Identification of Silica Present in the Giant-Reed (*Arundo donax* L.)[1]

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INTRODUCTION

The giant-reed (*Arundo donax* L.), known in Spanish as *caña de Castilla*[3], is of the family Gramineae, and is the sole source of material used for the manufacture of reeds for woodwind instruments. Other uses of this grass are described elsewhere in the literature (*9*).[4] The giant-reed has been reported from Puerto Rico (*1*), and is predominant along river banks of the south coast (*3*).

Silicon usually occurs in plants in the form of its oxide, SiO_2, commonly called silica. High silica content of the internodes of the giant-reed is considered undesirable for reed manufacture (*2*). Jayme and Harders-Steinhausen (*4*), studying the cellulose content of the giant-reed for paper manufacture, reported a 1- to 2-percent content of silica in the culms. These highly silicified cells are associated with the vascular bundles and also located in the epidermal tissue. Silica in the form of opal has been reported in sorghum (*5*, *8*), corn, wheat, bamboo, and sunflower (*5*).

Opal and α-quartz have been reported to occur in lantana (*5*), strawberry (*6*), and black raspberry (*7*). The purpose of this investigation was to identify the type of silica present in the internodes, and to determine the silica content of *A. donax* L. grown in Puerto Rico.

MATERIALS AND METHODS

Culms of *A. donax* L. meeting specifications for the manufacture of single reeds were collected from areas along nine different rivers of south Puerto Rico. This material was air-dried, using the European system of curing (*9*). French-grown giant-reed material was also obtained and included in this study (*2*).

The method of Lanning *et al.* (*5*) was used to determine the percentage

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[3] This common name is also used in reference to *Gynerium sagittatum* Beauv.; the 2 plants should not be confused.

[4] Italic numbers in parentheses refer to Literature Cited, p. 62.

of silica in the internodes. This consisted of completely ashing samples of ground, oven-dried internodes at 700° to 900° C. The ash was repeatedly treated with hydrochloric acid to remove mineral impurities and the silica was determined gravimetrically.

Samples used in X-ray diffraction and petrographic-microscope studies were prepared using the same technique, except that the washed silicas were dried at 100° C.

X-ray diffraction patterns (*5*) were made on a North American Phillips diffractometer, utilizing nickel-filtered-copper radiation with a current

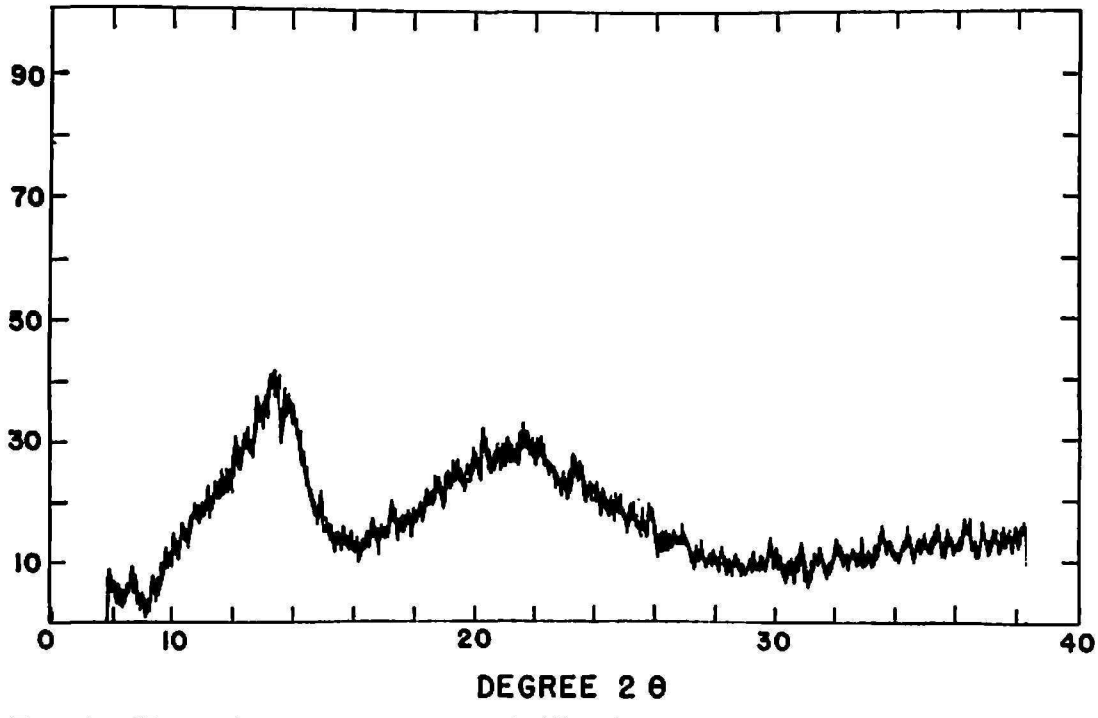

FIG. 1.—X-ray diffraction pattern of silica from culms (internodes) of the giant-reed, (*Arundo donax* L.).

setting of 40 kw. and 20 ma. A 1-degree slit system and a goniometer scanning speed of 1 degree 2-θ per minute were employed in conjunction with a chart-scale factor of 400 and a time constant of 4.

RESULTS AND DISCUSSION

Figure 1 is the X-ray diffraction pattern of silica from the internodes of the giant-reed. This is considered a typical pattern for opal. Identical X-ray diffraction patterns were obtained from the French material tested.

Petrographic-microscope studies of silica obtained from ash of the internodes of *A. donax* L. show that the silica is clear, colorless, and isotropic, with an index of refraction of 1.45. These are properties of mineral opal (*5*, *6*, *7*, *8*). Petrographic-microscope studies revealed that silica from the French-grown material also was opal.

The silica content of 19 samples representing 9 different areas of the South Coast of Puerto Rico ranged from 0.92 to 2.03 percent. The French-grown material averaged 0.64 percent of silica. Plants accumulate silica with age, usually depositing it in cells not engaged in active growth. In France, the giant-reed is grown as a crop and harvested yearly, usually in June. There was no practical way of determining the age of the uncultivated Puerto Rico material tested, therefore, it cannot be said, until material of known age is tested, whether the local giant-reed is suitable for industrial use.

SUMMARY

The silica content of the internodes of the giant-reed (*Arundo donax* L.) grown under our conditions was determined as being 0.92 to 2.03 percent. Through the employment of X-ray diffraction patterns and petrographic-microscope studies the silica present in the internodes was identified as mineral opal, being clear, colorless, and isotropic, with an index of refraction of 1.45.

RESUMEN

Los entrenudos de la caña de Castilla (*Arundo donax* L.) que crece bajo nuestras condiciones ambientales, contiene de 0.92 a 2.03 por ciento de sílice. Mediante la determinación de los patrones de difracción de rayos X y estudios petrográficos con microscopio, el sílice presente en los entrenudos fue identificado como el mineral ópalo, siendo éste semitransparente, incoloro o isotrópico con un índice de refracción de 1.45.

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