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ROTOR SPINNING OF AMERICAN COTTONS (Part IV) We are presenting in this issue of *Textile Topics* the last segment of a report on research that studied the rotor spinning performance of cottons from four major production areas in the United States. We have previously explained that the full report could not be presented in the limited space of this bulletin, and we have divided it into four parts. We recommend that our readers place this issue and the three preceding ones together so the complete report will be in proper sequence for study.

As stated before, the report is entitled "The Suitability of Certain American Cottons for the Production of Fine Count Rotor-Spun Yarns." The sponsors were W. Schlafhorst Company of Monchengladbach, West Germany, and American Schlafhorst Company, Charlotte, North Carolina. We have found this investigation and the resulting report to be quite interesting, and we hope our readers will feel the same. We believe the information presented here can be useful to those textile companies that produce rotor-spun yarns from cottons grown in the production areas mentioned.

If someone should find that any part of this report is missing, we ask you to contact us. We will be happy to supply extra copies of the issues that carry the information you need.

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6.3. TRASH PARTICLES

Trash, in this sense, included everything that was not identified as fragments of bark or seed coat. The highest number were recorded with California cotton. Conceivably, these "trash" particles may have been seed-coat fragments. In general, they were not frequent enough to have a major influence on the spinning performance of the cottons evaluated.

For a comparison of these causes of spinning interruptions, see Figure 17 [next page], in which the bar charts are subdivided into trash-related, entanglement-related, and unknown causes.

6.4. BREAKS ASSOCIATED WITH NEPS

A significant number of spinning interruptions was associated with neps when producing N_e 40 from Delta cotton and all yarns from California cotton. Particularly for the California cotton data, it is very possible that these neps may have been associated with seed-coat fragments.

6.5. SLUB—RELATED BREAKS

The incidence of slub-related breaks generally increased as finer yarns were spun. The exception to this trend was the Pima cotton for which the number decreased with a finer count of yarn spun. In fact, slubs were the major cause of spinning interruptions for the Pima cotton and were of similar order of incidence as bark when spinning from Delta and Texas cottons.

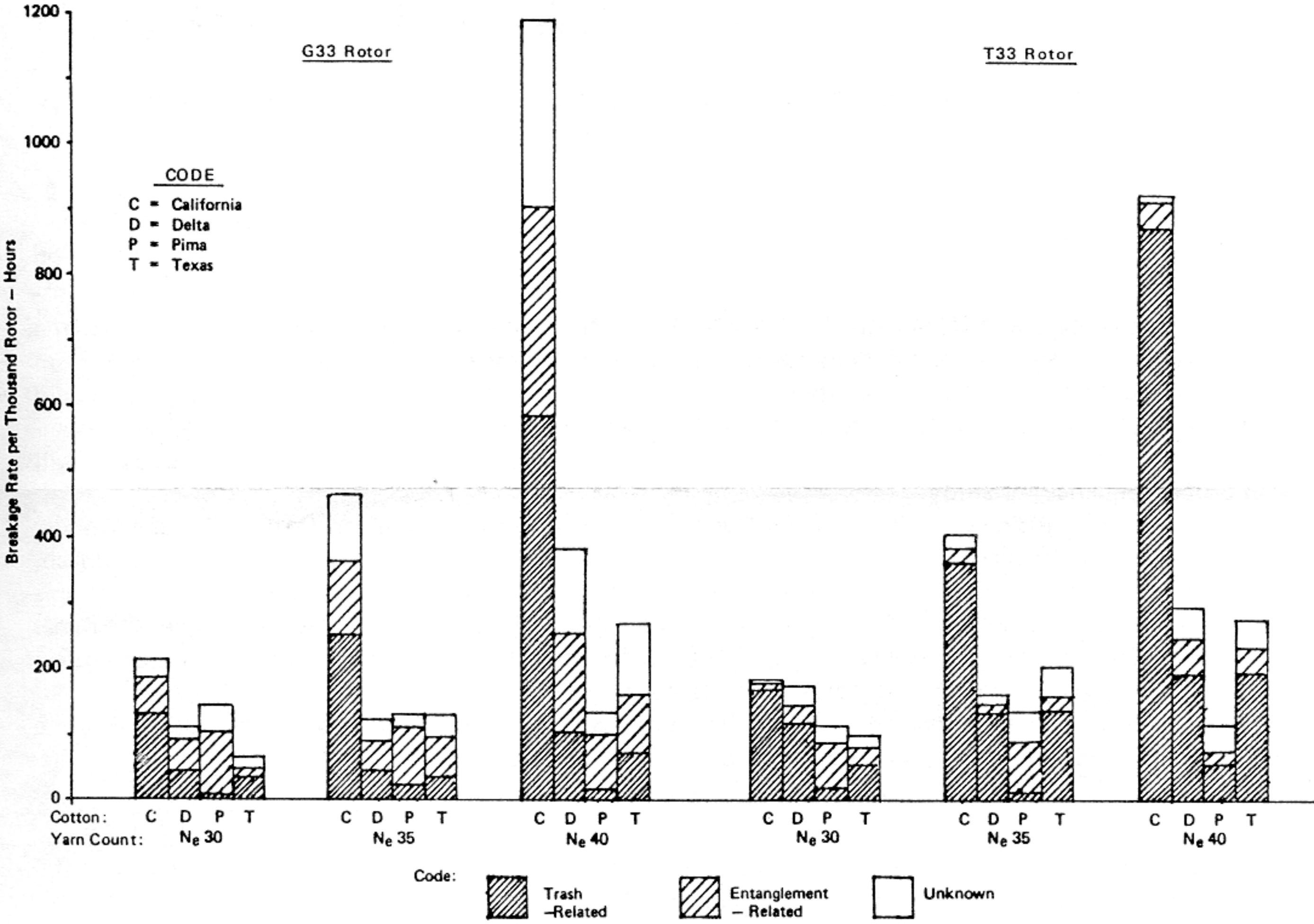
Neps and slubs are included in the entanglement-related spinning breaks in Figure 17.

The number of breaks associated with a slub that contains a number of trash particles was very low. Often, the fibers in such slubs are discolored, and their incidence is symptomatic of contamination or mechanical damage within spinboxes. The absence of these interruptions is reassurance that differences observed in breakage rates are functions of the raw materials supplied, and not the mechanical condition of spinning elements.

6.6. BREAKS DUE TO FOREIGN MATERIAL

Breaks involving fragments of material believed to be unassociated with the cotton plant were relatively infrequent, generally less than 5% of the total number of interruptions experienced. The greatest number of breaks attributed to foreign material were recorded for the Delta cotton, mostly polypropylene bale bagging. It should be noted however, that some of those breaks may have been misclassified bark

FIGURE 17: INFLUENCE OF COTTON TYPE AND YARN COUNT ON FREQUENCY OF SPINNING BREAKS



fragments and vice versa, since identification is purely visual.

6.7. BREAKS OF UNKNOWN CAUSE

Such breaks are characterized by a tapering yarn tail and the absence of slubs, trash particles, etc. Whereas they may arise because of a starvation of fiber supply, e.g. a thin place in the sliver, their incidence is considered indicative of having exceeded the "spinning limit" of the fiber for the combination of spinning elements selected. The spinning limit may have been exceeded by using either too low a twist multiplier or by attempting to spin too fine a yarn, or both.

6.8. DISCUSSION OF RESULTS

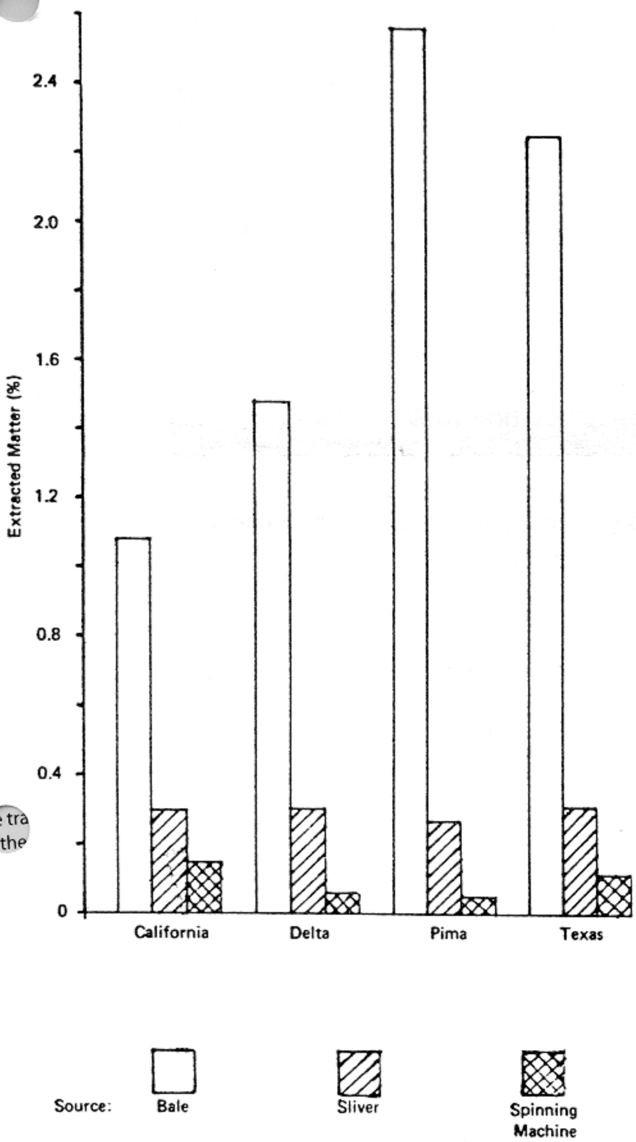
The longest and finest fibers were expected to produce the best spinning performance. This was, in fact, the case. The spinning performance was so stable that the breakage rate was almost independent of the yarn counts spun.

On the basis of fiber properties, the California cotton had been expected to provide the next-best spinning performance. The presence of an extremely high number of fragments of seed coat completely dictated spinning stability to the extent that no yarn was produced satisfactorily.

The shorter Delta and Texas cottons exhibited greater stability, being determined by the presence of bark fragments and small slubs. The fact that the Texas cotton was at least equal to the Delta cotton in terms of spinning stability again suggests that the use of finer fibers can offset the negative influence of shortness of fibers. Certainly for the Delta and Texas cottons, the rapid increase in break rate with increase in yarn count beyond N_e 35 suggests that the spinning limit for these cottons had been exceeded.

The break rate data also exposes the inadequacy of tests designed to quantify the non-lint content of cotton to estimate spinning performance. The bar chart presented in Figure 18 [facing page] shows that the two cottons having the highest non-lint content in bale samples were the Pima cotton and the Texas cotton, both of which gave the best spinning performance. Even measurements of sliver samples failed to indicate

FIGURE 18: VARIATION OF EXTRACTED MATTER WITH COTTON TYPE AND SOURCE



that the California cotton was likely to give the worst performance. The trash collected at the spinning machine was greater for the California cotton than for the Pima cotton, as might be expected; yet this trend was contradicted by the quantity of trash collected from the Texas cotton as opposed to the Delta cotton.

The tests used to determine the trash and dust contents of the cottons, in either bale or sliver form, have been shown to be ineffective in estimating the number of particles which persist through preparatory processes and survive the action of the opening roller to cause an interruption to the spinning process. Only those particles which succeed in passing through opening processes together with lint are of interest, not necessarily those which are extracted.

Current test methods for the determination of the Non-lint or trash content operate on similar principles to opening and carding machinery components. Such tests may be expected to provide reasonable indications of the quantity of trash expelled during cleaning processes, but not the contamination which persists into the spinning chamber of the rotor spinning process. Consequently, one must rely upon the quantity of extracted material determined by current tests being proportional to the quantity persisting with the fibers. Such a relationship can be expected to vary according to the natures, size distributions and proportions of the impurities present in the cotton.

To estimate likely spinning performances of cottons using currently available instruments to assess trash contents, it seems necessary that the quantity of impurity should be qualified by its origin (leaf, bract, seed coat, bark, etc.). In so doing, the density of the impurity and also the particle size distribution is loosely defined, and therefore indirectly indicate its case of removal - or persistance. This need is exemplified by the difference between California and Texas cottons, for the higher trash content of the Texas cotton detected in both bale and sliver samples was clearly less troublesome than the contaminant of the California cotton.

7. CONCLUSIONS

7.1. Pima cotton produced, as expected, the best quality yarns and gave the most stable spinning performance, independent of yarn count, at maximum rotor speeds of 100,000 rpm. It appears possible to spin Pima cotton on the rotor system into yarn counts finer than N_e 40.
Slubs were the most frequent cause of spinning breaks with this cotton.

7.2. California cotton yielded the next best yarn quality, but spinning performance was very adversely affected by the presence of seed coat fragments. Without this contamination, California cotton could have been spun into good yarns as fine as N_e 40 at rotor speeds above 90,000 rpm.

7.3. Overall, Delta cotton and Texas cotton were comparable in terms of yarn quality and spinning performance. Depending upon spinning specifications, yarns from Texas cotton tend to be somewhat stronger than those from Delta cotton, because the greater fineness of the Texas cotton is compensating its shorter length.
If they are used in 100% form, a yarn count of N_e 35 appears to be the spinlimit for both Delta and Texas cottons (carded).
Fragments of bark and slubs determined the spinning performance of both cottons.

7.4. Assessments of trash or dust content were inadequate for the estimation of spinning performance. There is a need to describe the nature of the impurity in cotton rather than its quantity alone.

7.5. Improved harvesting and ginning methods to remove impurities without damage to the cotton fiber as well as better opening and cleaning in the textile mill would greatly enhance both yarn quality and processibility in high-speed, fine-count rotor spinning.

7.6. This study indicates that a spinning mill can put together cost-effective cotton mixes from two or more of the major U.S. growth regions to economically produce high-quality, 100% fine-count carded cotton yarns on the rotor system.

Knowledge of cotton fiber properties through HVI testing, and knowledge of the nature and quantity of contaminants coupled with judicious selection of spinning components can enable a rotor spinner to design fine-count cotton yarns from the available supply of U.S. cotton varieties.

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This concludes the final segment of our reprint of "The Suitability of Certain American Cottons for the Production of Fine Count Rotor-Spun Yarns." The research was conducted under the supervision of John B. Price, assistant director of ICTRD. We extend our appreciation to W. Schlafhorst Company and American Schlafhorst Company for permitting us to reprint the report for our readers.

SENATOR PHIL GRAMM VISITS CENTER We were very pleased to have U.S. Senator Phil Gramm visit with us on March 17. He came to the Center to study the research conducted here and in particular to review the programs underway to promote Texas cotton, wool and mohair. We were delighted with his understanding of our research and his appreciation for the significance of it.

We invite Senator Gramm to visit with us again whenever there is an opportunity.

VISITORS Other visitors during March included Jerry Harris, Mesa Gin, Lamesa, TX; Dean Pelczar, Cotton Incorporated, Raleigh, NC; Robert Stobart, University of Wyoming, Laramie, WY; Henry Perkins, USDA, Clemson, SC; Dr. Robert Weller, National Science Foundation, Washington, DC; Roger Bolick, Allied Fibers, Hopewell, VA; James E. Nayfa, Stop-Shock, Inc., Dallas, TX; Bucky Powell and Seburn Crocker, Henkel Chemical Co., Charlotte, NC; John Arlett, Clark Cotton, Johannesburg, South Africa; and twenty members of the Texas Society of Professional Engineers.

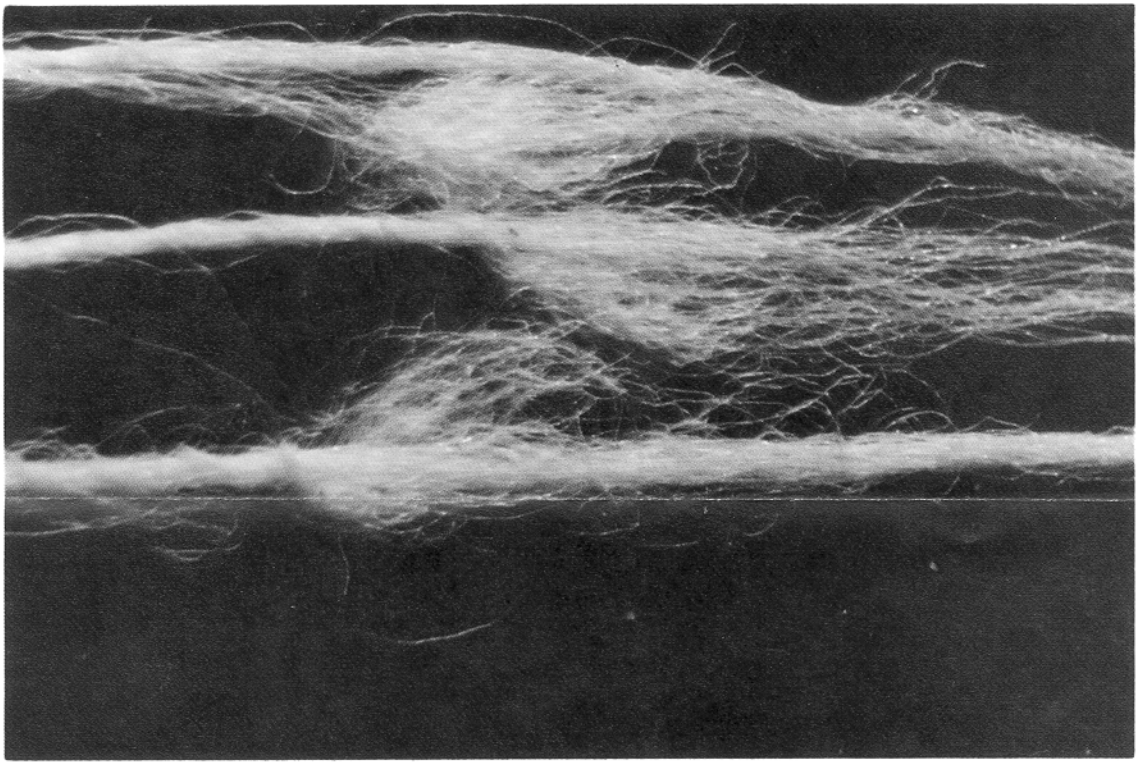

PLATE 5: Neps

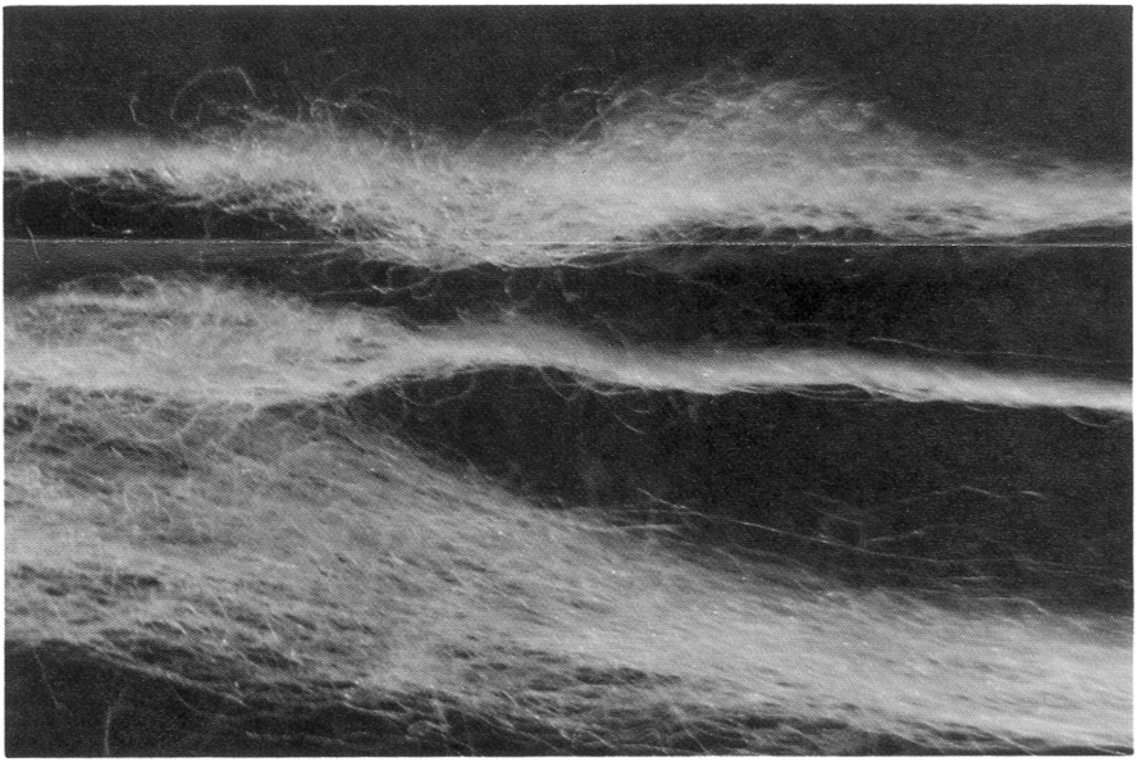

PLATE 6: Slubs

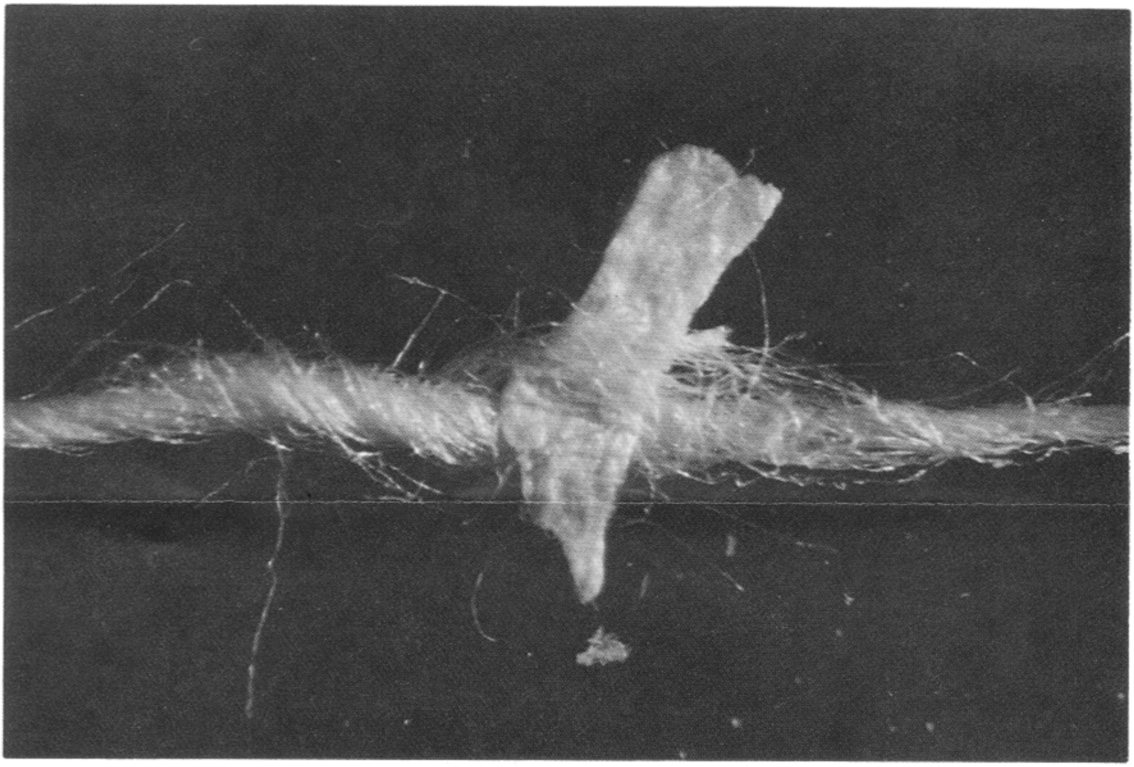

PLATE 7: Detail of Trash Particle

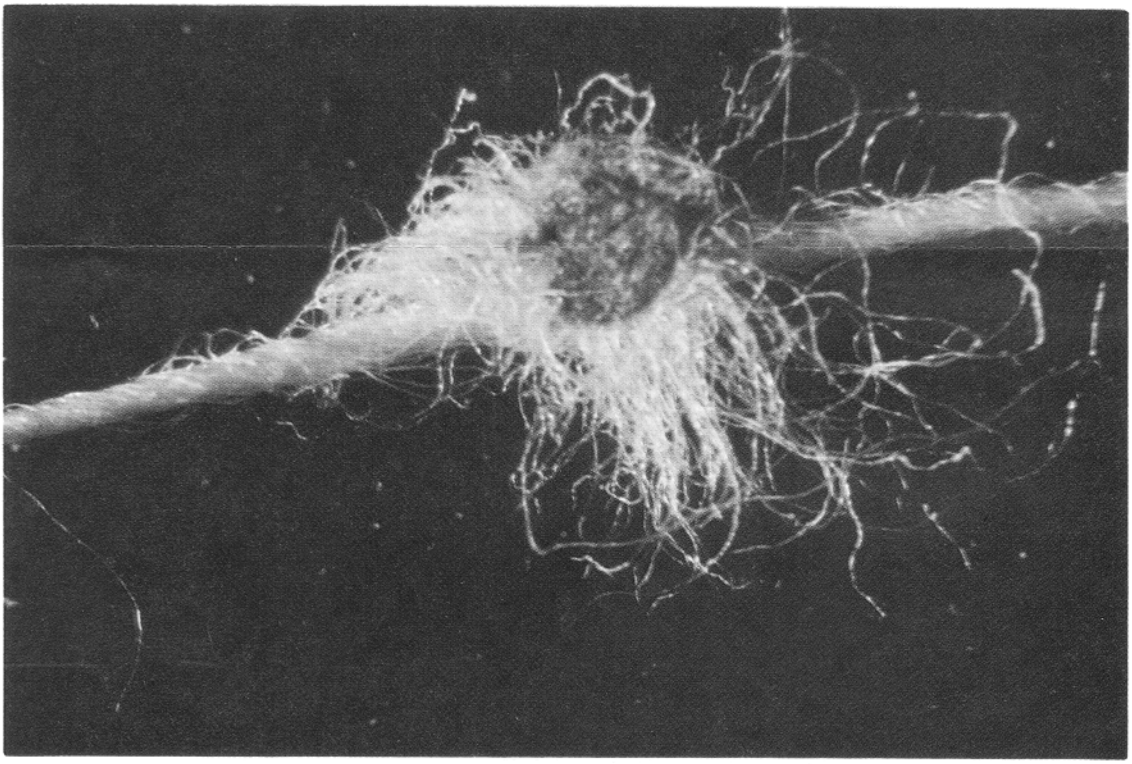

PLATE 8: Detail of Seed Coat Fragment