was greater than in agitated cultures. One must therefore conclude that the agitation culture technique in this case is superior to culture on an agar-solidified medium, but is inferior to standard techniques in which the gametophytes develop on the surface of a liquid medium.

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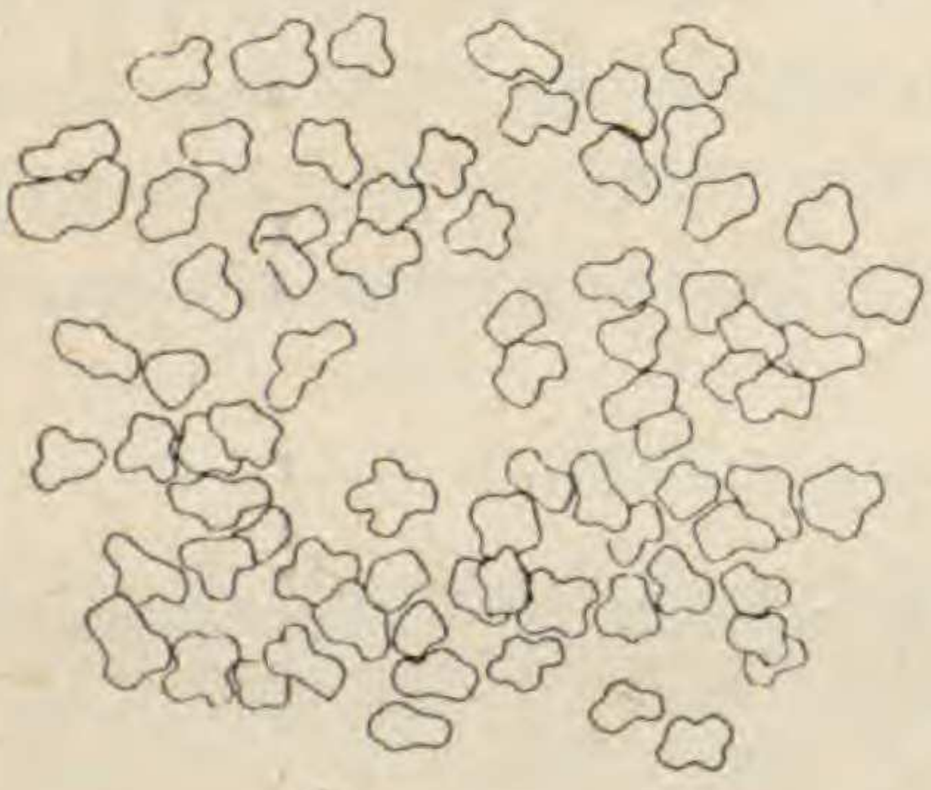
Chromosome Studies in the Polypodiaceae

VEIKKO SORSA

The Polypodiaceae are typically epiphytic, rarely terrestrial, mostly tropical ferns. The type genus has been considered one of the largest fern genera by many pteridologists, but Copeland (1947) has construed it narrowly, and includes only about 75 species, mostly in the American tropics. Chromosome counts of about 35 species mostly from southeast Asia have been published (Chiarugi, 1960, Fabbri, 1963, Evans, 1963a), while the American species have been reported by Manton (1951), Knobloch (1962), Evans (1963a, b), Lloyd (1963), Taylor and Lang (1963), and Wagner (1963).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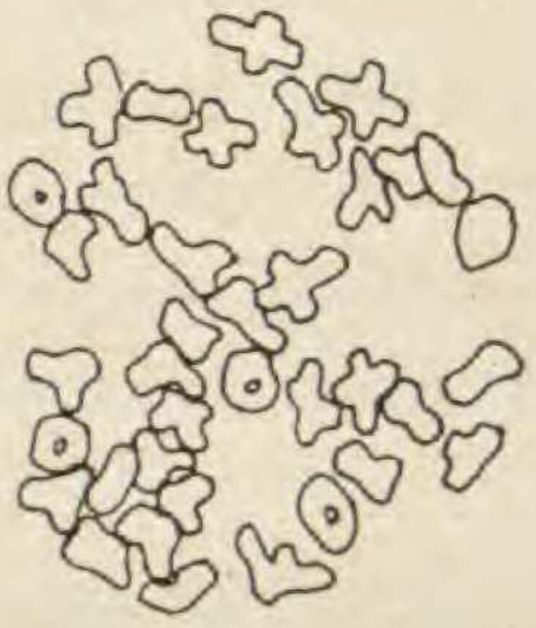
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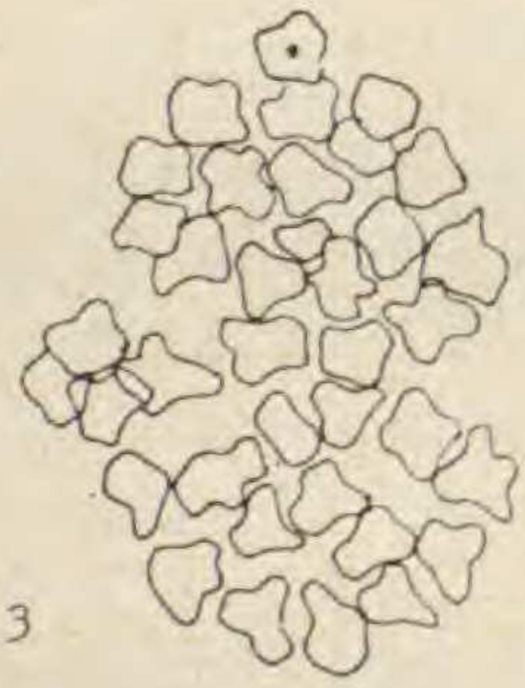
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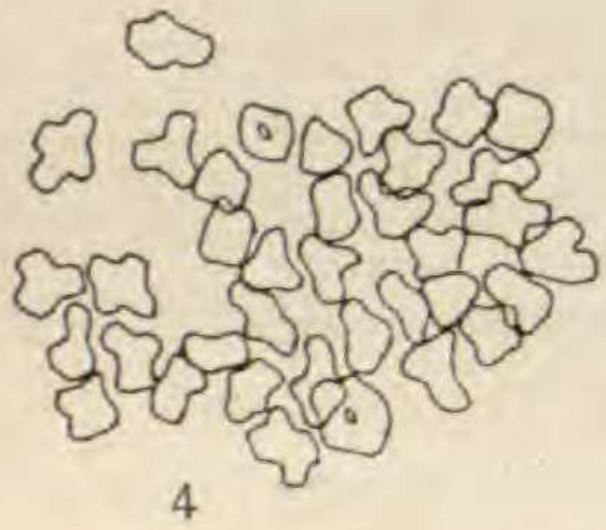
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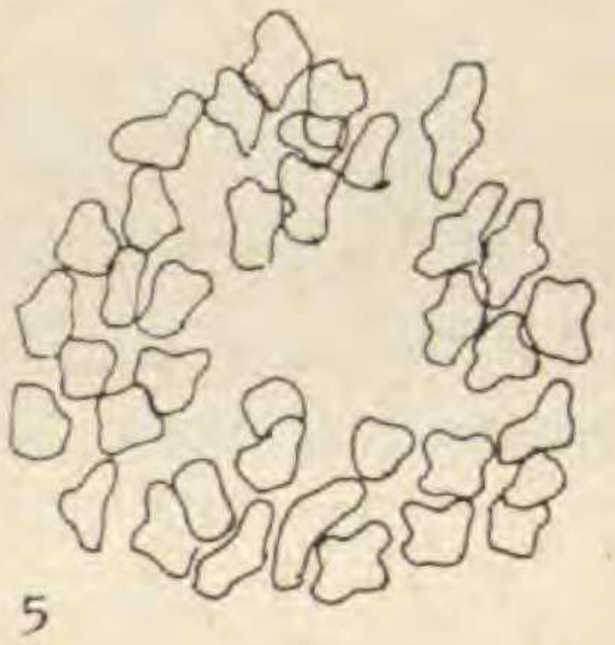
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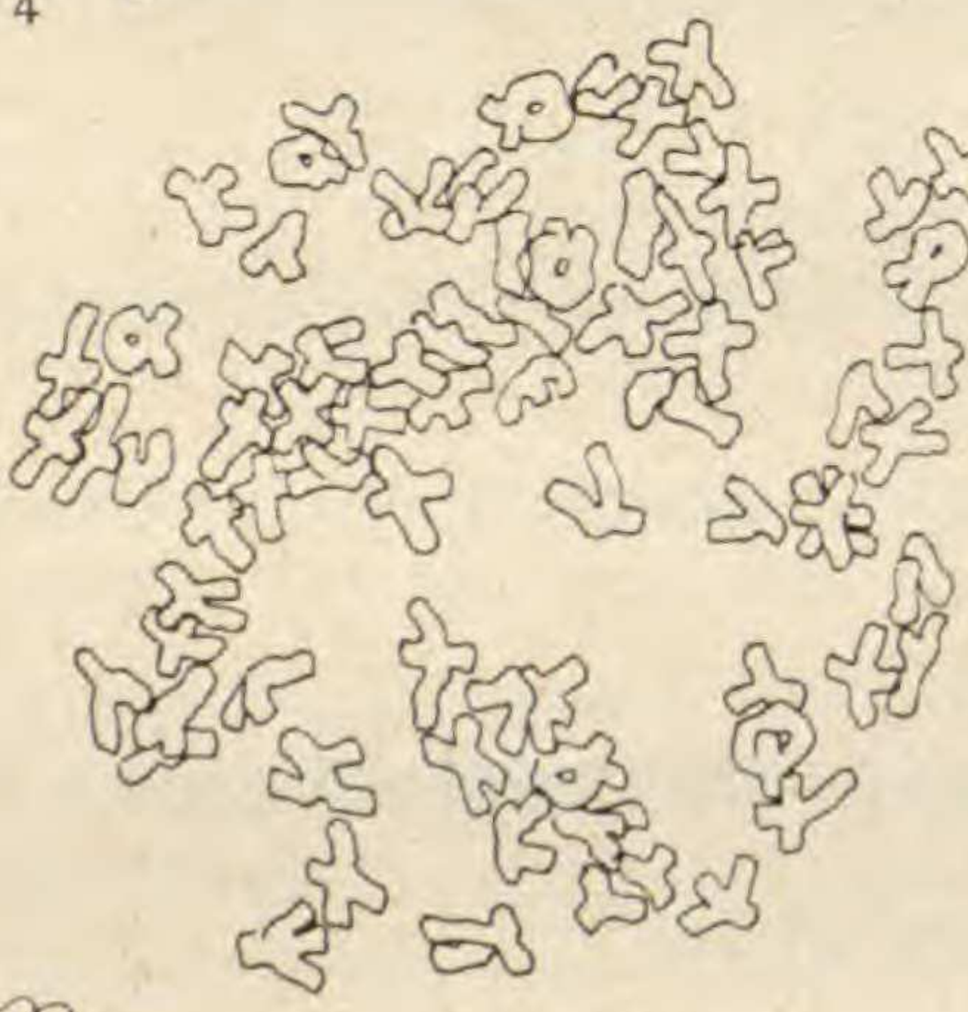
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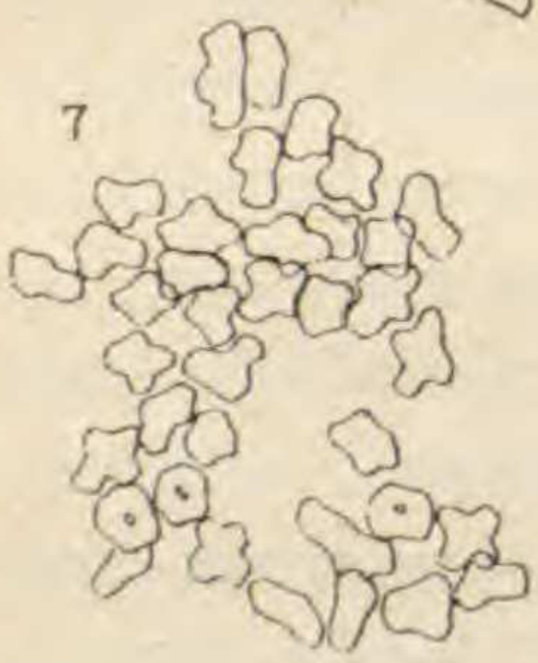
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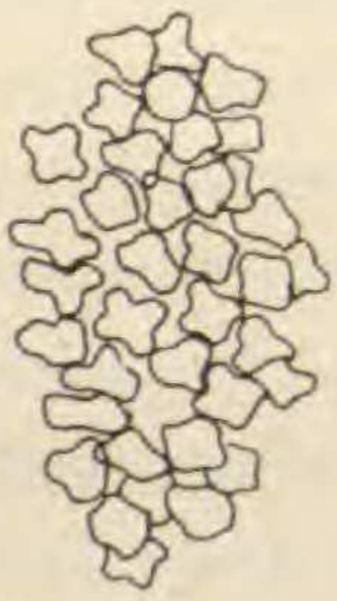
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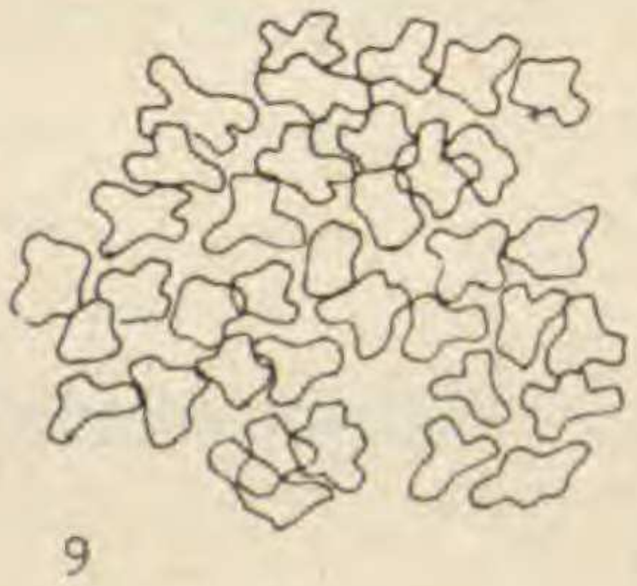
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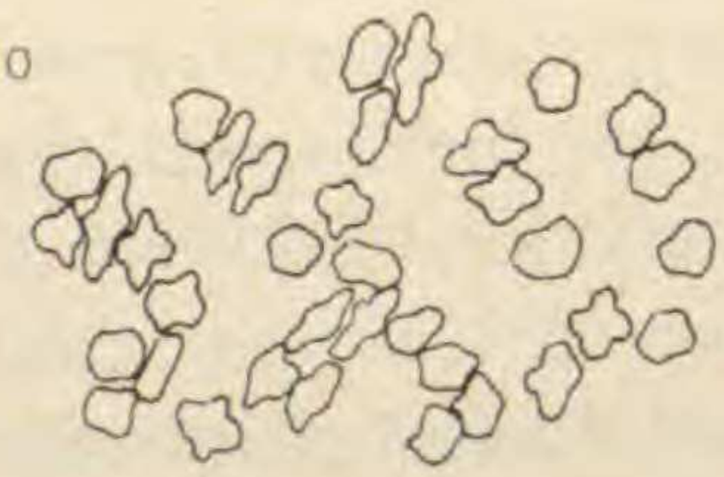
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Figures 1–10. Camera lucida drawings of the chromosomes at the first meiotic division, ca. × 1200.

Material for the present study was obtained from the Botanical Garden of the University of California at Berkeley in 1963 and 1964, and their accession numbers are indicated in the list of species. Young sporangia were fixed in acetic acid-alcohol (1:3) and stained about one to four hours later in aceto-carmine solution. After squashing and preliminary inspection, the preparations were restained with acetic acid-iron-hematoxylin solution. These investigations were carried out in the Department of Genetics at the University of California, Berkeley. Names and other information on the species are according to the register at the Botanical Garden of the University (UCBG). Voucher specimens of most of the species are deposited in the University's herbarium (UC).[1]

POLYPODIUM ANGUSTIFOLIUM Swartz. 57.006-S1, Costa Rica. *Fig. 1.* $n =$ ca. 74.

The number $n = 74$ has been counted in *P. leucorhizon* Klotzsch, which is possibly identical with this species. The same number has been reported by Fabbri (1957) and Evans (1963a) for this species under *Campyloneurum*. Inclusion of this species in *Goniophlebium* (Conzatti, 1946) does not seem correct, for Patnaik and Panigrahi (1963) report only $n = 36$ for that genus.

POLYPODIUM ANGUSTUM (Humb. & Bonpl.) Liebm. 50.434-1, Guatemala. *Fig. 2.* $n = 37$.

Some taxonomists (e.g., Conzatti, 1946) have included this species in *Phymatodes*, but all known species of this genus have $n = 36$ (Chiarugi, 1960, Fabbri, 1963). Copeland (1947) included *Phymatodes* in *Microsorium*, which has $n = 36$ (Chiarugi, 1960, Fabbri, 1963).

POLYPODIUM FEEI (Bory) Mett. 61.697-1, Java. *Fig. 3.* $n = 37$.

Copeland (1947) considered this species to be a *Selliguea*.

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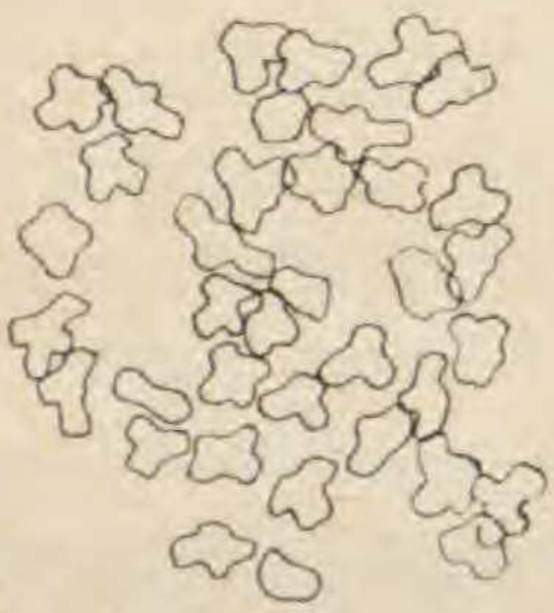
[1]The author is very much obliged to Dr. H. G. Baker and Dr. D. R. Cameron, University of California, Berkeley, for reading the manuscript of this paper, and to Mr. P. C. Hutchison, Senior Botanist of the UCBG, for many valuable notes concerning the names and the identifications of the species studied.



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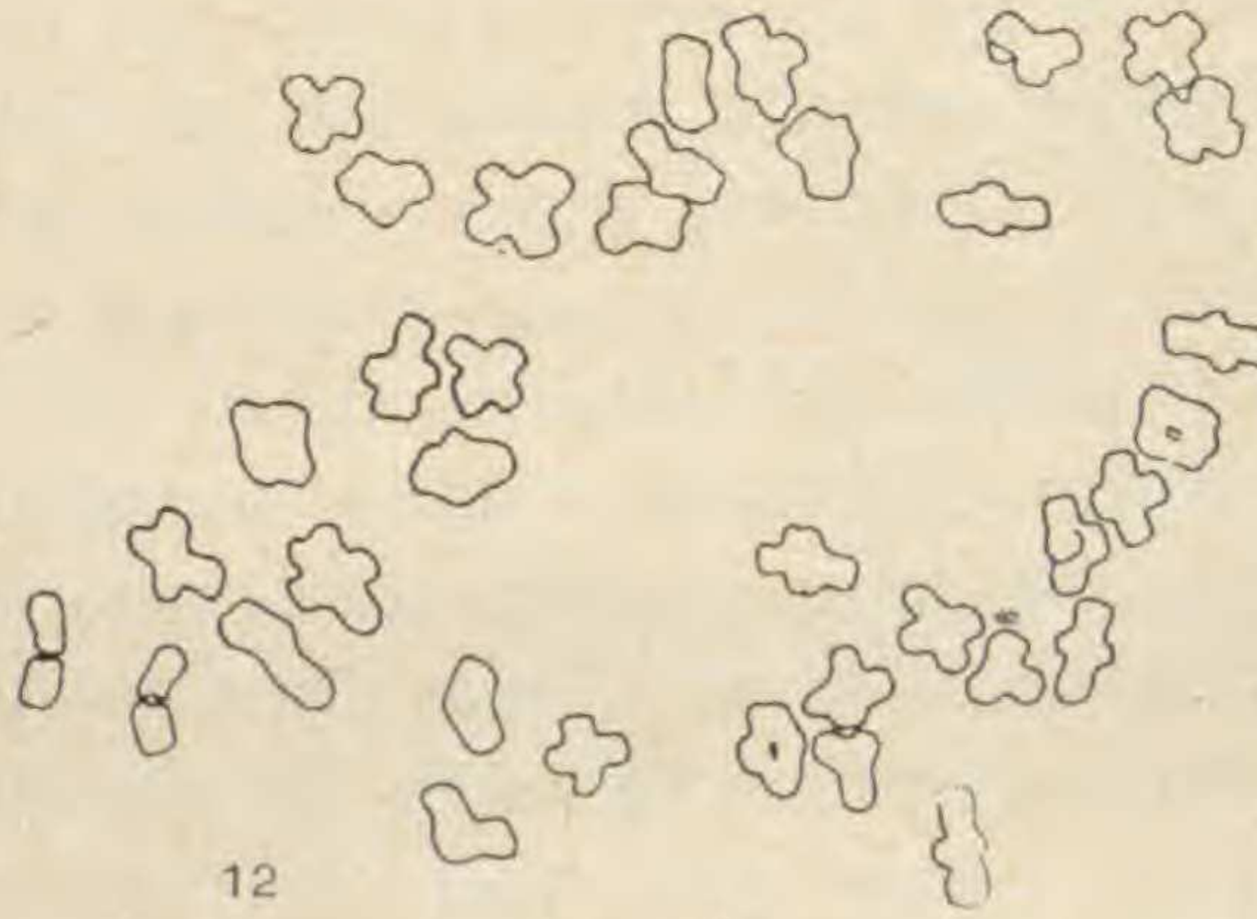

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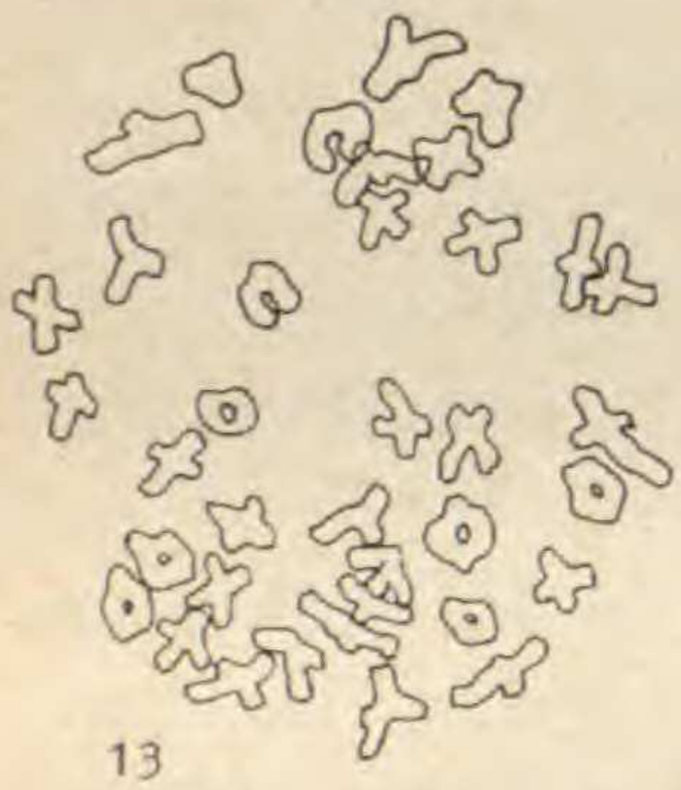

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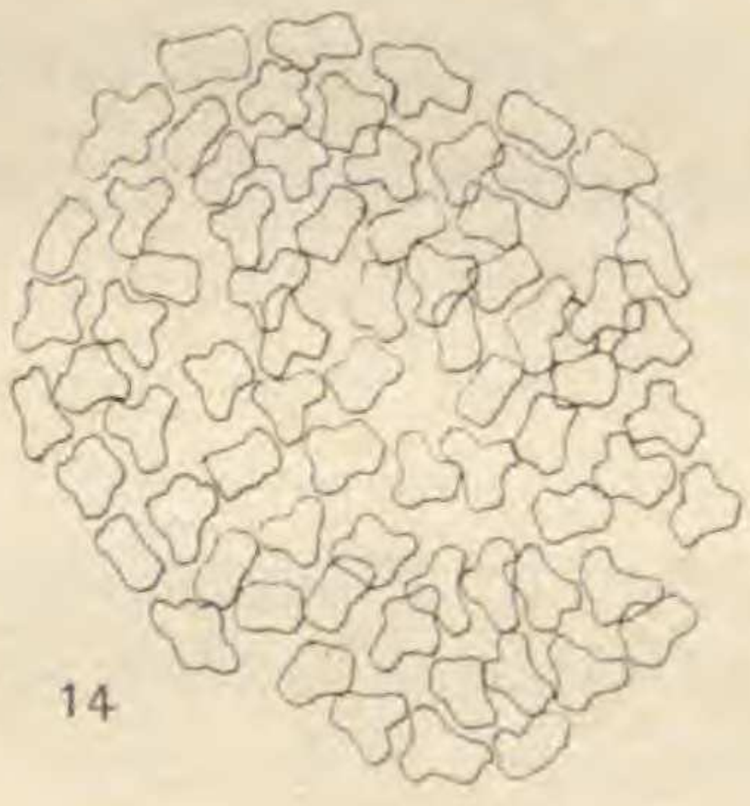

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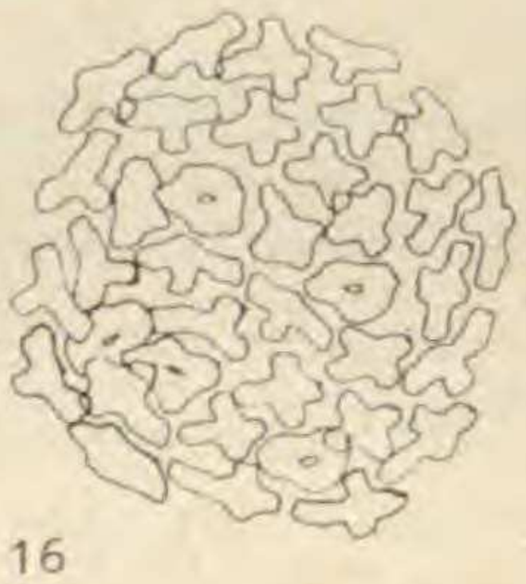

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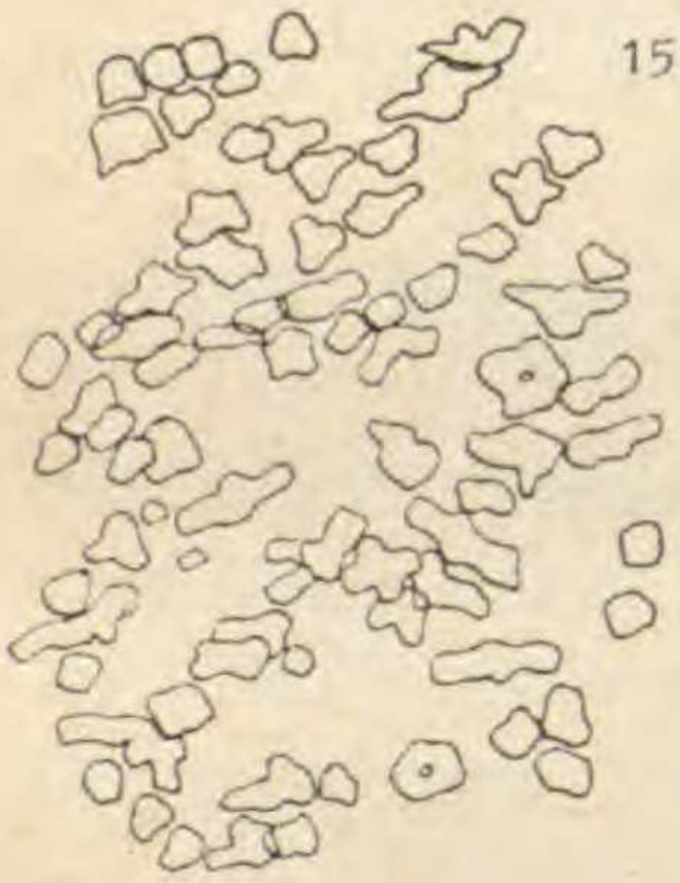

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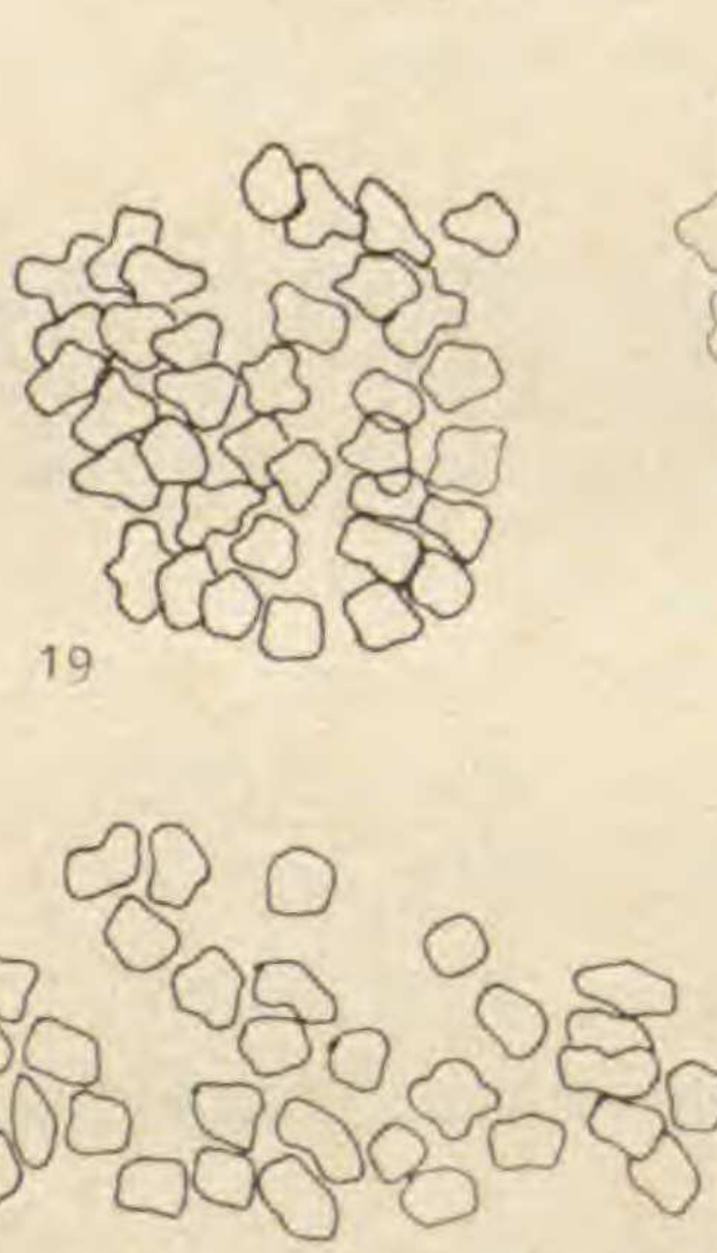

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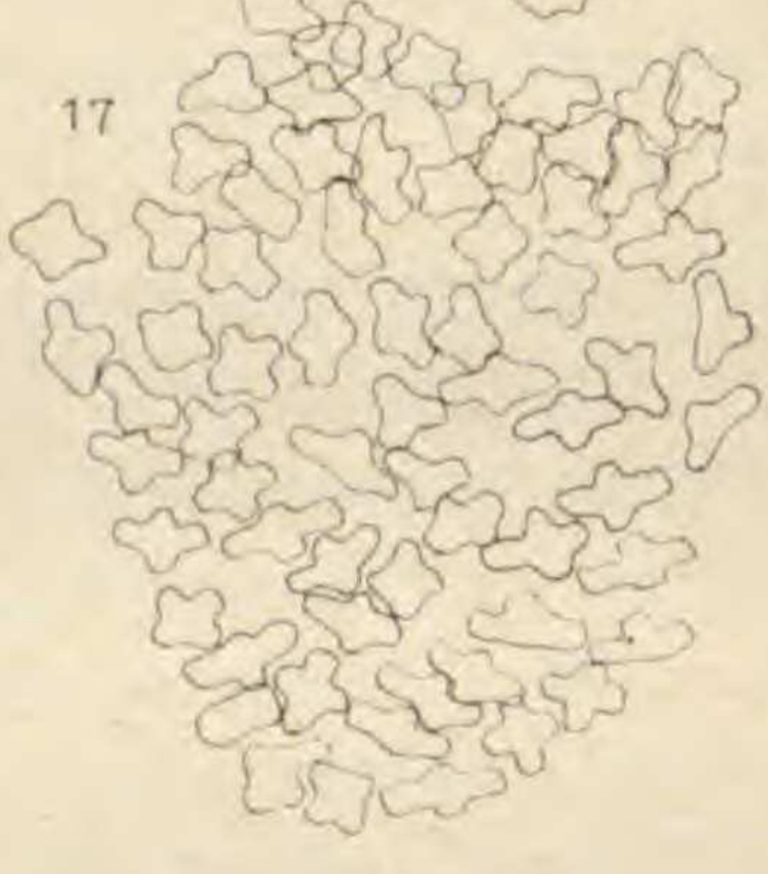

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Figures 11–19. Camera lucida drawings of the chromosomes at the first meiotic division, ca. × 1200.

POLYPODIUM FRAXINIFOLIUM Jacq. 57.017-1, Costa Rica. *Fig. 4.*

$n = 37$.

This species is also known as *Goniophlebium distans* (Raddi) J. Smith.

POLYPODIUM LACHNIFERUM Hieron. 58.1122-1, Peru. *Fig. 5.*

$n = 37$.

Evans (1963a) reported the same number.

POLYPODIUM LEUCORHIZON Klotzsch. 58.1124-S1, Peru. *Fig. 6.*

$n = 74$.

POLYPODIUM LYCOPODIOIDES L. 57.151-S1, Costa Rica. *Fig. 8.*

$n = 37$.

This species has been referred to *Phymatodes*, *Pleopeltis*, and *Anapeltis*. Copeland (1947) used the name *Microgramma*. While *Phymatodes* has $n = 36$, *Pleopeltis* has been reported by Manton (1953, 1959) to have $n = 35$ and by Wagner (1963) as $n = 51$. *Microgramma owariensis* (Desv.) Alston from tropical West Africa has $n =$ ca. 37 according to Manton (1959) and *M. vacciniifolium* (Langsd. & Fisch.) Copel. has $n = 36$ according to Evans (1963a), who also reported $n = 37$ for Costa Rican material of *P. lycopodioides*.

POLYPODIUM PHYLLITIDIS L. 58.1125-S1, Peru. *Fig. 9.* $n = 37$.

This species is sometimes included in *Campyloneurum*, and has previously been found to be tetraploid (Pal, 1961, $n = 76$, Evans, 1963a, and Wagner, 1963, $n = 74$). Evans (1963a) found $n = 37$ in diploid Peruvian material of this species, in *C. costatum* (Kunze) Presl, and in *C. latum* Moore.

POLYPODIUM PLEBEIUM Cham. & Schlecht. 52.1322-1. *Fig. 10.*

$n = 36$–37.

The evidently aneuploid number, $n = 36$, is not common in *Polypodium*, but has been reported by Patnaik and Panigrahi (1963) and by Evans (1963a).

POLYPODIUM PLECTOLEPIS (Fée) Hook. 50.438-1, Mexico. *Fig. 11.*

$n = 37$.

Evans (1963a) reported the same number.

POLYPODIUM PTILORHIZON Christ. 59.113-1, Costa Rica. *Fig. 7.* $n = 37$.

POLYPODIUM RHODOPLEURON Kunze. 53.1091-1, Mexico. *Fig. 12.* $n = 37$.

Evans (1963a) reported the same number.

POLYPODIUM ROSEI Maxon. 59.1499-1, Mexico. *Fig. 13.* $n = 37$.

POLYPODIUM SCOLOPENDRIA Burm. 54.1142-S1, Guam. $n = 72$–74.

This species is also called *Microsorium*. In southern India it has $n = 36$, according to Abraham et al. (1962).

POLYPODIUM THYSSANOLEPIS A. Braun. 59.1506-1, Mexico. *Fig. 15.* $n =$ ca. 74.

Meiosis seems to be irregular; both bivalents and univalents and possibly some multivalents are present in the first metaphase. Evans (1963a) reported $n = 37$ in diploid Peruvian material.

POLYPODIUM VITIENSE Baker. 55.092-S1, Admiralty Islands. *Fig. 16.* $n = 37$.

Considered a *Microsorium* by some pteridologists.

POLYPODIUM CALIFORNICUM Kaulf. 50.733-1, California. *Fig. 17.* $n = 74$.

Manton (1951), Lloyd (1963), and Evans (1963a) reported the same number.

MERINTHOSORUS DRYNARIOIDES (Hook.) Copel. 55.078-1, New Guinea. *Fig. 18.* $n = 36$.

DRYNARIA QUERCIFOLIA (L.) J. Smith. 56.660, Java. *Fig. 19.* $n = 36$–37.

Similar numbers have been reported by Manton and Sledge (1954) from Ceylon, by Abraham et al. (1962) from southern India, and by Patnaik and Panigrahi (1963) from eastern India.

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