

Airborne Fungal Spores, Pollen Grains, and Vegetable Cells in Routine Papanicolaou Smears

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The objective was to demonstrate the presence of airborne fungal spores, pollen grains, and vegetable cells in smears and establish their significance. Microscopic examination was of smears stained by the Papanicolaou technique. We found several types of airborne spores (Alternaria, Exserohilum, Aspergillus, Cladosporium, Epicoccum, Curvularia, and Ascosmycete), pollen grains (Lilium, bullrush, Pinus, Acacia, hazelnut, and oak), and several types of vegetable cells. The existence of these structures may be due to intrinsic or to extrinsic contamination of the sample. Anemophilous fungi spores and pollen grains have been shown to possess great allergenic capacity. Pollen grains and vegetable cells may be mistaken for certain microorganisms or malignant cells. Diagn. Cytopathol. 2004;30:381–385.

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From observation of cytological smears under the microscope, we have found a variety of spores of several species of fungi, different kinds of pollen grains, and also a number of vegetable cells.

There are certain kinds of fungi (anemophilous fungi) the spores of which are airborne. These gather in damp areas of rooms, in cellars and basements, drainpipes, and food stores, among others. Examples of these species are *Alternaria*, *Cladosporium*, *Aspergillus*, etc. (Figs. 1 and 2) Besides provoking

contamination, these spores may also be inhaled and then deposited in various parts of the respiratory tract.

Pollen grains are microscopic masculine cells that come from flower-bearing plants and also trees, crops, and shrubbery. Pollen grains are mono- or multicellular, with a variety of sizes and shapes (Fig. 3). They are enclosed in two layers: the external, or exine, and the internal, or intine. The external layer (exine) may be smooth or rough, with warts, grains, or troughs. These characteristics permit identification.

Vegetable cells are similarly organized in the human body and that of other animals, being differentiated by tissues. Depending on the kind of tissue (merismatic, conductor, etc.), the vegetable cells may present a wide variety of sizes and shapes (Fig. 4).

In the case of sputa and nasal emissions, the existence of these structures may be due to intrinsic contamination of the sample (already present in the cytological smears before staining, either as a result of inhalation or oral contamination), or to extrinsic contamination (deposited in the smear during staining). In the case of cervical-vaginal exploration, there is generally an extrinsic contamination, although fecal contamination may also appear in the sample.

Anemophilous fungi spores have been shown to possess great allergenic capacity; they are involved in the development of diseases such as asthma or allergic rhinitis.

There exists a specialty, forensic palinology, the principal concern of which is the study of pollen grains and spores so as to provide evidence or proof of harmful activities. The understanding of the microscopic characteristics of vegetable cells has also played an important part in this specialty.

Finally, pollen grains may be mistaken for protozoa cysts, worm's eggs, certain species of algae, and noncellular structures such as calcareous deposits. Occasionally, the vegetable cells may be mistaken for malignant ones or for certain microorganisms such as fungi, nematodes, etc.

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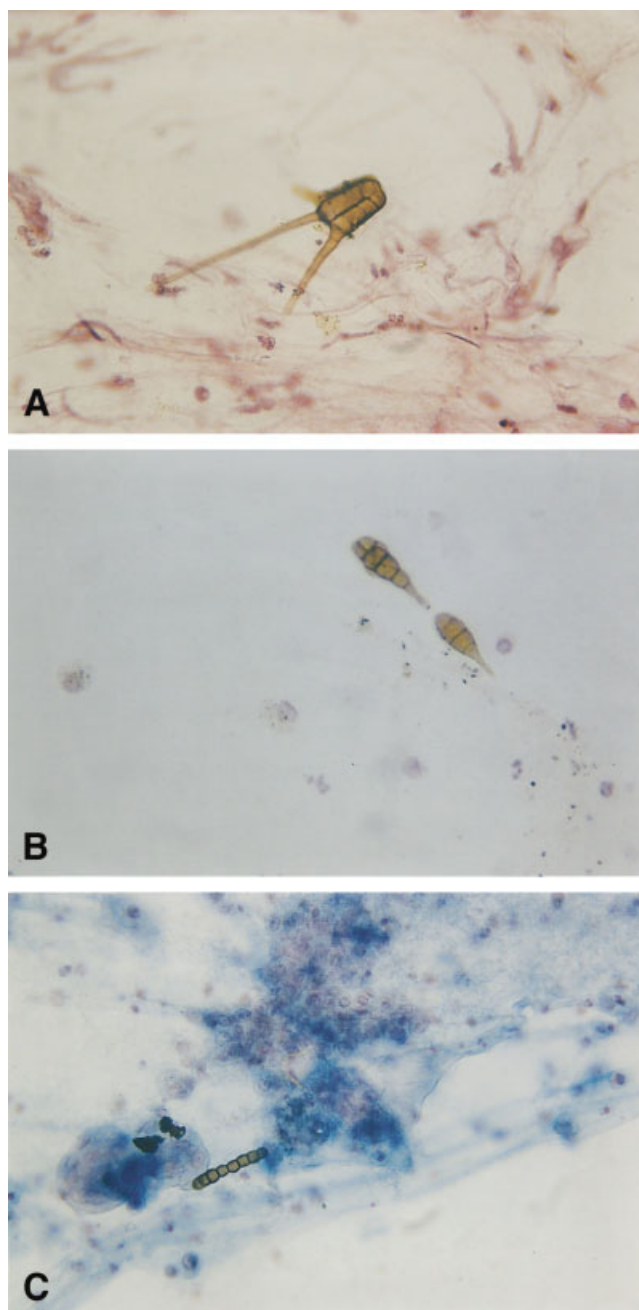


Fig. 1. *Alternaria* in sputum smears. Although its normal morphology is that of a racket-shaped conidia, with longitudinal and transversal supports inside, it may occasionally adopt different forms. **A,B:** Conidium (Papanicolaou stain, $\times 400$). **C:** Short chain of spores (Papanicolaou stain, $\times 400$).

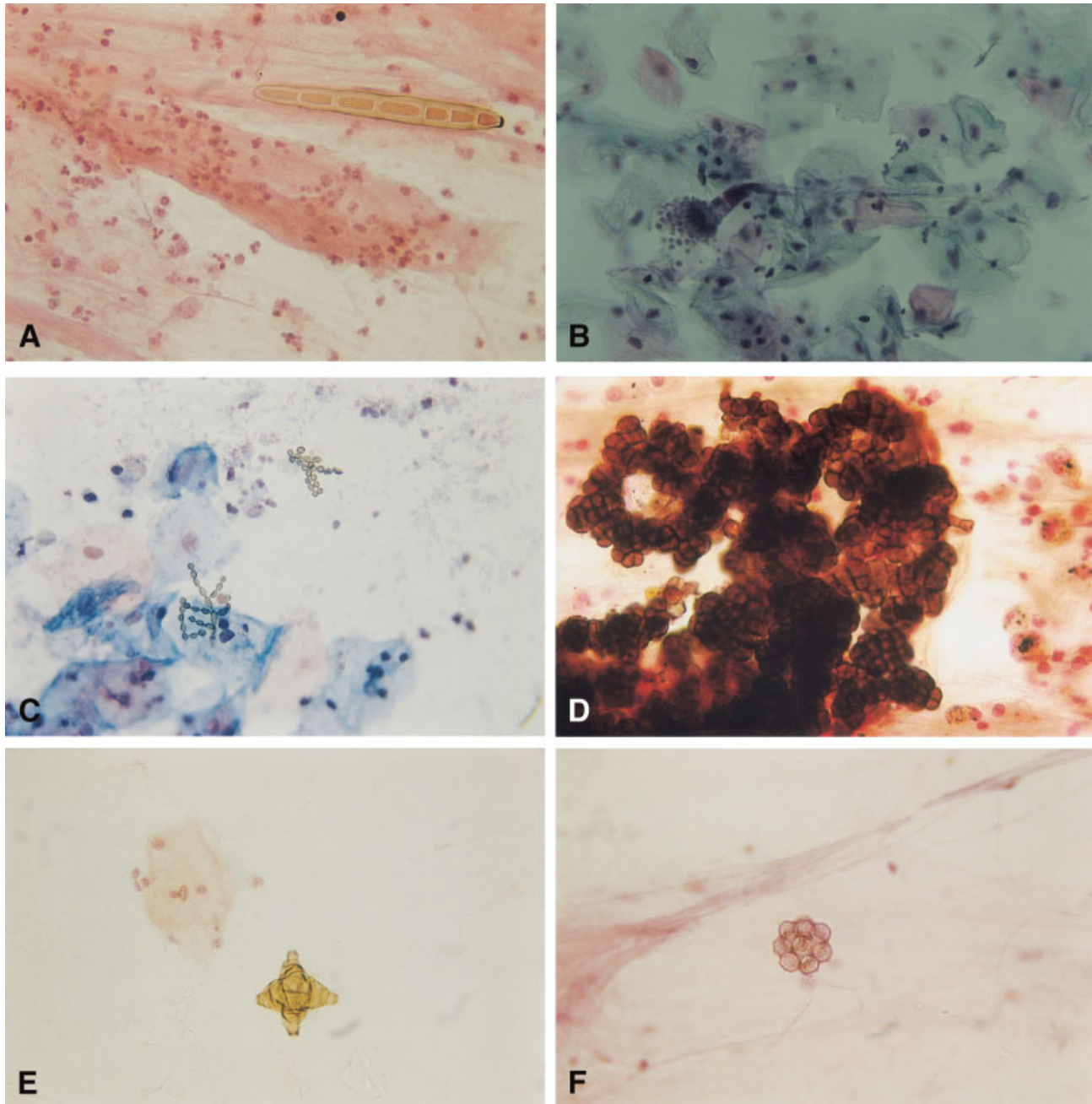


Fig. 2. Airborne spores in smears. **A:** *Exserohilum* or *Drechslera*-type spores (*Drechslera*, *Bipolaris*, *Helminthosporium*) in a nasal emission. Extended macroconidia is seen, in which the cells are separated by thick walls (Papanicolaou stain, $\times 400$). **B:** *Aspergillus* in a cervicovaginal smear. The characteristic conidiphore is observed, perpendicular to the surface of which short conidia chains emerge. This morphology may sometimes be difficult to distinguish from *Penicillium* (Papanicolaou stain, $\times 400$). **C:** *Cladosporium* in a cervicovaginal smear. The spores form chains with short branches (Papanicolaou stain, $\times 400$). **D:** *Epicoccum* in sputum. Numerous septate spores are observed; the cells are forming round structures (Papanicolaou stain, $\times 400$). **E:** *Curvularia* in sputum. Two overlaid conidia are seen, with transversal supports and the typical crescent or "croissant" form (Papanicolaou stain, $\times 400$). **F:** *Ascospore* in sputum (possibly *Eremascus albus* or similar). We can see a group of round spores, moruliform in appearance. These are usually contained in sacs known as ascos (Papanicolaou stain, $\times 400$).

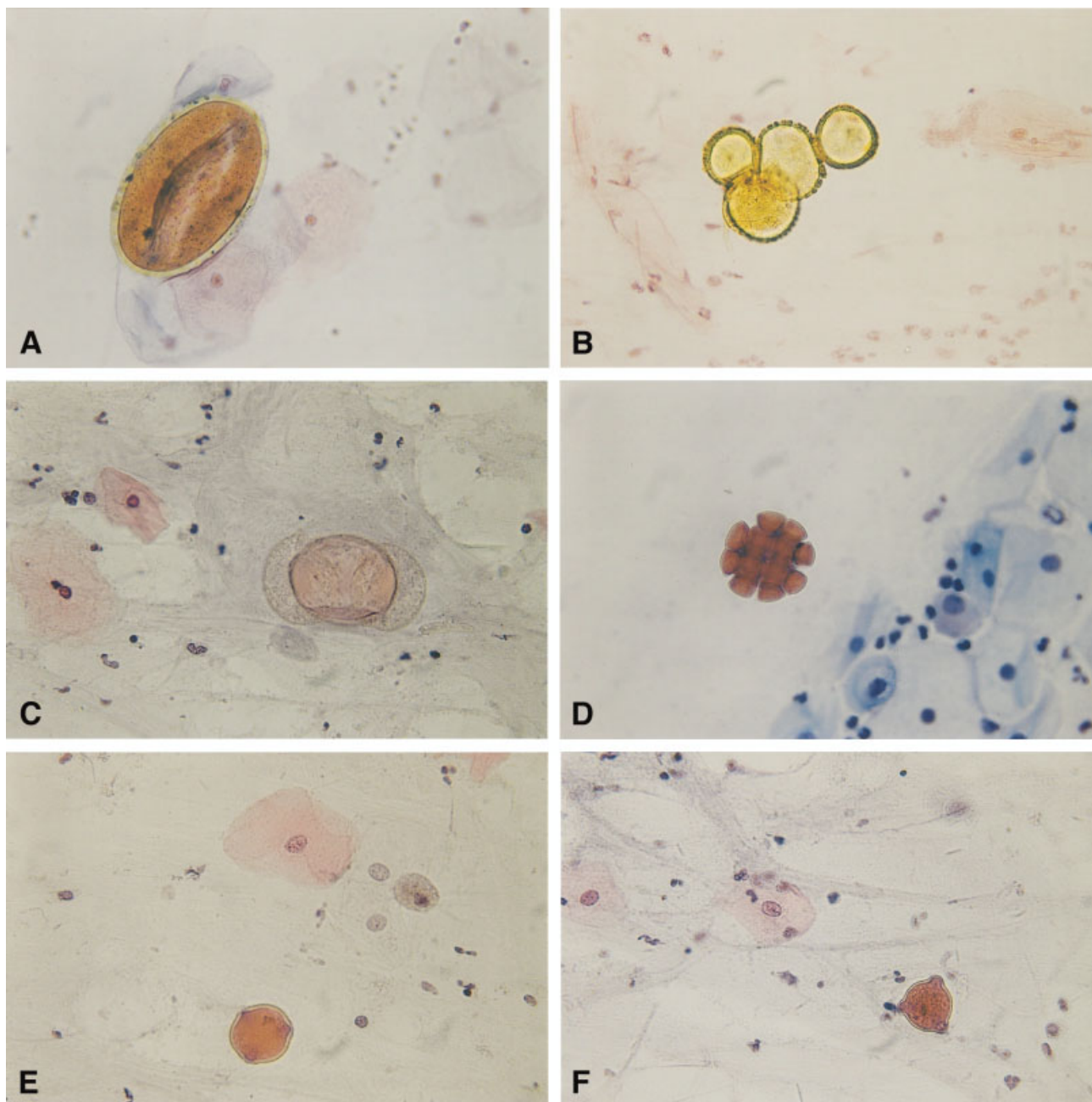


Fig. 3. Pollen grains in smears. **A:** Pollen of the genus *Lilium*, belonging to the *Liliaceae* family, in a cervicovaginal smear. The grain is large, ovoid, and with a notable fold on the surface (Papanicolaou stain, $\times 400$). **B:** Herbaceous pollen (possibly bullrush), of the genus *Typha*, in sputum. The grains are round, of medium size, with a coarse exine and of granular appearance (Papanicolaou stain, $\times 400$). **C:** Pollen of the genus *Pinus*, belonging to the *Pinaceae* family, in sputum. The grains are large and form a central body with two lateral airborne sacs that favor their dispersion (Papanicolaou stain, $\times 400$). **D:** Pollen of the genus *Acacia*, belonging to the *Leguminosae* family, in a cervicovaginal smear. The structure is of various grains (8, 16, or 32 cells), of medium size (Papanicolaou stain, $\times 400$). **E:** Pollen of the genus *Corylus* (possibly hazelnut), belonging to the *Betulaceae* family, in sputum. Small to medium-sized grains, round in shape, and with three apertures or pores on the surface (Papanicolaou stain, $\times 400$). **F:** Pollen of the genus *Quercus* (possibly oak), belonging to the *Fagaceae* family, in sputum. Small to medium-sized grains, spherical/triangular in shape and with three equidistant folds on the surface, each of which has a central pore (Papanicolaou stain, $\times 400$).

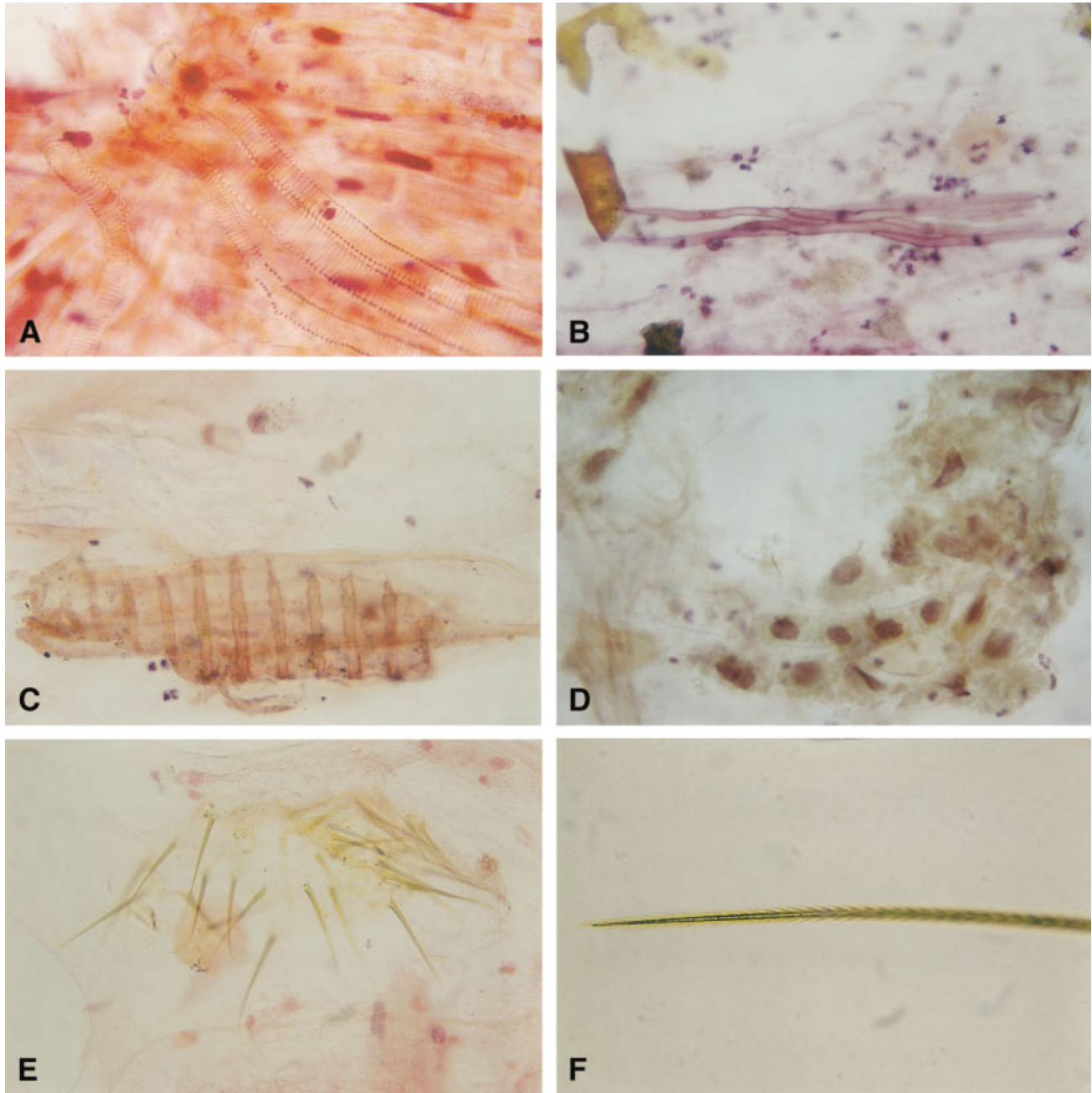


Fig. 4. Vegetable cells in smears. **A:** Conductor tissue belonging to the xilema. Various vegetable tracheas can be seen in the form of long structures with numerous thickenings of the walls, circular in shape (Sputum, Papanicolaou stain, $\times 400$). **B:** Conductor tissue belonging to phloema. Part of the protoplasm of the sieve tube can be seen. On account of its morphology and distribution, this structure may be confused with septate hyphae in fungal organisms (Sputum, Papanicolaou stain, $\times 400$). **C:** Tubes of cellulose coming from a wood fragment. Segmented and wrinkled appearance is typical of this morphology, and may be mistaken for the segmented body of an arthropod (Sputum, Papanicolaou stain, $\times 400$). **D:** Vegetable parenchymal cells in sputum. Various cells are observed, presenting a polygonal morphology with thin walls and a fine layer of cytoplasm around a large central nucleus. Their appearance may lead to confusion with malignant squamous cells (Papanicolaou stain, $\times 400$). **E:** Fragment of epidermal excrescence, corresponding to trychoma, in sputum. Various hair-like extensions can be seen (Papanicolaou stain, $\times 400$). **F:** Detail of a fragment of a graminea seed in sputum. It is characterized by its length and the many indentations along its wall, which serve as supports (Papanicolaou stain, $\times 400$).