

# ADVENTROP, an interactive weed-identification database for Sudano-Sahelian Africa

**The Adventrop database includes the Adventrop Doc CD-ROM and flora guide "Adventrop. Weeds of Sudano-Sahelian Africa". These two information media are effective tools for identifying weeds of western and central Africa (Figure 1). This multimedia system represents a unique source of information in the field of tropical agriculture, directly accessible to specialists and non-specialists for field, laboratory, teaching and research use.**

**W**eeds, or "...unwanted plants that grow where they have not been intentionally planted" (OKIGBO, 1978), are very harmful to crops in developing countries of the tropics. Farmers in these regions spend more of their time trying to control weeds than in any other part of the world. Weed scientists, who focus their research on weeds and means of controlling them, are unfortunately not very present in these regions.

## Maintaining an ecological balance

Most cropping systems developed in Sudano-Sahelian Africa currently aim at boosting production, often to the detriment of the natural ecological balance. Weed control is too often just a defensive operation, aimed at protecting crops and obtaining a very general level of weed-control efficacy, i.e. crop-selective chemical and mechanical means. Instead, such control should involve rational operations to stall the development of weeds based on full knowledge of these species — in this way, the most suitable control techniques could be chosen. However, weed infestation and behaviour are highly variable and still not clearly understood, and it is not always possible to maintain weeds below a nuisance threshold. Moreover, repeated use of herbicides can promote selec-

tion of unsusceptible species, which are soon able to compete with the crops. This is generally due to a lack of knowledge of the weed flora: composition, species diversity, ecology and biology. Knowledge of these characteristics and their evolutions, as influenced by natural and phytotechnical factors, is an essential prerequisite for improving control methods (BARRALIS & CHADDOEUF, 1980; MAILLET, 1992).

The Adventrop Doc CD-ROM, developed by Grard *et al.* (1995) and the flora guide "Adventrop. Weeds of Sudano-Sahelian Africa" (LE BOURGEOIS & MERLIER, 1995) highlight weed problems from a multidisciplinary perspective. This package should help farmers, extension



Figure 1. The region covered by Adventrop Doc.

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agents and researchers in identifying weeds, while providing them with a more detailed understanding of growing conditions and promoting better control of invasive weeds and the agricultural environment.

These two information tools were developed on the basis of results of several years of study in cotton-growing regions of northern Cameroon. This region was chosen for its high diversity and the fact that the edaphic, climatic and agronomic conditions are representative of single rainy season savanna regions throughout western and central Africa.

## 142 important weeds

The Adventrop database describes and helps users identify 142 of the most important weeds encountered in cotton, maize, sorghum and groundnut cropfields. About 40 of these are very common and often abundant weeds that can cause high crop losses (Figure 2). About 50 are common species that generally grow alongside the main weeds, but they are not yet considered dangerous (Figure 3). The remainder are restricted to very specific environments and are less common. They are thus excellent ecological indicators (Figure 4). Some are closely related, in botanical terms, to more important species from which they have to be differentiated (Figure 5).

For each species, the official name is given along with the most common synonyms. There is a complete botanical description, which focuses on vegetative traits to enable identification of incomplete samples. This is illustrated with a botanical plate of all of the plant's organs, covering the entire growth cycle from plantlet to seed, along with colour photographs of adult plants, plantlets and specific *in situ* details. Each plant's behaviour, biology, distribution, ecology in Sudano-Sahelian regions, and growth cycle are also detailed. Ecological aspects specifically



Figure 2. *Tridax procumbens* Linnaeus.



Figure 3. *Dactyloctenium aegyptium* (Linnaeus) Palisot de Beauvois.

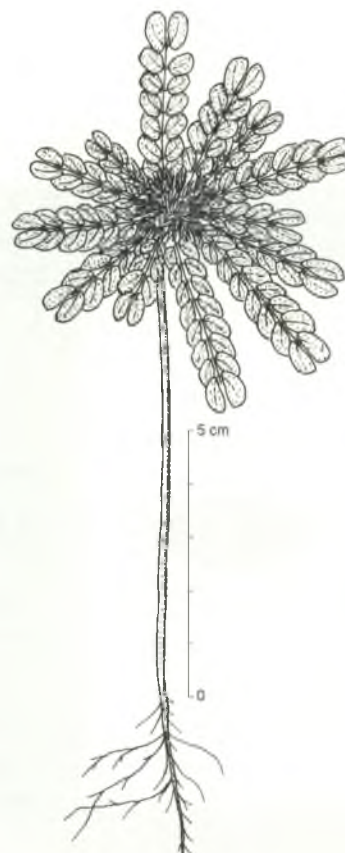


Figure 4. *Biophytum umbraculum* Welwitsch.

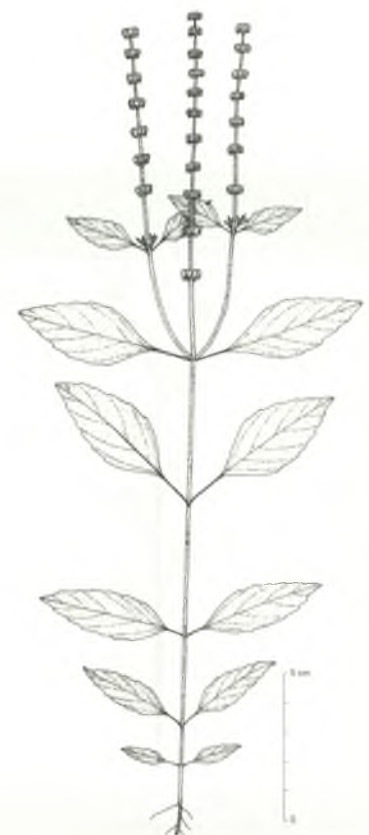


Figure 5. *Ocimum canum* Sims.

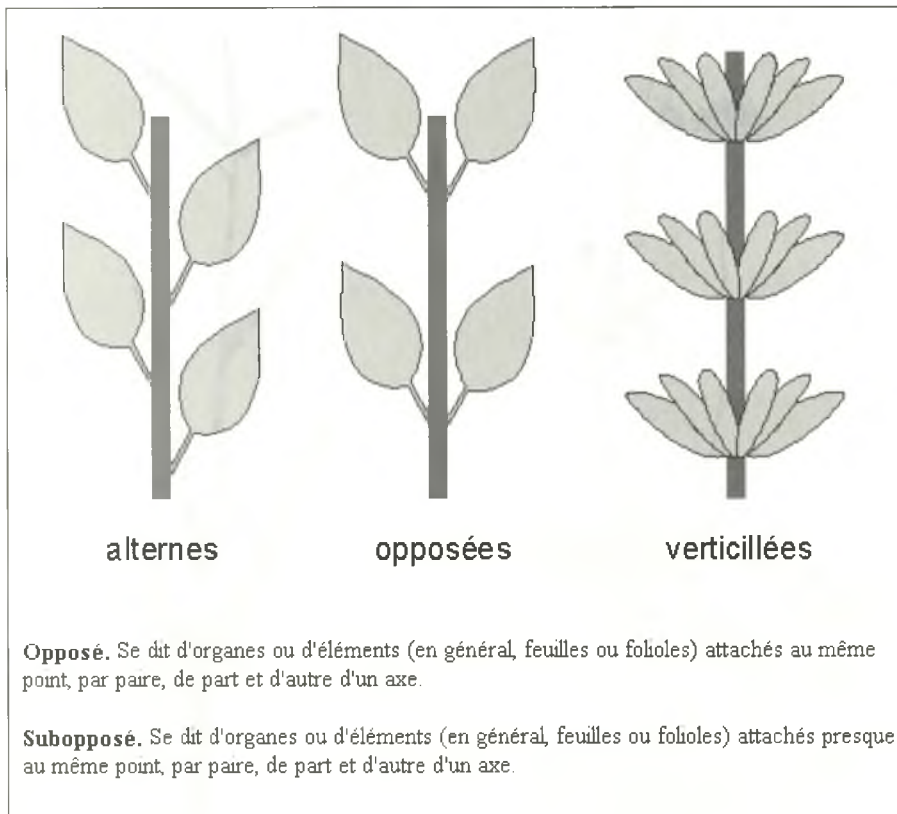


Figure 6. Illustrated glossary of definitions accessible through hypertext with associative trails.

concern the soil and climatic conditions required for growth, and the effects of different cropping systems on the extent of infestation. The phenological cycle is described with respect to the cropping calendar, while highlighting the effects of mechanical weeding.

A full glossary with colour illustrations explains all of the specialized botanical, meteorological and agronomic terms used in the descriptions (Figure 6).

## Adventrop Doc, an attractive interactive system

All of the data is integrated in the multimedia Adventrop Doc system on CD-ROM. In contrast to traditional approaches, this highly educational and fully illustrated interactive product provides easy and particularly lively access to flora.

The CD-ROM includes a species identification module linked to a database. Weeds are identified graphically by building a profile portrait of the plant (Figure 7). This method has several advantages:

- it only involves drawings, with no technical terminology;
- the user chooses which traits to describe;
- incomplete samples can be identified, as missing information is tolerated;
- observation errors are also tolerated.

At each step of the identification process, a probability of resemblance is calculated for each species. The most likely species are then listed in descending order of resemblance (Figure 8).

The user has access to the botanical plates, photographs and descriptive texts at all times, and they can also be printed (Figure 9). All technical terms are managed in hypertext with associative trails to illustrated definitions in the glossary.

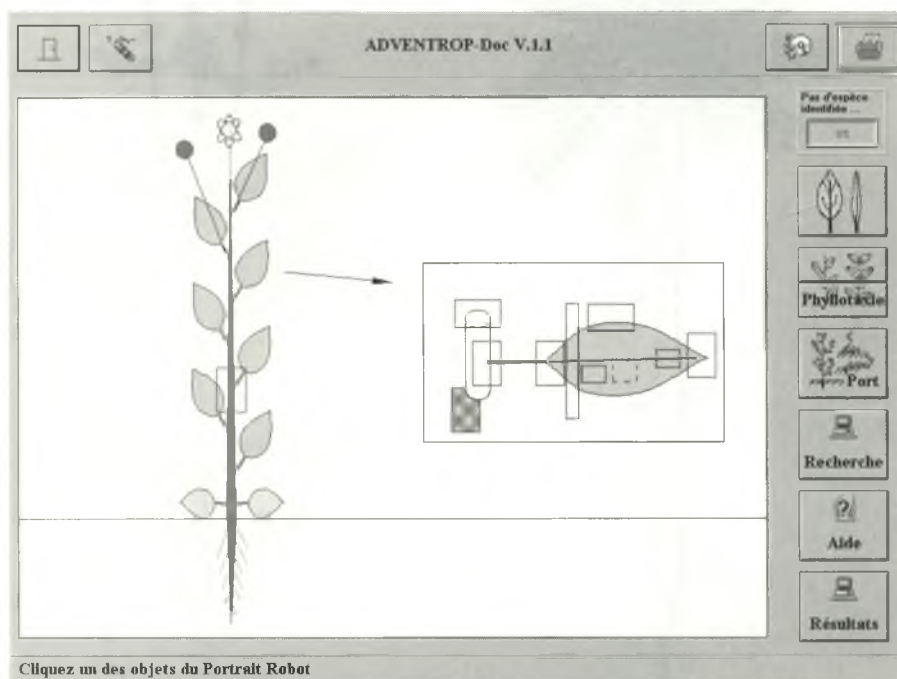


Figure 7. Profile-portrait identification.

The user, when uncertain as to which trait to describe, can ask the program to choose the most pertinent ones. When a species has been identified with a probability of less than 100%, the profile portrait highlights which traits are inadequately described (Figure 10).

No special computer skills are required to use *Adventrop Doc*: an on-screen icon bar gives the user access to all options, which can be selected by simply clicking on the chosen icon button.

## Conclusion and prospects

*Adventrop Doc*, including a book and CD-ROM in French, is a very complete package. The hardcopy flora guide is easy to use in the field, and accessible to those who are not yet equipped with a computer and CD-ROM drive. The interactive CD-ROM system is designed mainly for educational, research and development institutes, and represents an efficient research, extension and training tool.

The information offered by this package should help in developing rational weed control practices that are adjusted to each specific situation. Indeed, users should gain a great deal of knowledge on the major weeds and conditions required for their growth. Some species are good indicators of the fertility or degradation status of the soil, the history of the plot and cropping systems. These so-called weeds could also become essential elements for understanding cropping systems: "plants for which man has not yet found a use" (ANDERSON, 1977).

This database will be progressively updated with other weed species from the same region. In addition, this research is of considerable interest and should be extended into other regions of the world.



Figure 8. Species listed in descending order of resemblance.



Figure 9. Access to all information.

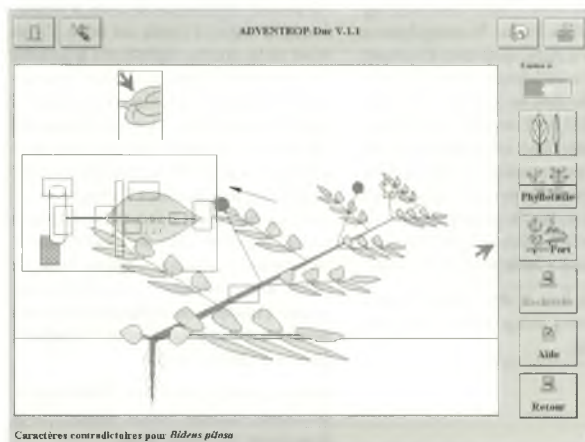


Figure 10. Identification of inadequately described traits.

## Equipment and distribution

### Computer equipment

The following computer hardware/software is required to run the *Adventrop Doc* CD-ROM:

- a PC computer with a 386 processor or above;
- 4 Mb RAM (or 8 Mb for more rapid access);
- 1 to 16 Mb free hard disk space, depending on the installation mode chosen;
- 256 colour video display;
- CD-ROM drive;
- Windows (3.1 or 95) and a mouse.

### Distribution

The *Adventrop Doc* package includes a CD-ROM and user's guide. The inclusive purchase price is 2 000 FF. A free copy of the flora guide "Adventrop. Weeds of Sudano-Sahelian Africa" is given with each CD-ROM ordered.

The flora guide can be purchased separately for 350 FF (inclusive price).

The package is distributed by the documentation service of CIRAD-CA (SPID), BP 5035, 34032 Montpellier Cedex 1, France.

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### Internet connection

For readers connected to Internet, a demonstration version of *Adventrop Doc* can be browsed on the CIRAD WWW (World Wide Web) site at the following URL (Uniform Resource Locator) address: <http://www.cirad.fr>

## Abstract... Résumé... Resumen

T. LE BOURGEOIS, P. GRARD, H. MERLIER — **Adventrop, an interactive weed-identification database for Sudano-Sahelian Africa.**

The multimedia *Adventrop-Doc* system on CD-ROM and the document "Adventrop. Les adventices d'Afrique soudano-sahélienne" (*Adventrop. Weeds of Sudano-Sahelian Africa*) are two complementary tools for identifying crop weeds in western and central Africa. Together they represent a unique source of information in the field of tropical agriculture which is accessible to specialists and nonspecialists for field, laboratory, teaching and research use. 142 weeds that are found in fields of cotton, maize sorghum and groundnut are described. This package focuses on vegetative traits to enable identification of incomplete samples. Details on the behaviour, biology, distribution and ecology of the plants are given. The *AdventropDoc* database on CD-ROM (for PC computers) includes a species identification module. Weeds can be identified from drawings through a process involving tree choices and error management, without any technical terminology with autocorrection. At any time, the user can gain access to and print botanical drawings, photographs and descriptions. This software package is distributed by CIRAD in French.

Keywords: weed, flora, CD-ROM, software program, identification, botany, biology, ecology, growth cycle, tropical zone, Africa.

T. LE BOURGEOIS, P. GRARD, H. MERLIER — **Adventrop, une base de connaissance interactive des adventices en Afrique soudano-sahélienne.**

Le système multimédia sur CD-ROM, *Adventrop Doc*, et l'ouvrage "Adventrop. Les adventices d'Afrique soudano-sahélienne" constituent deux outils complémentaires d'identification des mauvaises herbes des cultures en Afrique de l'Ouest et du Centre. Leur combinaison offre un matériel unique en agriculture tropicale, accessible aux non spécialistes et aux praticiens dans toutes les situations : terrain, laboratoire, enseignement et recherche. Les 142 adventices rencontrées dans les champs de cotonnier, de maïs, de sorgho et d'arachide sont décrites. L'accent est mis sur les caractères végétatifs afin de permettre la reconnaissance d'échantillons incomplets. Le comportement, la biologie, la répartition, l'écologie dans les régions soudano-sahéliennes et le cycle de développement sont détaillés. Le CD-ROM *Adventrop Doc* (pour micro-ordinateur compatible IBM-PC) comprend un module d'identification des espèces couplé à la base de connaissance. Un portrait-robot de la plante est constitué selon un processus permettant le libre choix des caractères, la gestion des erreurs, l'absence de terminologie technique et l'autocorrection. A tout moment, il est possible d'accéder aux dessins botaniques, aux photographies et aux textes descriptifs et de les imprimer. L'ensemble du produit est diffusé par le CIRAD en français.

Mots-clés : mauvaise herbe, flore, CD-ROM, logiciel, identification, botanique, biologie, écologie, cycle de développement, zone tropicale, Afrique.

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T. LE BOURGEOIS, P. GRARD, H. MERLIER — **Adventrop, una basa de conocimientos completa e interactiva de las plantas adventicias en África sudano-saheliana.**

El sistema multimedia en CD-ROM *Adventrop Doc* y la obra "Adventrop. Las adventicias de África sudano-saheliana" constituyen dos herramientas complementarias de identificación de las malezas de los cultivos en África occidental y central. La combinación de ambos soportes de información ofrece un material único en agricultura tropical, accesible a los no especialistas y los prácticos en todas las situaciones: terreno, laboratorio, enseñanza e investigación. Se describen las 142 adventicias encontradas en los campos de algodón, maíz, sorgo y cacahuete. Esta presentación subraya los caracteres vegetativos para permitir el reconocimiento de muestras incompletas. También se detallan el comportamiento, la biología, la distribución, la ecología en las regiones sudano-sahelianas y el ciclo de desarrollo. El CD-ROM *Adventrop* (para computadoras personales compatibles IBM) incluye un módulo de identificación de las especies asociado a la base de conocimientos. La identificación se hace de manera gráfica mediante la constitución de un retrato-robot de la planta, según un proceso que permite la libre elección de caracteres, la gestión de errores, la ausencia de terminología técnica y la corrección automática. En cualquier momento, es posible acceder a los dibujos botánicos, las fotografías y los textos descriptivos e imprimirlos. El producto es difundido por el CIRAD en francés.

Palabras clave: maleza, flora, CD-ROM, software, identificación, botánica, biología, ecología, ciclo de desarrollo, zona tropical, África.