juntos a los de caliza y pH. La correlación entre los dos métodos es buena ($r = +0{,}970$). El método de incineración da generalmente valores superiores, siendo su línea de regresión $X = 0{,}93Y - 1{,}15$; la correspondiente al de Walkley Black es $Y = 1.007X - 0{,}964$. Estos resultados se encuentran en buen acuerdo con los de Ball (1) y Davies (2).

En el Cuadro 2 se presentan las desviaciones de los valores de materia orgánica calculados con el factor obtenido y al mismo tiempo los encontrados por incineración, así como la desviación media, que resulta ser d: ±, 0,56.

Conclusiones

1ª—Comprobamos que el pH y los carbonatos no influyen significativamente en los resultados.

2ª—Existe una buena correlación entre los dos métodos.

3ª—El factor de conversión a porcentaje de materia orgánica por incineración, resulta de multiplicar los valores obtenidos por el método de Walkley-Black por 1,35.

4ª—Utilizando directamente lecturas fotométricas de 0 a 10, el factor de paso es 0,904 para obtener porcentajes de materia orgánica. Las lecturas son las correspondientes a 1 g de suelo seco.

Resumen

Se establece un factor de conversión entre los métodos de Walkley-Black y el de incineración, para la determinación de la materia orgánica en suelos de la isla de Gran Canaria. En el primero, la materia orgánica es oxidada con dicromato de potasio y ácido sulfúrico concentrado, midiendo el Cr (III) producido fotocolorimétricamente; en el de incineración, que se toma como referencia, se mantiene la muestra de suelo a 430°C. durante ocho horas. Se encuentra buena correlación entre ambos métodos, con un coeficiente de 0,970. El factor de conversión en las condiciones ensayadas es 1,35.

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REFERENCIAS

1 BALL, D. F. Loss-on-ignition as an estimate of organic matter and carbon in non-calcareous soils. Journal of Soil Science 15: 84-92. 1964.

2 DAVIES, B. E. Loss on ignition as an estimate of soil organic matter. Soil Science of America Proceedings 38:150. 1974.

3 GRAHAN, E. R. Determination of soil organic matter by means of a photoelectric colorimeter. Soil Science Society of America Proceedings 65:181-183. 1948.

4 MITCHELL, J. The origin, nature, and importance of soil organic constituents having base exchange properties. Journal of the American Society of Agronomy 24:256-275. 1932.

5 WALKLEY, A. y BLACK, I. A. An examination of the Degtjareff method for determining soil organic matter, and a proposed modification on the chromic acid titration method. Soil Science 37:29-38. 1934.

6 ———— An examination of methods for determining organic carbon and nitrogen in soils. Journal Agricultural Science 25: 598-609. 1935.

7 ———— A critical examination of a rapid method for determining organic carbon in soils; effect of variations in digestion conditions of inorganic soil constituents. Soil Science 63:251-264. 1947.

Germination of a pioneer tree (Trema guineensis Ficahlo) from Equatorial Africa

Sumario. Se presentan datos acerca de los factores que modifican la latencia y favorecen la germinación de las semillas de **Trema guineensis**; árbol pionero de Africa ecuatorial. Se demuestra que el almacenamiento a baja temperatura y el ácido giberélico reducen el tiempo de almacenamiento requerido para que cese la latencia endógena. Las semillas no latentes son fotoblásticas estrictas y presentan un alto poder germinativo.

Trema guineensis is a common tree in the tropical evergreen forest of equatorial Africa. This evergreen heliophyte may appear abundantly in newly abandoned fields of shifting agriculture and in other kinds of disturbed areas (2, 4), it grows very fast because of the lack of bud dormancy (1) and the peculiar branch growing pattern of this genera (5).

The available information on seed germination indicate that it is scarce and develops slowly (3) but more research is needed in order to find the germination trigger mechanisms that allows the tree to compete successfully with other pioneer plants during secondary succession.

Working with seeds of *T. guineensis* from Ivory Coast we found new and peculiar data on dormancy and germination that may help to explain the behaviour of this plant in the field.

Materials and Methods

Mature seeds were collected during October 1975, near the field station of Lamto, Ivory Coast. They were transported to the seed laboratory in México City, where they were stored in plastic bottles and kept at room temperature for a year (22° ± 3°C) or in a refrigerator at 2°C during 3 months.

Germination tests were always carried in Petri dishes on 1 per cent agar in distilled water. Gibberellic acid (GA) experiments were performed in the same way, but the agar contained 500 ppm GA. Fifty seeds were seeded per dish and each treatment required 300 seeds.

Constant and alternating temperatures in the germination chambers, employed during the first test after

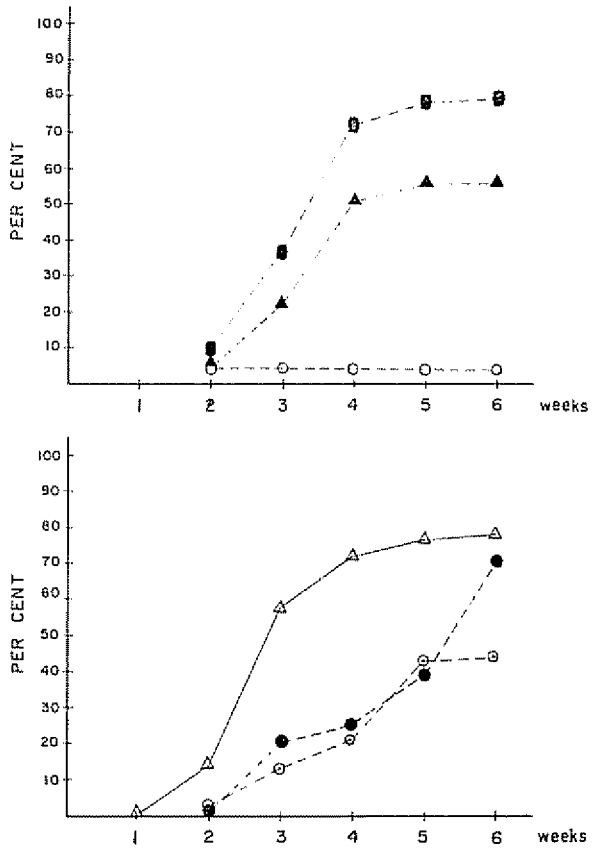

Fig. 1.—*The upper graphs show: white circles-germination after 6 months of storage at room temperature; black triangles-germination after 6 months of storage with gibberellic acid treatment; black squares-germination after 3 months of storage in cold chamber. The lower graphs show: white dotted circles-germination after 3 months of storage at room temperature; black circles-germination after 10 months of storage and gibberellic acid treatment; white triangles-germination after 12 months of storage*

1 month of storage, were 11°, 16°, 21°, 26°, 31°, 26°/16°, 21°/11° and 22°/28°C. The performed after 6, 10 and 12 months of storage were carried only at the alternating temperature 22°/28°C in a "Conviron" chamber (Controlled Enviroments).

Each treatment was repeated in white light (12 hours photoperiod) and complete dark and kept in the chambers for 60 days.

Results

During the first germination test performed after one month of storage, only 1 per cent of the seeds germinated in the 22°/28°C temperature condition. The seeds in other treatments did not germinate, even the treated with GA. After 6 months of storage at room temperature, similar results were obtained but GA and storage at low temperature promoted germination greatly. The seeds stored during 10 months at room temperature show an increase in germinability but GA still stimulate it. After a year the germination is similar with and without GA (Figure 1). No germination was observed in dark in any condition and time of storage.

Discussion

The seeds of *T. guineensis* are liberated with a strong endogenous dormancy that start to disappear arround 10 months later. GA treatment and storage at low temperature enable germination of dormant seeds before that time. These characteristic indicate the presence of a germination inhibitor in the seeds, because their behaviour in relation to GA and temperature is similar to that of several temperate species having a dormancy hormone (7).

The seeds in the field probably lie in the soil during the endogenous dormancy period and after that time they may germinate, if the light condition is appropriate, or continue in dormant state for longer time. The seeds in the soil of the forest probably germinate when the light quality change after a disturb in the coverture of the forest (6). In this way, the seeds of this species could explore their habitat in time and space efficiently.

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REFERENCES

1. COOMBE, D. E. An analysis of the growth of *Trema guineensis*. Journal of Ecology 48 (1): 219-231. 1960.
2. EVRARD, C. Recherches écologiques sur le peuplement forestier des sols hydromorphes de la cuvette centrale congolaise. Publication de L'Institute Nationale pour L'Etude Agronomique du Congo (Belgique). Serie Scientifique 110: 21-26. 1968.
3. MENSBRUGE, G. DE LA. La germination et les plantules des essences arborées de la forêt dense humide de la Cote D' Ivoire. Nogent sur Marne, France: Centre Technique Forestier Tropical, Publication 26. 1966. 381 p.
4. ROSS, R. Ecological studies on the rain forests of southern Nigeria. III. Secondary succession in the Shasha forest reserve. Journal of Ecology 42 (2): 259-282. 1954.
5. TOMLINSON, P. B. and GILL, A. M. Growth habits of tropical trees: Some guiding principles. In: Tropical forest ecosystem in Africa and America, a comparative review. Smithsonian tution of Washington Press. 1973. pp. 129-149.
6. VAZQUEZ-YANES, C. Seed dormancy and germination in secondary vegetation tropical plants: The role of light. Comparative Physiology and Ecology 1(1): 30-34. 1976.
7. WAREING, P. F., STADEN, J. VAN and WEBB, D. P. Endogenous hormones in the control of seed dormancy. In: Heydecker, W. (editor) Seed Ecology. London, Butterworths. 1973. pp. 145-155.