Coahuila.—*Rose*, 2193 (301103) Santa Teresa, Tepic; 2376 (302734), 2379 (302736) Sierra Madre, Zacatecas; 3004 (301980), 2727 (302713–4) Bolaños, Jalisco.—*Rose & Hay*, 5537 (395299) Ajusco, Mexico.—*Shaw*, Eslava, Mexico; Pachuca, Hidalgo.—*Pringle*, 8786, 9484, 10012, Ajusco, Mexico.



PINUS MONTEZUMAE VAR. LINDLEYI LOUD.



PINUS MONTEZUMAE VARS. RUDIS SHAW & HARTWEGGII ENGELM.

PINUS MONTEZUMAE VAR. HARTWEGII Engelm., *Trans. St. Louis Acad. Sci.* iv, 177, 181 (1880).

PINUS HARTWEGII Lindley, *Bot. Reg.* xxv, Misc. 62 (1839). — Loudon, *Encycl. Trees & Shrubs*, 1000, fig. 1875 (1842). — Endlicher, *Syn. Conif.* 152 (1847). — Parlatore, *DC. Prodr.* xvi, pt. 2, 399 (1868). — Hemsley, *Bot. Biol. Cent. Am.* iii, 187 (1883).

PINUS DONNELL-SMITHII Masters, *Bot. Gaz.* xvi, 199 (1891). — Smith, *Bot. Gaz.* xix, 13, t. 2 (1894).

Cones 6–12 cm. long, dull very dark brown or nearly black; leaves 7–15 cm. in length, often in fascicles of 3 or 4 as well as of 5; conelets blue or sooty black.

Growing at cool temperate altitudes up to the tree limit.

Nelson, 4 (398547) Salazar, Mexico; 177 (398548) no locality; 983 (398557) Yalalag, Oaxaca; 2534 (398578) Miahuatlan, Oaxaca; 3653 (398597) Chaulcol, Guatemala; 6563 (398629) Mt. Patamban, Michoacan. — *Nelson & Goldman*, 16 (396796) Volcan Iztacihuatl. — *Rose & Hay*, 5780 (395567) Mt. Orizaba; 6076 (395881–2), 6325 (396144–5) Volcan Popocatepetl. — *Rose & Painter*, 7953 (450779), 7971 (451591) Toluca, Mexico. — *Maxon & Hay*, 3688 (473628), 3693 (474793) Volcan de Agua, Guatemala. — *Pringle*, 8789, Ajusco, Mexico. — *Shaw*, Toro, Mexico.

Both the varieties *rudis* and *Hartwegii* bear short, rigid, glaucous leaves, blue or blue-black conelets and comparatively small cones. The typical cones of *var. rudis* are brown in color, those of *var. Hartwegii* black. *Var. rudis* grows at warmer temperate levels, *var. Hartwegii* in colder regions and at higher altitudes than any other Mexican Pine. Leaves of *var. rudis* are in fascicles of 5, occasionally more, those of *var. Hartwegii* are often in 3's and 4's as well as 5's. The variety *Hartwegii* appears to be the variety *rudis* modified by exposure to severer conditions. On the other hand the variety *rudis* may be considered a smaller form of the variety *Lindleyi*, separated from it by its shorter leaves, smaller cones and blue conelets. The blue color of the conelet, however, is superficial, for it disappears after a short immersion in alcohol.

In Lambert's plate of *P. Montezumae* the cone is of the common subtropical form. Both cones and leaves often attain greater length than shown on the plate, but dimensions, in this species, are of no diagnostic value. Three cones taken from a single tree at Cuernavaca measure 12, 15 and 20 cm. The type passes into the variety *Lindleyi* through numerous intermediates, which may be found in great numbers in the states of Tlaxcala, Puebla and Vera Cruz, directly east of the City of Mexico.

Trees bearing fascicles of 6, 7 or 8 leaves are quite common, but such excessive numbers are found usually on older trees and in favorable years. On young trees fascicles of 3 and 4 leaves may be found, but in all cases fascicles of 5 predominate. The epiderm of the branchlets falls away sooner or later, but the cushions formed by the decurrent bases of the bracts remain, their freshly exposed surfaces being of a buff gray color. This character is common to all forms of *P. Montezumae* and may be seen on several of the specimens of the Nelson collection; it also appears on cultivated specimens sent to me from southern England.

PLATE XVI.

Fig. 1, 2. Cones of *var. rudis*.

" 3. Leaf-section of Nelson 4567, magn. 30 diam.

" 4. " " " " 4916, " " "

" 5. Conelet of Nelson 4916.

Fig. 6. Cone of *var. Hartwegii*.

" 7. Leaf-section of " magn. 30 diam.

" 8. Habit of *var. rudis*.

13. PINUS PONDEROSA DOUGL.

PINUS PONDEROSA Douglas ex *Lawson & Son Agric. Man.* 354 (1836).— Loudon, *Arb. et Frut. Brit.* iv, 2243, fig. 2133 (1838).— *Encycl. Trees & Shrubs*, 981, fig. 1831 (1842); Forbes, *Pinet. Woburn.* 44, t. 15 (1839).— Antoine, *Die Conif.* 28, t. 8, fig. 1 (1840).— Sargent, *Gard. & For.* i, 392, fig. 62 (1888); *Silva N. Am.* xi, 77, t. 560 and 561 (1897); *Man. Trees N. Am.* 15, fig. 15 (1905).— Britton, *N. Am. Trees*, 24, fig. 18 (1908).— Sudworth, *Forest Trees Pacif. Slope*, 42, fig. 13 (1908).

PINUS BRACHYPTERA Engelm., *Wislizenus' Tour Nor. Mex.* 89 (*Senate Doc.* 1848).

Leaves stout, in fascicles of 2–5, their numerous resin ducts medial. Cones 6–19 cm. long, early deciduous, the peduncle and a few basal scales usually temporarily persistent on the tree after the fall of the cone; apophyses armed with usually stout and persistent prickles.

Northern Mexico and from western Texas and the eastern slope of the southern Rocky Mountains to the Pacific Ocean.

Nelson, 4568 (398622) El Salto, Durango; 6055 (398626) Sierra Madre, Chihuahua.— *Shaw*, Sandia, Durango,

PINUS PONDEROSA VAR. MACROPHYLLA N. VAR.

PINUS MACROPHYLLA Engelm., *Wislizenus' Tour Nor. Mex.* 103 (*Senate Doc.* 1848), not Lindley.

PINUS ENGELMANNI Carrière, *Rev. Hort.* 227 (1854).

Leaves stout, 30–40 cm. long, in fascicles of 3–5; cones large, their apophyses prolonged into a more or less reflexed protuberance armed with a stout or weak prickle.

Sierras of north western Mexico.

Goldman, 163 (396790) Guasarachi, Chihuahua; 290 (396792) Alamos, Sonora.— *Pringle*, 1448, Chihuahua.

PINUS PONDEROSA VAR. JEFFREYI Vasey, *Rep. Dept. Agric. U. S.*, 179 (1875).— Sargent, *Silva N. Am.* xi, 79, t. 562 and 563 (1897); *Man. Trees N. Am.* 16, fig. 16 (1905).

PINUS JEFFREYI A. Murray, *Oreg. Comm.* 2, fig. (1853).— Lawson, *Pinet. Brit.* i, 45, fig. (1884).— Sudworth, *Forest Trees Pacif. Slope*, 47, fig. 14 (1908).

PINUS DEFLEXA Torrey, *Emory's Rep. Mex. Bound.* ii, pt. 1, 209, t. 56 (1859).— A. Murray, *Gard. Chron.* ser. 2, iv, 295, fig. 65 (1875).

Cones large, their scales armed with slender or stout reflexed prickles; branchlets pruinose. Northern California Baja, and on the Mountains of California.

Goldman, 1245 (565150) San Pedro Martir Mts., California Baja.

PINUS PONDEROSA VAR. ARIZONICA N. VAR.

PINUS ARIZONICA Engelm., *Rothrock Wheeler's Rep.* vi, 260 (1878).— Sargent, *Silva N. Am.* xi, 75 t. 559 (1897); *Man. Trees N. Am.* 14, fig. 14 (1905).— Britton, *N. Am. Trees*, 22, fig. 16 (1908).

Leaves in fascicles of 3–5; cones small; branchlets pruinose.

On the north eastern and north western Sierras, and mountains of southern Arizona.

Nelson, 4502 (398616) Miquihuana, Nuevo Leon.

PLATE XVII.

Fig. 1. Cone of *P. ponderosa*.

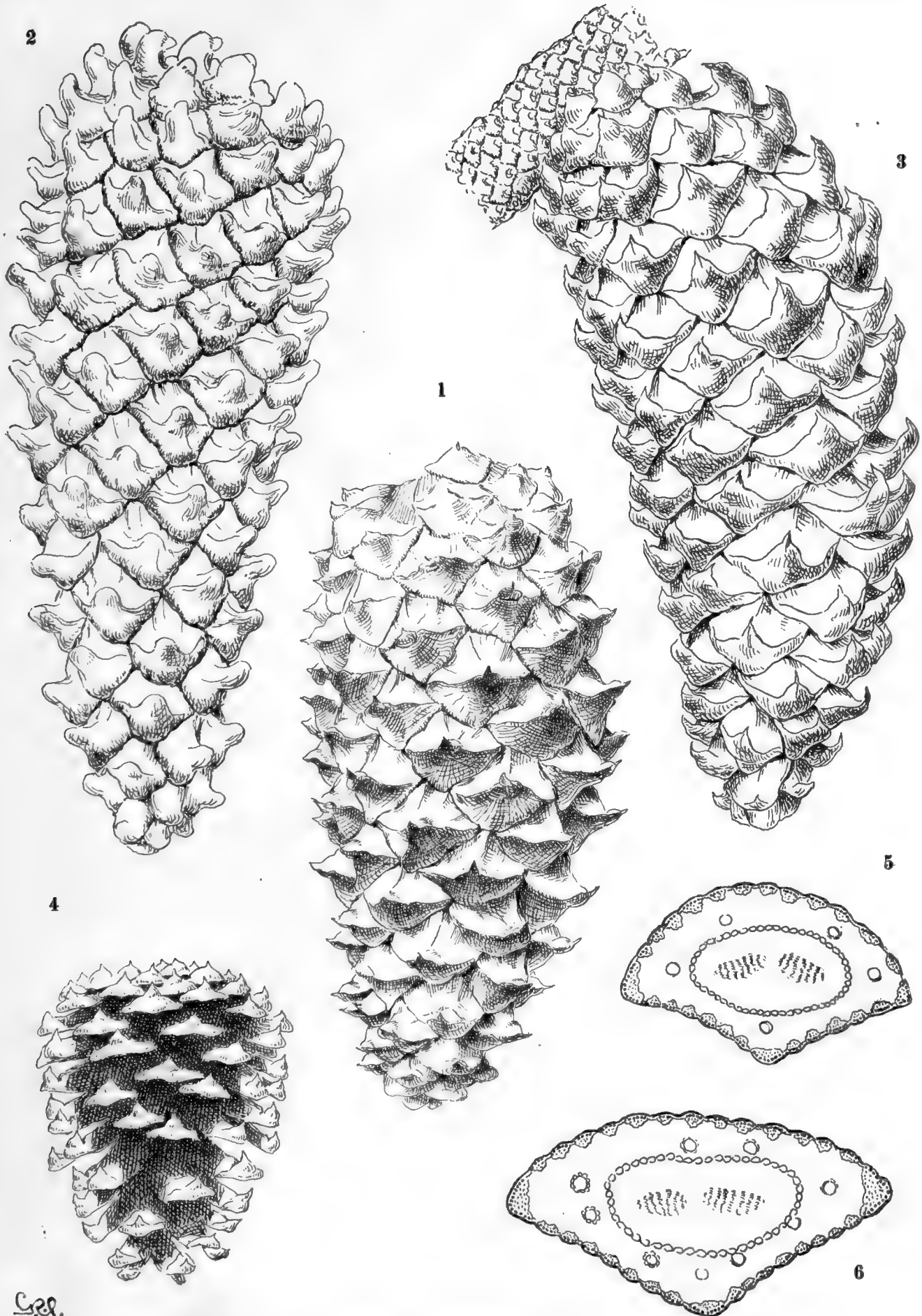
" 2. Cone of *var. macrophylla*, Goldman 163.

" 3. " " " " Pringle 1448.

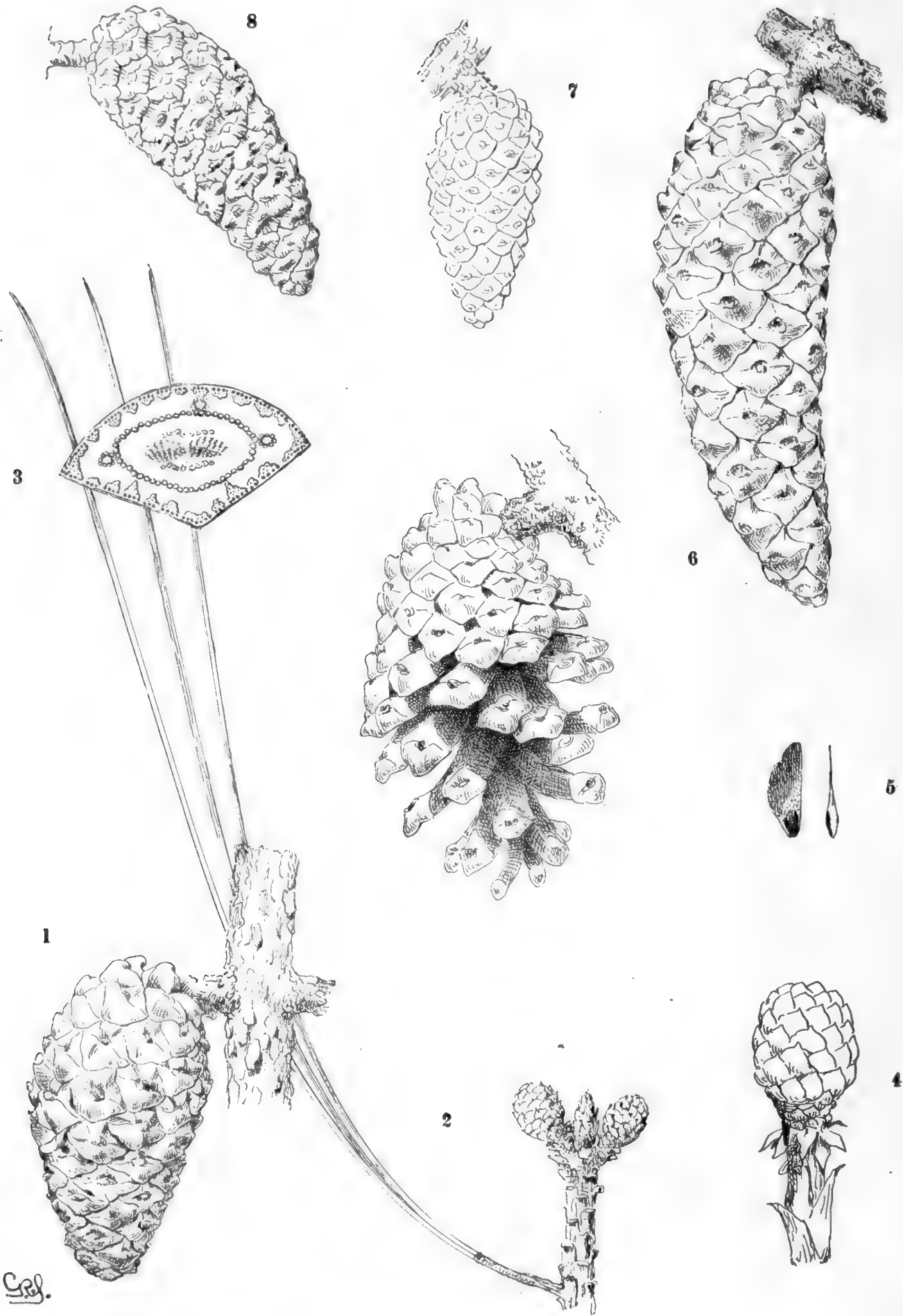
Fig. 4. Cone of *var. arizonica*.

" 5. Leaf-section " magn. 30 diam.

" 6. " " *var. macrophylla*, magn. 30 diam.



PINUS PONDEROSA DOUGL.



PINUS PRINGLEI SHAW.

14. PINUS PRINGLEI SHAW.

PINUS PRINGLEI Shaw, *Sargent Trees & Shrubs*, i, 211, t. 100 (1905.)

Leaves with persistent sheaths, in fascicles of 3, 15-25 cm. long, stout, serrate; resin ducts internal; hypoderm bundles projecting far into and occasionally across the green tissue. Conelets subterminal, long-pedunculate, single or in pairs, the prickles of the scales very small and deciduous. Cones reflexed, on short stout rigid peduncles, 5-10 cm. long, conical, pendent or patulous, persistent, their apophyses tumid or somewhat pyramidal, lustrous ochre-yellow, those at the base of the cone often prominent and slightly reflexed; seed-wing conspicuously thickened at the base. Branchlets sometimes pruinose; the decurrent bases of the bracts deciduous. Bark for a few years scaly and red.

A tree of the subtropical zone, with bright green, long, stout leaves, persistent, often abundant cones and long sinuous branches; associated with *P. oocarpa* and *P. Lawsoni*. Its geographical limits are not now definitely determined.

Nelson, 2182 (398570) Chilpancingo, Guerrero.—*Pringle*, 10019, Uruapan, Michoacan.—*Shaw*, Uruapan and Huingo, Michoacan; Cuernavaca, Morelos.

Pinus Pringlei flowers in November or in early December, earlier than its associate and near relative *P. oocarpa*. I have seen it at Uruapan, at Huingo on Lake Cuisco, and near Cuernavaca at the base of the northern slope of the Ajusco Mountains. In the last station a tree was found bearing several fascicles of two leaves, an exceptional number for a Hard Pine exclusively Mexican. From my limited observations it appears that the species is quite constant in its long stout leaves, but the cones vary much in size on different trees.

PLATE XVIII.

Fig. 1. Cone from Uruapan.

" 2. Leaves and conelets.

" 3. Leaf-section, magn. 30 diam.

" 4. Conelet magnified.

Fig. 5. Seeds.

" 6, 7. Cones from Uruapan.

" 8. Cone of Nelson 2182.

15. PINUS OOCARPA SCHIEDE.

PINUS OOCARPA Schiede, *Linnaea* xii, 491 (1838).—Antoine, *Die Conif.* 38, t. 17, fig. 2 (1840).—Loudon, *Encycl. Trees & Shrubs*, 1012, fig. 1896 (1842).—Endlicher, *Syn. Conif.* 152 (1847).—Parlatore, *DC. Prodr.* xvi, pt. 2, 401 (1868).—Hemsley, *Bot. Biol. Cent. Am.* iii, 188 (1883).

PINUS OOCARPOIDES Lindley, ex Loudon *Encycl. Trees & Shrubs*, 1118 (1842).

Leaves with persistent sheaths, in fascicles of 3, 4 and 5, 18–28 cm. long, serrate; resin ducts usually combining with the hypoderm bundles and forming partitions across the green tissue. Conelets subterminal, long-pedunculate, reflexed or patulous, single or in pairs, their scales armed with a very small prickle. Cones pendent or patulous on long, often curved peduncles, symmetrical or somewhat oblique, 4–8, sometimes 10 cm. long, persistent, their apophyses thin and flat or pyramidal, usually delicately but distinctly carinate transversely and radially, lustrous, ochre-yellow often tinged with gray or green. Seed-wing much thickened at the base. Branchlets usually stout, the decurrent bases of the bracts deciduous, their bark for a few years thin, scaly and red.

A tree 12–15 metres in height, with stout branches, a round compact head and bright green leaves in spreading tufts; growing in Central America and extending through southern and western Mexico to the boundary between the states of Sinaloa and Sonora; confined to the subtropical zone and associated with *P. Pringlei* and *P. Lawsoni*.

Nelson, 941 (398551) Comaltepec, Oaxaca; 978–9 (398552–3) Yalalag, Oaxaca; 1761 (398564) Reyes, Oaxaca; 2152, 2158 (398566–7) Patatlan to Chilapa, Guerrero; 2406 (398574) Jaquila to Nepala, Oaxaca; 2558 (398585–6) San Carlos to San Bartolo, Oaxaca; 2678 (398587–8) Santo Domingo, Oaxaca; 2854 (229353) Efigenia, Oaxaca; 3130 (398590) San Cristobal, Chiapas; 3493 (398595) Comitán, Chiapas. 3673 (398598), 3681 (398600) Huehuetenango, Guatemala; 4044 (398608) Talpa to Mascota, Jalisco; 4119 (398612) La Laguna, Jalisco; 6845 (398632) Los Reyes, Michoacan; 7039 (399380) Ocotito, Guerrero.—*Goldman*, 19 (324782) Huauchinango, Puebla; 268 (396791) Sierra de Choix, Sinaloa; 341 (396793) Chacala, Durango; 798 (398790) Canjob, Chiapas; 846 (398792) Comitán, Chiapas; 996 (398798–9) Ixtapa, Chiapas; 1055 (347474) Los Pinos, Chiapas.—*Rose*, 2003 (300896) Pedro Paulo to San Blasato, Tepic; 2195 (301105–6), Santa Teresa, Tepic; 3026 (301983), 3068 (302029) Bolaños to Guadalajara, Jalisco; 2262 (302733), 2264 (301178) Durango; 3736 (302724) Sierra Madre, Zacatecas; 3737 (302725–6) Sierra Madre, Tepic.—*Rose & Painter*, 7508 (451115) Guadalajara, Jalisco.—*Maxon & Hay*, 3370 (473357) Purula, Guatemala; 3428 (473408) Chiquin, Guatemala; 3375 (473361) Santa Rosa, Guatemala.—*Pringle*, 2109, 2455, Guadalajara, Jalisco; 10141, Uruapan, Michoacan;—*Shaw*, Etzatlán, Jalisco; Cuernavaca, Morelos.

PLATE XIX.

Fig. 1. Cone from Uruapan.

" 2. Habit of *P. oocarpa*.

" 3. Conelets from Uruapan.

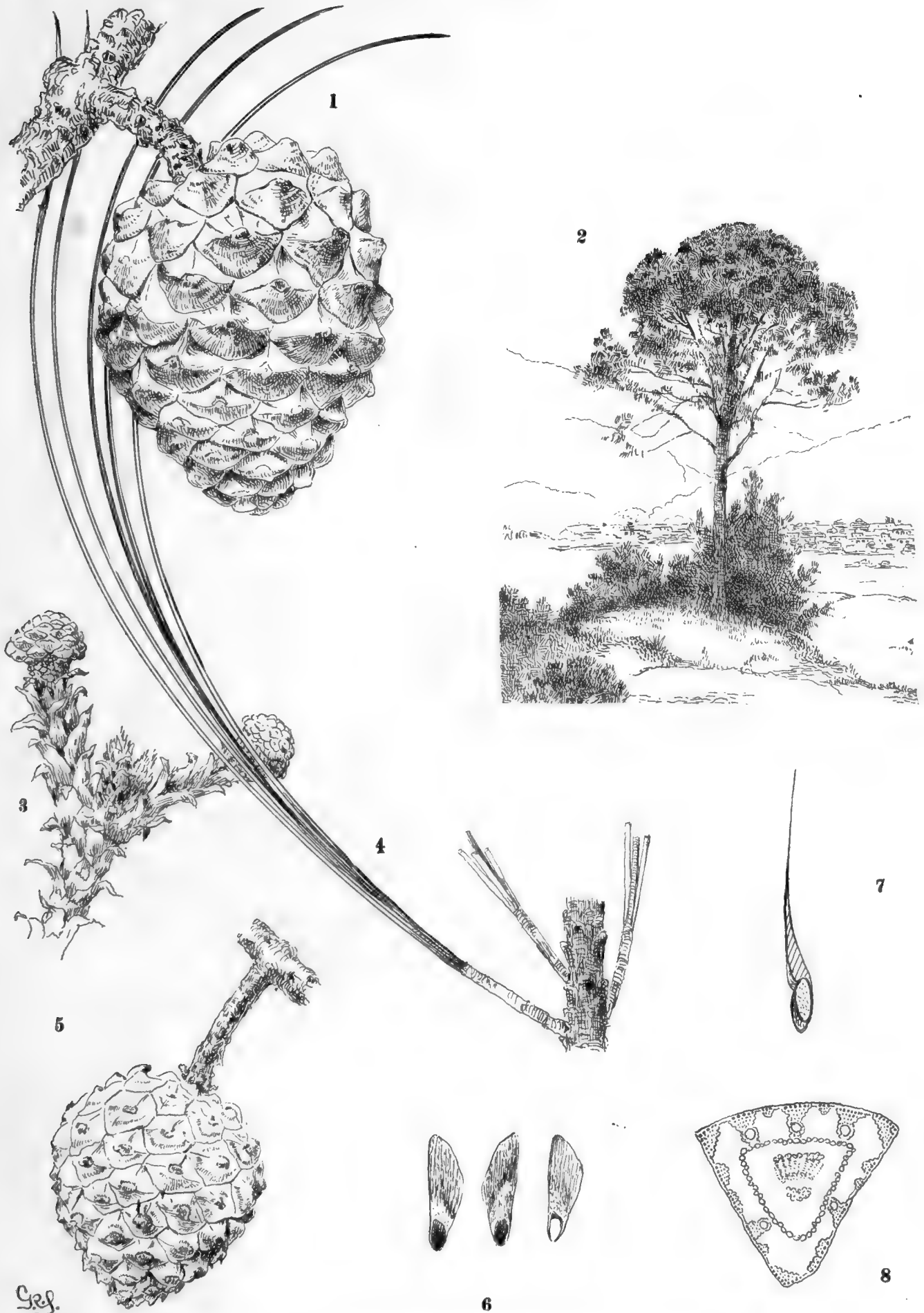
" 4. Leaves " "

Fig. 5. Cone of Nelson 979.

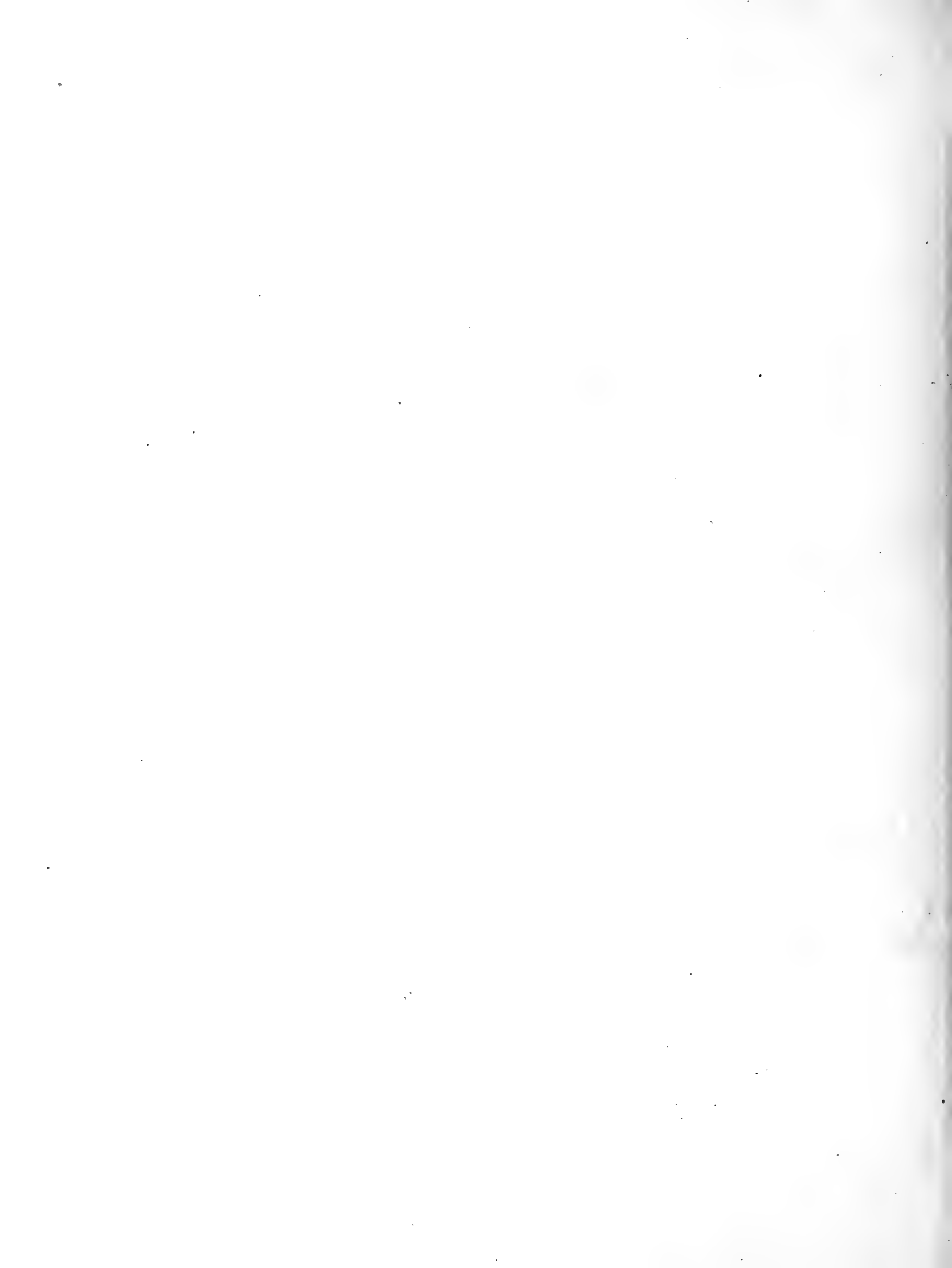
" 6. Seeds of *P. oocarpa*.

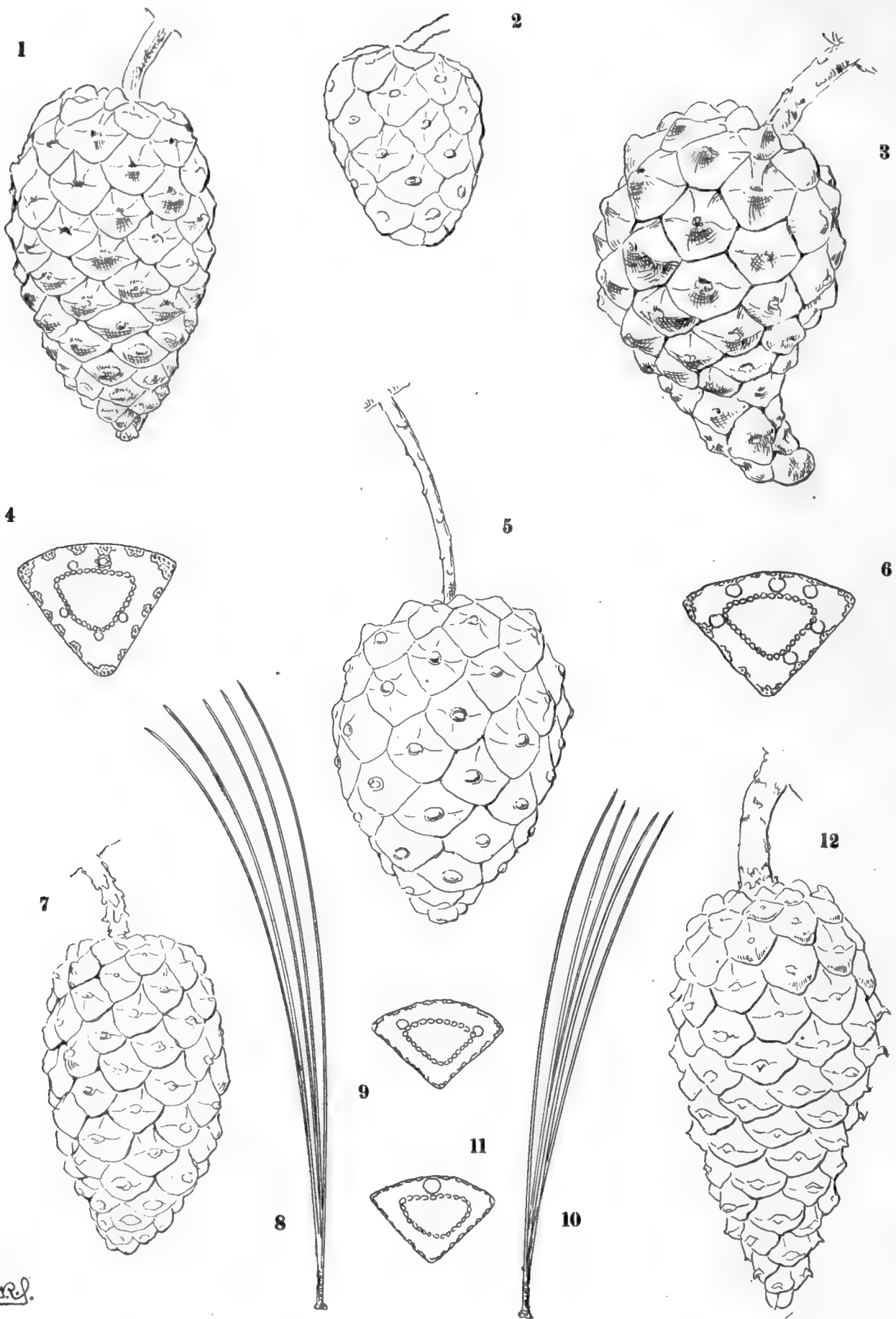
" 7. Section through wing and nut, magnified.

" 8. Typical leaf-section, magn. 30 diam.



PINUS OOCARPA SCHIEDE.





PINUS OOCARPA SCHIEDE.

PINUS OOCARPA VAR. MICROPHYLLA. N. VAR.

Leaves much shorter and more slender than those of the species, 8–13 cm. long.
Sinaloa and the Territory of Tepic.

Rose, 1755 (300624–5) Colomas, Sinaloa; 1997 (300890) Pedro Paulo to San Blasato, Tepic.—Palmer, 1998, Tepic.

The specimens of this variety that have been collected indicate a limited range on either side of the boundary between Sinaloa and Tepic. The cones are distinctly of the *oocarpa* form, although with thin scales and slender peduncles, but the leaves are very much shorter and thinner than those of the species and, were it not for the cones, would scarcely be recognized as belonging even to a variety of *P. oocarpa*.

Pinus oocarpa can easily be recognized by its characteristic cone and by the peculiar section of its leaf. When one of these characters fails the other is usually present. The leaf-section, however, is not invariable and it is advisable, in investigating this or related species, to examine a number of leaves. The cone, too, does not always conform to the type. There are ovate or long-conical shapes which do not suggest the species. A form from Guatemala (Plate XX, fig. 12) collected by Kellermann, was also found by Nelson (No. 3681). This, according to Nelson, was a single tree in a grove of *P. oocarpa* at Huehuetenango, Guatemala. This form, if it proves to be common, may deserve a varietal name.

The thickening of the basal portion of the seed-wing is more conspicuous in this species than in others of this section. The base above the nut is thick and rigid, the upper portion of the wing is membranous, the two parts meet in an oblique line, along which the membranous part is easily broken away. Apparently the reinforced base contributes something toward the security of the grasp of the wing on the nut, for, while collecting Pine-seeds in Mexico, it was found that the seed-wings of *P. oocarpa* and *P. Pringlei* were more difficult to remove than those of other species not provided with this peculiar kind of wing. This character is most conspicuous in the group of three California Pines with very large cones, *P. Sabiniana* Doug. *P. Coulteri* Don and *P. Torreyana* Parry. At Uruapan the fallen leaves of this and other long-leaved Pines are used in the manufacture of adobe, the sun-dried brick of Spanish-American countries.

PLATE XX.

- | | |
|---|---|
| Fig. 1. Cone of Nelson 6845. | Fig. 7. Cone from Uruapan. |
| " 2. Cone of Rose 1755 (<i>var. microphylla</i>). | " 8. Leaves of Palmer 1998 (<i>var. microphylla</i>). |
| " 3. Cone from Uruapan. | " 9. Leaf-section of same, magn. 30 diam. |
| " 4. Leaf-section of Nelson 2158, magn. 30 diam. | " 10. Leaves of Rose 1755 (<i>var. microphylla</i>). |
| " 5. Cone of Palmer 1998 (<i>var. microphylla</i>). | " 11. Leaf-section of same, magn. 30 diam. |
| " 6. Leaf-section of Nelson 2406, magn. 30 diam. | " 12. Cone of Kellermann 4521. |

16. PINUS GREGGII ENGELM.

PINUS GREGGII Engelmann, ex *Parlatore DC. Prodr.* xvi, pt. 2, 396 (1868).—Engelmann, *Trans. St. Louis Acad. Sci.* iv, 177 (1880).—Hemsley, *Bot. Biol. Cent. Am.* iii, 187 (1883).—Shaw, *Sargent Trees & Shrubs* ii, 53, t. 124 (1907).

PINUS PATULA β *STRICTA* Bentham ex *Endlicher Syn. Conif.* 157 (1847).

PINUS PATULA VAR. *MACROCARPA* Masters, *Gard. Chron.*, ser. 3, ix, 438, fig. 92 (1891).

Leaves with persistent sheaths, in fascicles of 3, 7–10 cm. long, erect, serrate; resin ducts medial; hypoderm of thin-walled, inconspicuous cells. Conelets subterminal, pedunculate, single or aggregate, their scales armed with a small, usually deciduous prickle. Cones subsessile, reflexed, oblique, conical, 6–12 cm. long, persistent; apophyses tumid, unevenly developed, lustrous ochre-yellow. Seed-wing thickened at the base. Branchlets pruinose, the decurrent bases of the bracts not prominent and becoming merged in the long-persistent smooth gray bark of the young trees.

A tree 10–15 metres in height, with short erect bright green leaves, smooth gray upper trunk and persistent clustered cones, growing on the north eastern Sierras at cool temperate altitudes.

Gregg, 402 (type), *Pringle*, 10142, *Shaw*, all near Saltillo, Coahuila.

There are no specimens of this species in the Nelson & Rose collections.

The conelets are subterminal at the time of flowering, after which the shoot elongates and leaves them in a pseudo-lateral position at the end of the first season. Occasionally a true lateral conelet occurs, but the character is not normal as it is with *P. patula*.

Cones just before ripening change from green to a lustrous reddish-brown, not unlike the color of a dry cone of *P. halepensis*, *Miller*, but quite unlike the purple black color of the cone of *P. patula* at the same stage of development. The erect short sparse foliage and the smooth gray upper trunk of *P. Greggii* give the tree an aspect totally different from that of *P. patula*, with its slender, long, drooping leaves and red scaly upper trunk. The cone, however, is remarkably like that of *P. patula* and has the same sessile attachment to the branch, the long peduncle of the conelet being overgrown and concealed by the basal scales of the cone in both species.

From the descriptions of Lambert and later authors it is evident that *P. Greggii* and *P. patula* have been long confused. The peculiar gray, persistently smooth bark of *P. Greggii* forms part of their descriptions of *P. patula*. The error must have arisen from Hartweg's specimens from Real del Monte, where *P. Greggii* might naturally have been found before that mining property was deforested.

PLATE XXI.

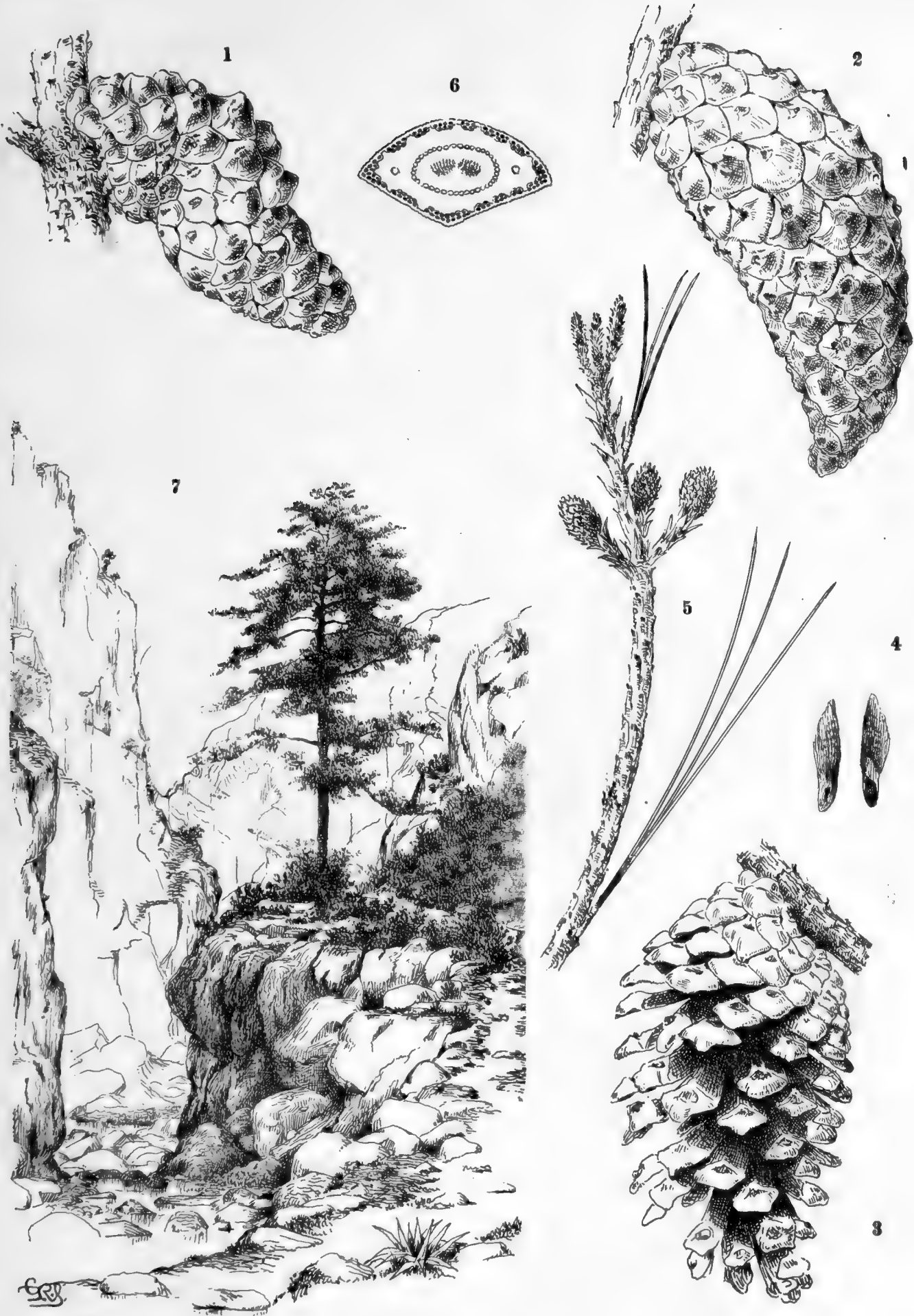
Fig. 1, 2, 3. Cones from Saltillo.

" 4. Seeds from Saltillo.

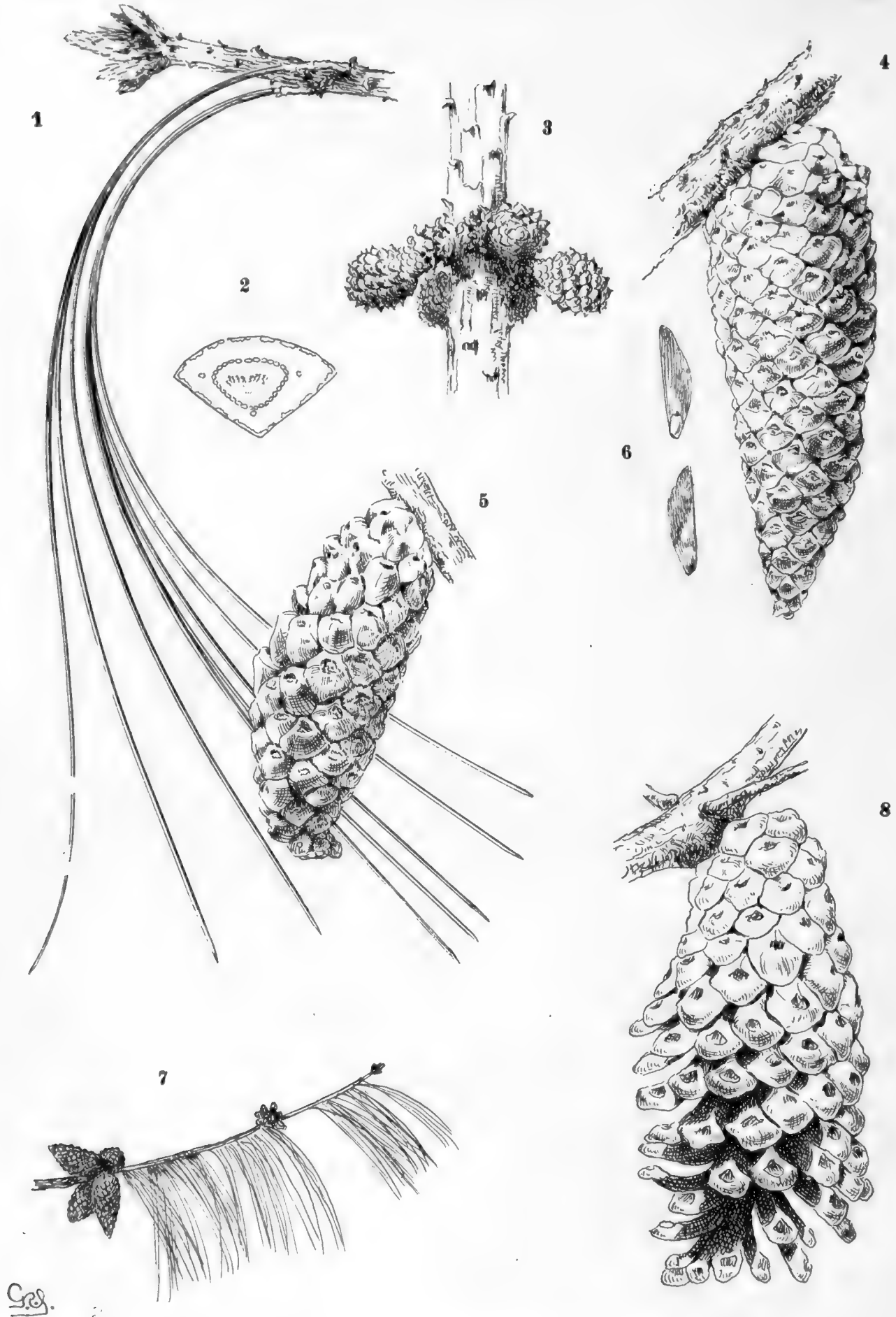
" 5. Branch, leaves and conelets.

Fig. 6. Leaf-section, magn. 30 diam.

" 7. Habit of the tree.



PINUS GREGGII ENGELM.



Ces.

PINUS PATULA SCHL. & CHAM.

17. PINUS PATULA SCHL. & CHAM.

PINUS PATULA Schlechtendal & Chamisso, *Linnaea* vi, 354 (1831); xii, 488 (1838).—Lambert, *Gen. Pin.* ed. 3, i, 36, t. 19 (1832); ed. 1, iii, text and plate (1837).—Loudon, *Arb. et Frut. Brit.* iv, 2266, fig. 2175 (1838); *Encycl. Trees & Shrubs*, 992, fig. 1856 (1842).—Antoine, *Die Conif.* 35, t. 16, fig. 2 (1840).—Endlicher, *Syn. Conif.* 157 (1847).—Parlatore, *DC. Prodr.* xvi, pt. 2, 397 (1868).—Hemsley, *Bot. Biol. Cent. Am.* iii, 189 (1883);—*Gard. Chron.* ser. 2, xxiii, 108, figs. 19, 20, 22 (1885).—Veitch, *Man. Conif.* ed. 2, 355 (1900).

Leaves with persistent sheaths, in fascicles of 3, sometimes 4 or 5, 15–30 cm. long, slender, pendent, serrate; resin ducts medial, occasionally internal; hypoderm weak and inconspicuous. Conelets lateral, long-pedunculate, single or in clusters of 2–12, their scales tumid, transversely carinate, armed with a delicate deciduous prickle. Cones sessile, reflexed, oblique, conical, 6–9 cm. in length, persistent; apophyses tumid, unequally developed, of a glossy dark brown color. Seed-wing somewhat thickened at the base. Branchlets multinodal, pruinose, slender, the cortex deciduous, scaly and red for many years.

A tree 12–15 meters in height, with long, slender branches, red upper trunk, persistent clustered cones and slender drooping leaves. Growing in warm temperate altitudes of central and eastern states and associated with *P. teocote*.

Nelson, 289 (398550, 347472) Mt. Orizaba; 3936 (398605) Pinal des Amoles, Querétaro; 3938 (398606) Encarnacion, Hidalgo.—*Goldman*, 16 (324779) Huauchinango, Puebla.—*Rose & Hough*, 4291 (346234–5) Las Vigas, Vera Cruz.—*Rose, Painter & Rose*, 8481 (451973) Encarnacion, Mexico.—*Pringle*, 7835, Jalapa, Vera Cruz; 8785, Honey, Hidalgo.

PLATE XXII.

- | | |
|-----------------------------------|--------------------------|
| Fig. 1. Leaves and buds. | Fig. 5. Cone from Honey. |
| " 2. Leaf-section, magn. 30 diam. | " 6. Seeds. |
| " 3. Clustered conelets. | " 7. Branch reduced. |
| " 4. Cone from Honey. | " 8. Open cone. |

18. PINUS CONTORTA DOUGL.

PINUS CONTORTA Douglas, ex *Loudon Arb. et Frut. Brit.* iv, 2292, fig. 2211 (1838); *Encycl. Trees & Shrubs*, 975, fig. 1815 (1842).—Endlicher, *Syn. Conif.* 168 (1847).—Parlatore, *DC. Prodr.* xvi, pt. 2, 381 (1868).—Sargent, *Silva N. Am.* xi, 89, t. 567 (1897); *Man. Trees N. Am.* 26, fig. 27 (1905).—Britton, *N. Am. Trees*, 27, fig. 20 (1908).—Sudworth, *Forest Trees Pacif. Slope*, 49, figs. 15, 16 (1908).

PINUS MURRAYANA, *Oreg. Comm.* 2, fig. (1853).

Leaves in fascicles of 2, 3–8 cm. long. Cone small, 5–6 cm. in length, lustrous ochre-brown, oblique, persistent, serotinous. Branchlets multinodal.

One locality only; common north of the United States boundary in western North America.

Goldman 1220 (565126) San Pedro Martir Mts., California Baja.

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Names of admitted species are in roman type, of synonyms in italics.

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	<i>cembroides</i> var. <i>monophylla</i> Voss	5		<i>oocarpa</i> var. <i>microphylla</i> Shaw	27
	<i>cembroides</i> var. <i>Parryana</i> Voss	6		<i>oocarpoides</i> Lindl.	26
	<i>chihuahuana</i> Engelm.	14		<i>orizabae</i> Gord.	19
	<i>contorta</i> Dougl.	29		<i>osteosperma</i> Engelm.	5
	<i>deflexa</i> Torr.	24		<i>Parryana</i> Engelm.	6
	<i>Devoniana</i> Lindl.	21		<i>patula</i> Schl. & Cham.	29
	<i>Donnell-Smithii</i> Mast.	23		<i>patula</i> Seem.	15
	<i>edulis</i> Engelm.	6		<i>patula</i> var. <i>macrocarpa</i> Mast.	28
	<i>Ehrenbergii</i> Endl.	22		<i>patula</i> β <i>Stricta</i> Benth.	28
	<i>Engelmanni</i> Carr.	24		<i>Pinceana</i> Gord.	7
	<i>filifolia</i> Lindl.	21		<i>ponderosa</i> Dougl.	24
	<i>flexilis</i> James	12		<i>ponderosa</i> var. <i>arizonica</i> Shaw	24
	<i>flexilis</i> var. <i>reflexa</i> Engelm.	12		<i>ponderosa</i> var. <i>Jeffreyi</i> Vasey	24
	<i>Fremontiana</i> Endl.	5		<i>ponderosa</i> var. <i>macrophylla</i> Shaw	24
	<i>Gordoniana</i> Hartw.	21		<i>Pringlei</i> Shaw	25
	<i>Greggii</i> Engelm.	28		<i>pseudostrobus</i> Lindl.	19
	<i>Grenvilleae</i> Gord.	21		<i>pseudostrobus</i> var. <i>apulcensis</i> Shaw	19
	<i>Hartwegii</i> Lindl.	23		<i>pseudostrobus</i> var. <i>tenuifolia</i> Shaw	20
	<i>Hartwegii</i> Parl.	22		<i>quadriifolia</i> Sudw.	6
	<i>Jeffreyi</i> Murr.	24		<i>reflexa</i> Engelm.	12
	<i>Lambertiana</i> Dougl.	12		<i>rudis</i> Endl.	22
	<i>Lawsoni</i> Roezl	18		<i>Russelliana</i> Lindl.	21
	<i>latisquama</i> Engelm.	7		<i>strobiformis</i> Engelm.	11
	<i>leiophylla</i> Benth.	17		<i>strobiformis</i> Sudw.	12
	<i>leiophylla</i> Schl. & Cham.	13		<i>tenuifolia</i> Benth.	20
	<i>leiophylla</i> var. <i>chihuahuana</i> Shaw	14		<i>teocote</i> Schl. & Cham.	16
	<i>Lindleyana</i> Gord.	22		<i>teocote</i> var. <i>macrocarpa</i> Shaw	17
	<i>Llaveana</i> Schiede	5		<i>Veitchii</i> Roezl.	10
	<i>Loudoniana</i> Gord.	10		<i>Winchesteriana</i> Gord.	21



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