# Influence of Maturity and Fruit Yield on Susceptibility of Peanut to *Cercosporidium personatum* (Late Leafspot Pathogen)[1]

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**ABSTRACT**

A positive relationship between both low pod yield and late maturity of peanut (*Arachis hypogaea* L.) with resistance to leafspot (*Cercospora arachidicola* Hori and *Cercosporidium personatum* (Berk & Curt.) Deighton) has been observed in breeding material and germplasm. To study this association, three peanut genotypes (Early Bunch, Florunner, and Dixie Runner) varying in maturity and yield potential were grown both with and without fungicide spray. Lower yield and later maturity treatments were further imposed on these genotypes through floral bud removal. Removal of floral buds resulted in less leafspot injury, as measured by lesion number per leaf or by a leaf retention score. There was a significant cultivar x treatment interaction. Removal of floral buds significantly reduced pod yield for Early Bunch. The use of chlorothalonil improved yields for Early Bunch and Florunner, but not for Dixie Runner. The proportion of sound mature kernels was increased in Florunner and decreased in Early Bunch by the floral bud removal treatment with no fungicide. Trends for yield of sound mature kernels were similar to those of pod yields. The improved resistance, delayed maturity, and lower yield of treatments with floral bud removal may explain the association noted among three traits in breeding material.

Key words: Groundnut, breeding, leafspot disease resistance, *Cercospora*, *Cercosporidium*, peanut yield, peanut maturity, peanut cultivars.

Leafspot diseases of peanut (*Arachis hypogaea* L.), caused by *C. arachidicola* Hori (early leafspot) and *C. personatum* (Berk and Curt) Deighton (late leafspot) occur throughout the world and cause losses that range from 10% to 80% with inadequate control measures (9, 11, 17). Use of fungicides can effectively control leafspot damage. However, resistance to these diseases in peanut would decrease the need for fungicide use and reduce both costs and risks in production.

A recently released peanut cultivar, Southern Runner, which matures 10-14 d later than Florunner, has moderate resistance to late leafspot (5). Pod yields of Southern Runner approximate those of Florunner. In addition, a range of germplasm has been identified with specific components of resistance to early (6) and late leafspot (2, 8, 19). The reaction of these genotypes to leafspot differs from the response of susceptible cultivars and lines. The contrasts include a prolonged time from disease inoculation to first sporulation (latent period), reduced spore production, and smaller lesion sizes.

Many of the genotypes identified with resistance produce lower pod yields than standard cultivars (13). Also, late maturity is highly associated with resistance to late leafspot (4, 7, 12, 18). It is not known whether the lower yields and/or the later maturities are causally related to resistance in peanut germplasm. To study this association, three peanut genotypes varying in maturity and yield potential were grown both with and without fungicide spray. Lower yield and later maturity treatments were further imposed on these genotypes by removal of floral buds. The effects of these treatments on leafspot disease were studied to test the hypothesis that the onset of fruit load contributes to susceptibility of peanut cultivars to leafspot diseases.

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# Materials and Methods

The experiment was conducted at the Agronomy Farm near Gainesville, Florida on an Arredondo fine sand (Grossarenic Paleudult) soil. A split-plot design with four replications was used with the two main plot treatments, either receiving no fungicide or receiving weekly applications of chlorothalonil as 500 g $L^{-1}$ applied at 2.5 L $ha^{-1}$. The six subplot treatments consisted of the three cultivars Early Bunch, Florunner, and Dixie Runner (early, medium, and late maturity, respectively) with and without removal of the initial floral buds. Early Bunch is the earliest in maturity with the highest yield potential, while Dixie Runner is the latest and with the lowest yield potential (1, 14, 15). Seed were planted by hand in mechanically opened furrows on 2 May 1979 and 1 June 1980. In the first year of the experiment, plots were one row 6.1 m long with 0.30 m between plants and 0.91 m between plots. In the second year plot length was reduced to 4.3 m, with the other spacings the same as the previous year.

Plants began flowering approximately 30 d after planting in both years. In treatments where floral buds were removed, the initial floral buds of five plants were removed from 1900 hours to 2300 hours daily after the hypanthium had lengthened and the peanut leaflets had folded together. Any remaining buds were removed the following morning prior to 0930 hours to insure that fertilization had not occurred. Removal of floral buds began with the first flowers and continued until flowering reached a maximum and then began to decline. This corresponded to 76, 83, and 90 d after planting for Early Bunch, Florunner, and Dixie Runner, respectively. With the exception of leafspot control, controls of insects and weeds and other cultural practices were applied as needed.

The relative amounts of leafspot disease for each plot were estimated in 1979 by visual leaf retention ratings on 17 September. A one to five rating scale was used with one being totally defoliated and five retaining a full canopy. Disease severity in 1980 was assessed by sampling 10 leaves randomly from each plot at 10 d intervals, beginning 80 days after planting, and counting the number of lesions.

Plots were harvested at the average physiological maturity (PM) for the respective cultivars and also at PM + 15 d. Early Bunch was harvested at 125 and 140 days after planting, Florunner at 135 and 150 d, and Dixie Runner at 145 and 160 d. Plants were loosened from the soil with a potato fork and then lifted, and pods picked by hand. After the plants were removed, the soil was sifted to gather any remaining pods. After harvest the fruit samples were dried, weighed, and graded for market quality following standard United States Federal-State Inspection Service grading procedures.

# Results

## Leafspot disease assessments

In both years of the study, early leafspot lesions were found infrequently and only relatively early in the season. After initial appearance, incidence of early leafspot declined. Therefore, these leafspot assessments primarily reflect the response to late leafspot.

Removal of floral buds significantly improved leaf retention for Early Bunch, regardless of fungicide application in 1979 (Table 1). Removal of floral buds from Florunner plants and fungicide applications resulted in less leaf loss than occurred under normal reproductive development without fungicides. For Dixie Runner, removal of floral buds and fungicide application resulted in significantly higher leaf retention than either treatment without fungicides. The late maturing Dixie Runner, with normal flowering and no fungicide application, did not differ significantly in leaf retention from the higher yielding cultivars with floral bud removal and fungicide sprays.

The summer of 1980 was very dry and peanut leafspot diseases developed later than normal. Late leafspot appeared approximately 80 d after planting. The disease increased rapidly in the unsprayed plots after a brief period of rain (Table 2). The number of lesions per plot decreased during a period of dry weather from 30 August to 10 September and then increased again until a maximum of about 750 lesions per plot sample was reached.

**Table 1. Effects of fungicidal spray and removal of floral buds on leaf retention ratings of three peanut cultivars 135 days after planting, 1979.**

| Cultivar | Treatment | | | |
|---|---|---|---|---|
| | Sprayed* | | Not Sprayed | |
| | Floral Buds Removed | Control | Floral Buds Removed | Control |
| Early Bunch | 3.5** | 2.0 | 2.7 | 1.5 |
| Florunner | 3.7 | 3.0 | 3.0 | 2.5 |
| Dixie Runner | 4.0 | 3.7 | 3.0 | 3.0 |
| $LSD_{0.05}$ = 0.8 | | | | |

* Plots were sprayed with chlorothalonil at a rate of 1.8 kg $ha^{-1}$.

** Ratings were on a scale of 1-5 where 1 = complete defoliation, 2, 3, and 4 had means of 75%, 50%, and 25% defoliation, respectively, and 5 = a full canopy.

On the first sampling date (20 August) no significant differences were found among fungicide-sprayed plots. The number of lesions was much greater in the unsprayed plots. There were significant differences between reproductive treatments of Early Bunch, and between Early Bunch and other cultivars (Table 2).

At the second sampling date (30 August), Early Bunch had significantly more lesions than the other two cultivars. Within each genotype, significantly more lesions were found in the unsprayed plots than in the sprayed plots. However, removal of floral buds and no effect on lesion numbers.

The number of lesions per plot on the third sampling date (10 September) was reduced relative to the first two sampling dates, particularly in the unsprayed block. The only significant difference between treatments within spray regimes was for Early Bunch in plots where floral buds were removed and no fungicide was applied (Table 2).

Conditions for leafspot development occurred after the third sampling date and lesion numbers increased at the last two sampling dates. On 20 September, removal of floral buds of Early Bunch resulted in significantly reduced numbers in both sprayed and unsprayed plots and significantly reduced lesion numbers in the unsprayed plots of Florunner and Dixie Runner. Within genotypes, all fungicide-treated plots had fewer lesions than untreated plots.

In the final sample (10 October), Early Bunch plots that received fungicide sprays and in which floral buds had been removed had fewer lesions than the other Early Bunch treatments. Florunner plots in which floral buds had been removed has significantly fewer lesions than those with normal flowering in both the sprayed and unsprayed plots. Lesion numbers were reduced in plots of Dixie Runner in which floral buds had been removed and no fungicides applied. In similar plots receiving the fungicide treatment, there was nearly a significant reduction.

Leaf retention measurements were not made in 1980 due to a severe infection with peanut rust (*Puccinia arachidis* Speg.).

## Pod yield

The number of days from planting to harvest for pod yield was the same in this experiment as in standard production of these cultivars. Since the standard number of days to harvest was used for the respective cultivars, the removal of floral buds effectively reduced the length of the pod filling period

Table 2. Effects of fungicidal spray and removal of floral buds on leafspot lesion numbers on ten leaves of three peanut cultivars, 1980.

| Cultivar | Treatment | | Sample Date | | | | |
|---|---|---|---|---|---|---|---|
| | | | 8/20 | 8/30 | 9/10 | 9/20 | 10/10 |
| | Fungicide* | Floral Buds | -------No. of lesions -------- | | | | |
| Early Bunch | Yes | Removed | 66 | 71 | 25 | 113 | 653 |
| | Yes | Control | 57 | 90 | 40 | 240 | 761 |
| | No | Removed | 699 | 713 | 215 | 531 | 745 |
| | No | Control | 496 | 766 | 312 | 755 | 763 |
| Florunner | Yes | Removed | 11 | 22 | 16 | 81 | 350 |
| | Yes | Control | 23 | 46 | 21 | 103 | 574 |
| | No | Removed | 136 | 254 | 51 | 225 | 483 |
| | No | Control | 129 | 281 | 56 | 353 | 719 |
| Dixie Runner | Yes | Removed | 10 | 19 | 10 | 51 | 166 |
| | Yes | Control | 20 | 26 | 12 | 122 | 238 |
| | No | Removed | 137 | 288 | 62 | 279 | 328 |
| | No | Control | 200 | 300 | 60 | 357 | 492 |
| | | $LSD_{0.05}$ = | 75 | 43 | 25 | 63 | 78 |

* Plots were sprayed with chlorothalonil at a rate of 1.8 kg $ha^{-1}$.

(number of days from initial flower fertilization to first harvest). In the case of Early Bunch, this time was reduced from a normal 95 d from first flower fertilization to mature pods to 59 d. For Florunner the time was reduced from 105 to 82 d, and for Dixie Runner from 115 to 85 d. The second harvest in this study required 15 d longer, giving a total of 74, 97, and 100 d for pod production and filling for Early Bunch, Florunner, and Dixie Runner, respectively. For Early Bunch, floral bud removal reduced pod yields in all fungicide, year, and harvest combinations (Table 3). For Florunner, although in each fungicide, year, and harvest combination there was a numerical reduction in yield when floral buds were removed, in only two cases were the differences statistically significant. This occurred for the first harvest in 1980 sprayed and the second harvest unsprayed. A similar trend existed for Dixie Runner.

Yields of Early Bunch and Florunner were higher in the sprayed than in the unsprayed block while the yields of Dixie Runner were greater in the unsprayed (Table 3).

**Market grade**

Florunner and Dixie Runner had a higher percentage of sound mature kernels (SMK) than Early Bunch in both years of the study and in all fungicide and floral bud treatments (Table 4). Fungicide usage increased the proportion of SMK for Early Bunch, regardless of the floral bud treatment, and removal of buds resulted in lowered SMK. Percentages of SMK for Florunner were similar for all treatments, except for a large increase when floral buds were removed without sprays. Treatments had no significant effect on SMK percentages for Dixie Runner, but the unsprayed and bud removal treatment produced the higher SMK values.

The SMK yield per hectare of Early Bunch with floral buds removed was numerically higher than other treatments within harvests, although the yields were only significantly higher in the two harvest of the second year (Table 5). Early Bunch showed the greatest yield response to fungicide sprays. Florunner SMK yields were higher in the sprayed than in the unsprayed plots, while removal of floral buds had no significant effect. Dixie Runner gave a significant negative response to fungicide sprays for three of the four harvests.

## Discussion

The three cultivars in this study differ in maturity, fruit size, yield potential, and apparent reaction to leafspot diseases. Critical data on reaction to leafspot between Early Bunch and Florunner were provided by Shokes *et al.* (17). Their

Table 3. Effects of fungicidal spray and removal of floral buds on the pod yield (g plot$^{-1}$) for two harvests of three peanut cultivars in 1979 and 1980.

| Cultivar | Treatment | | 1979 Harvest | | 1980 Harvest | |
|---|---|---|---|---|---|---|
| | | | First | Second | First | Second |
| | Fungicide* | Floral Buds | g plot$^{-1}$ | | | |
| Early Bunch | Yes | Removed | 561 | 552 | 534 | 545 |
| | Yes | Control | 830 | 820 | 792 | 807 |
| | No | Removed | 170 | 174 | 212 | 211 |
| | No | Control | 446 | 439 | 432 | 445 |
| Florunner | Yes | Removed | 628 | 641 | 528 | 584 |
| | Yes | Control | 679 | 703 | 597 | 615 |
| | No | Removed | 438 | 452 | 415 | 423 |
| | No | Control | 534 | 531 | 432 | 470 |
| Dixie Runner | Yes | Removed | 262 | 283 | 273 | 299 |
| | Yes | Control | 322 | 366 | 329 | 384 |
| | No | Removed | 390 | 400 | 384 | 412 |
| | No | Control | 405 | 451 | 397 | 471 |
| | | $LSD_{0.05}$ = | 182 | 170 | 47 | 33 |

* Plots were sprayed with chlorothalonil at a rate of 1.8 kg ha$^{-1}$.

data indicated that Early Bunch was more susceptible to *C. personatum* (late leafspot), which is the dominant peanut pathogen in the southeastern USA, based on lesion counts, defoliation, and pod yields. Knauft and Gorbet (12) found that late leafspot caused less necrotic leaf tissue and less defoliation of Dixie Runner than of either Florunner or Early Bunch. The results from this study support their findings that Dixie Runner is less affected by leafspot than the other two cultivars.

These cultivars also differ in the proportion of assimilate partitioned to developing fruit in relation to continuous vegetative growth. Duncan *et al.*, (3) found the proportion to be 40, 85, and 98% for Dixie Runner, Florunner, and Early Bunch, respectively when leafspot diseases were controlled. Knauft and Gorbet (12) found similar partitioning rates for Florunner but slightly higher for Dixie Runner and lower for Early Bunch when the cultivars were grown without controlling leafspot. Neither Florunner or Early Bunch produce much new vegetation once the linear phase of pod development begins, while Dixie Runner continues to partition more assimilate to vegetative growth than to pod dry weight. When Florunner and Early Bunch were debudded to delay the onset of fruit development, leafspot disease was reduced (Tables 1 and 2). The mechanism for this may be that removal of floral buds caused the plants to continue vegetative growth. Also, the removal or reduction of the fruit sink could change the physiological reactions of the plant to leafspot. If removal of floral buds caused all cultivars to continue vegetative growth, new leaves would replace diseased and lost leaves. This would not be possible in normal growth since vegetative growth would have ceased. This may partially explain the frequent observation of lower yields and later maturity associated with leafspot resistance in peanut germplasm. Lines which continue vegetative growth during pod filling may contribute to the appearance of resistance by replacing leaves lost from leafspot disease. Lines with continued vegetative growth could also be expected to have lower pod yields than lines that partition most of the assimilate to pods. Persistent vegetative growth with slower pod accumulation can delay maturity.

Much of the leafspot breeding work in peanut has concentrated on selection based on visual ratings of overall

Table 4. Effects of fungicidal spray and removal of floral buds on the percentage of sound mature kernels (SMK) for two harvests of three peanut cultivars.

| Cultivar | Treatment | | 1979 Harvest | | 1980 Harvest | |
|---|---|---|---|---|---|---|
| | | | First | Second | First | Second |
| | Fungicide* | Floral Buds | % SMK | | | |
| Early Bunch | Yes | Removed | 61.4 | 65.5 | 65.2 | 65.6 |
| | Yes | Control | 67.0 | 65.0 | 69.3 | 67.3 |
| | No | Removed | 39.5 | 51.2 | 60.1 | 58.4 |
| | No | Control | 62.0 | 62.8 | 63.4 | 64.4 |
| Florunner | Yes | Removed | 73.8 | 74.3 | 74.3 | 75.8 |
| | Yes | Control | 74.3 | 74.5 | 74.8 | 75.7 |
| | No | Removed | 81.7 | 81.5 | 82.0 | 83.7 |
| | No | Control | 74.3 | 74.9 | 74.5 | 75.6 |
| Dixie Runner | Yes | Removed | 73.8 | 70.5 | 71.5 | 71.2 |
| | Yes | Control | 73.1 | 73.0 | 74.2 | 73.9 |
| | No | Removed | 74.4 | 73.8 | 75.3 | 74.9 |
| | No | Control | 72.3 | 72.2 | 73.1 | 73.5 |
| | | $LSD_{0.05}$ = | 6.0 | 6.9 | 3.9 | 1.6 |

* Plots were sprayed with chlorothalonil at a rate of 1.8 kg $ha^{-1}$.

disease resistance (2, 5, 10, 11). These procedures may have selected lines with continued vegetative growth. Southern Runner is a leafspot resistant cultivar with later maturity and continued vegetative growth through the season. However, its pod yield is comparable to Florunner (5, 11, 16). Concentration of additional selection techniques to identify specific components of resistance, as noted by Chiteka *et al.* (2) or by Green and Wynne (6) may be a more appropriate method of selecting true resistance and reducing the influence of inefficient partitioning.

For each spray, year, and harvest combination, floral bud removal caused a significant yield reduction for Early Bunch. The reduced reaction to leafspot due to removal of floral buds had little effect on the yields, since the treatment with no spray and floral buds removed had lower yields than any other treatment combination. Delaying harvests for 15 days did not afford an opportunity for the plants to add sufficient yield to compensate for the delayed start of pod fill.

The pod yield of Florunner and Dixie Runner and percentage sound mature kernels were scarcely affected by floral bud removal. In fact, there were few significant differences between floral bud treatments within spray treatments. The use of fungicides on Florunner increased yields, while it appears that fungicides actually may have decreased yields of Dixie Runner. In no case, however, was the improved control of leafspot through floral bud removal associated with an increase in yield. This undoubtedly occurred because the plants were unable to recover the pod loss due to bud removal.

The prevention of fruit formation on peanut cultivars by removal of floral buds resulted in improved leafspot resistance. The disease resistance afforded by the debudding treatment was not sufficient, however, to overcome pod loss from early bud removal and provide an increase in pod or seed yields.

The association of leafspot resistance with later maturity and lower pod yields may be the result of unconscious selection of lines with continued vegetative growth during the pod filling period, as may have occurred to the cultivars in this study when flowers were removed. The resistance of such lines could come about through replacement of diseased leaves, as much as or more than through any effect on the

**Table 5. Effects of fungicidal spray and removal of floral buds on the yield of sound mature kernels (kg ha$^{-1}$) for two harvests of three peanut cultivars.**

| Cultivar | Treatment | | 1979 Harvest | | 1980 Harvest | |
|---|---|---|---|---|---|---|
| | | | First | Second | First | Second |
| | Fungicide* | Floral Buds | ---------- kg ha$^{-1}$ ---------- | | | |
| Early Bunch | Yes | Removed | 2425 | 2612 | 2502 | 2570 |
| | Yes | Control | 4025 | 3837 | 3947 | 3909 |
| | No | Removed | 477 | 656 | 917 | 885 |
| | No | Control | 2000 | 1985 | 1971 | 2064 |
| Florunner | Yes | Removed | 3325 | 3420 | 3126 | 3355 |
| | Yes | Control | 3627 | 3774 | 3213 | 3181 |
| | No | Removed | 2580 | 2653 | 2447 | 2550 |
| | No | Control | 2853 | 2852 | 2315 | 2556 |
| Dixie Runner | Yes | Removed | 1327 | 1432 | 1407 | 1531 |
| | Yes | Control | 1679 | 1887 | 1759 | 2043 |
| | No | Removed | 2080 | 2127 | 2077 | 2221 |
| | No | Control | 2180 | 2342 | 2088 | 2488 |
| | | $LSD_{0.05}$ = | 902 | 838 | 283 | 188 |

* Plots were sprayed with chlorothalonil at a rate of 1.8 kg ha$^{-1}$.

pathogen. However, lack of fruit load and possibly other physiological conditions could contribute to the ability of plants to withstand leafspot. Emphasis on selection techniques to include selection for actual components of resistance may assist breeders in identifying earlier maturing, higher yielding lines.

## Literature Cited


1. Carver, W. A., and F. H. Hull. 1950. Dixie Runner peanut. Fla. Agric. Exp. Sta. Circ. S-16.
2. Chiteka, Z. A., D. W. Gorbet, F. M. Shokes, T. A. Kucharek and D. A. Knauft. 1988. Components of resistance to late leafspot in peanut. I. Levels and variability - implications for selection. Peanut Sci. 15:25-30.
3. Duncan, W. G., D. E. McCloud, R. L. McGraw, and K. J. Boote. 1978. Physiological aspects of peanut yield improvement. Crop Sci. 18:1015-1020.
4. Gibbons, R. W., and B. E. Bailey. 1967. Resistance to *Cercospora arachidicola* in some species of *Arachis*. Rhod. Zamb. and Mal. J. Agric. Res. 5:57-59.
5. Gorbet, D. W., A. J. Norden, F. M. Shokes, and D. A. Knauft. 1986. Southern Runner - A new leafspot-resistant peanut variety. Circ. No. S-324. Florida Aric. Exp. Stn., Gainesville.
6. Green, C. C., and J. C. Wynne. 1986. Field and greenhouse evaluation of components of partial resistance to early leafspot in peanut. Euphytica 35:561-563.
7. Hemingway, J. S. 1955. The prevalence of two species of *Cercospora* on groundnuts. Trans. Brit. Mycol. Soc. 38:243-246.
8. Iroume, R. N., and D. A. Knauft. 1987. Heritabilities and genetic, environmental, and phenotypic correlations for pod yield and leafspot severity in peanuts (*Arachis hypogaea* L.): Implications for early generation selection. Peanut Sci. 14:46-50.
9. Knauft, D. A., A. J. Norden and D. W. Gorbet. 1986. The effect of three digging dates on oil quality, yield and grade of five peanut genotypes grown without leafspot control. Peanut Sci. 13:82-86.
10. Knauft, D. A., A. J. Norden and D. W. Gorbet. 1987. Peanut breeding. in: Principles of Cultivar Development. Vol. 2. pp. 346-384. W. R. Fehr (ed.), Macmillan Pub. Co., N. Y.
11. Knauft, D. A., D. W. Gorbet and A. J. Norden. 1988. Yield and market quality of seven peanut genotypes as affected by leafspot disease and harvest date. Peanut Sci. 15:9-13.
12. Knauft, D. A., and D. W. Gorbet. 1990. Variability in growth characteristics and leafspot resistance parameters of peanut lines. Crop Sci. 30:169-175.
13. Monasterios de la Torre, T. 1980. Genetic resistance to *Cercospora* leafspot disease in peanut (*Arachis hypogaea* L.). Ph. D. Dissertation, Univ. of Florida, Gainesville. 102 p. (Diss. Abstr. 0419-4217).

14. Norden, A. J., R. W. Lipscomb, and W. A. Carver. 1969. Registration of Florunner peanut. Crop Sci. 9:850.
15. Norden, A. J., R. O. Hammons, and D. W. Gorbet. 1978. Registration of Early Bunch peanut. Crop Sci. 18:913-914.
16. Pixley, K. V. 1985. Physiological and epidemiological characteristics of leafspot resistance in four peanut genotypes. M. S. Thesis. Univ. of Florida, Gainesville. 138 p.
17. Shokes, F. M., D. W. Gorbet, and L. F. Jackson. 1983. Control of early and late leafspot on two peanut cultivars.Peanut Sci. 10:17-21.
18. Sowell, G. Jr., D. H. Smith, and R. O. Hammons. 1976. Resistance of peanut plant introductions to *Cercospora arachidicola*. Plant Dis. Rept. 60:494-498.
19. Walls, S. B., J. C. Wynne, and M. K. Beute. 1985. Resistance to late leafspot of peanut progenies selected for resistance to early leafspot. Peanut Sci. 12:17-22.

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