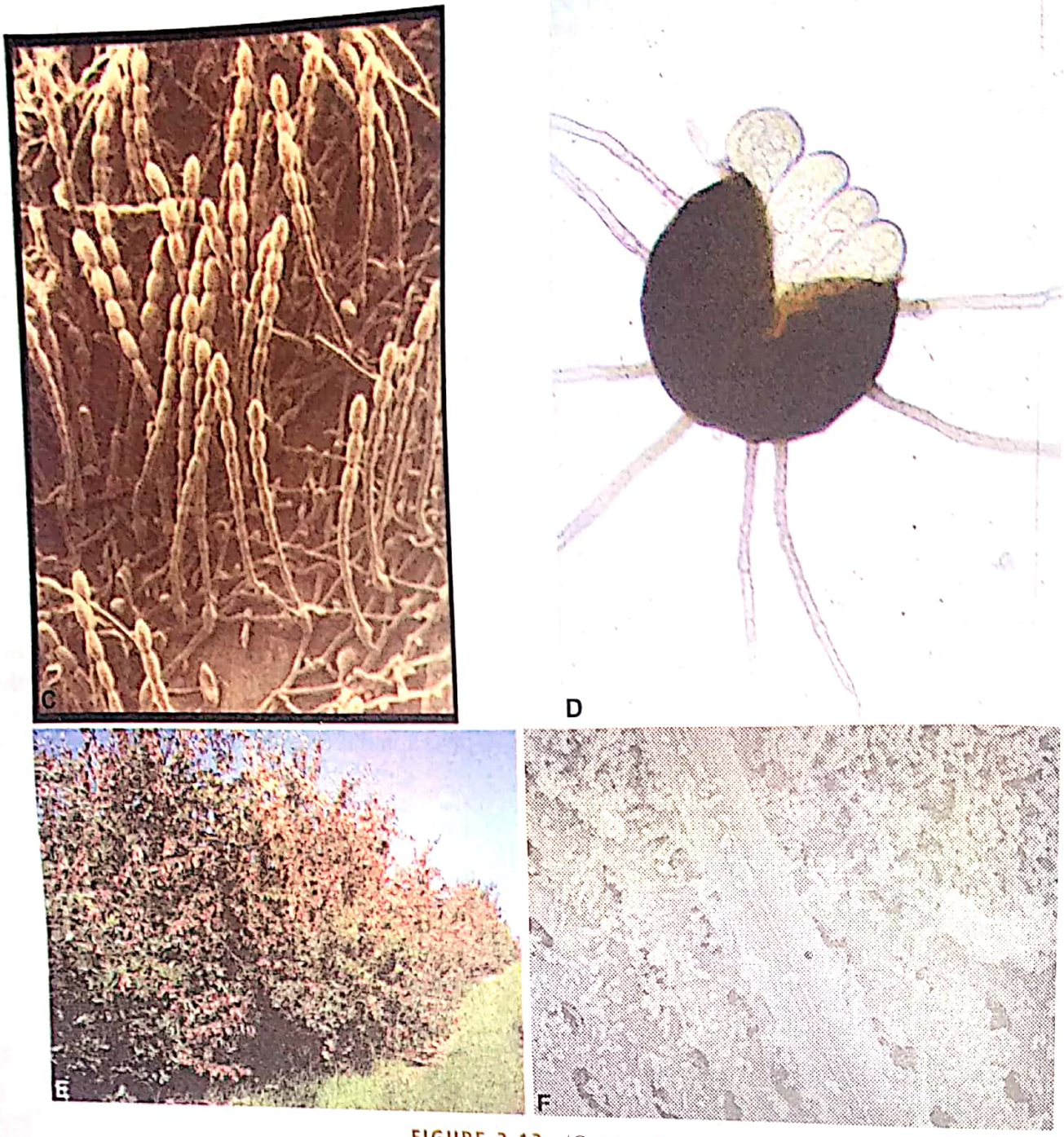

FIGURE 2-13 (*Continued*)

produce spores on, or just below, the surface of the infected area of the host, and the spores are released outward into the environment. Plant pathogenic plasmodiophoromycetes, however, such as the clubroot pathogen and fungi causing vascular wilts, produce spores within the host tissues, and these spores are not released outward until the host dies and disintegrates. Parasitic higher plants produce their seeds on aerial branches, and some nematodes lay their eggs at or near the surface of the host plant. Bacteria reproduce between or, in xylem- or phloem-inhabiting bacteria, within host cells (Fig. 2-13F), generally inside the host plant; they come to the host surface only through wounds, cracks, stomata, and so on. Viruses, viroids, mollicutes, protozoa, and fastidious bacteria reproduce only inside cells and apparently do not reach or exist on the surface of the host plant.

The rate of reproduction varies considerably among the various kinds of pathogens, but in all types, one or a few pathogens can produce tremendous numbers of individuals within one growing season. Some fungi produce spores more or less continuously (Fig. 2-14), whereas others produce them in successive crops. In either case, several thousand to several hundreds of

FIGURE 2-14 Invasion and reproduction of oomycete and fungal plant pathogens. Sporangiophores and sporangia (A) on the underside of a grape leaf infected with the grape downy mildew pathogen *Plasmopara viticola* and (B) on the root of a lettuce plant infected with *Plasmopara lactucae-radicis*. (C) A wheat leaf showing numerous infection lesions (uredia) of the leaf rust fungus. (D) Uredospores of the soybean rust. (E) Leaves of three barley varieties showing infection lesions, the severity (number and size) of which are inversely proportional to the degree of resistance of each variety to the fungal pathogen. (F) Spores of the fungus *Cochliobolus* that cause leaf spot on barley. [Photographs courtesy of (A) J. Rytter and J. W. Travis, Pennsylvania State University, (B) M. E. Stanghellini, University of California, Riverside, and (E) B. Steffenson, University of Minnesota.]