VARIETAL REACTION OF COCONUT TO *OLIGONYCHUS VELASCOI* RIMANDO USING FIVE MITE-BASED BIOLOGICAL PARAMETERS

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ABSTRACT

Five mite-based biological parameters were used to determine the effect of the coconut varieties Baybay Tall, Malayan Orange Dwarf (MOD) and MAWA on the biology of spider mite *Oligonychus velascoi* Rimando. Parameters like total developmental period, fecundity of females and adult longevity indicated that Baybay Tall was the most suitable host for spider mites. On the other hand, MOD seedlings were unsuitable to the mites. A high mortality of immatures was noted in MOD, suggesting the presence of antibiotic component in its sap. An intermediate suitability of immatures was observed in MAWA hybrid seedlings. The prescribed minimum number of seedlings for assessing varietal reaction of pests differed with the coconut varieties used and the biological parameters considered.

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KEY WORDS: Coconut. Varietal reaction. *Oligonychus velascoi.* Mite.

INTRODUCTION

Coconut, being a perennial crop, is continuously subject to attack by a number of pests. One of the more serious pests attacking coconut is the spider mite, *Oligonychus velascoi* Rimando. With a ready host, this pest can multiply without interruption, resulting in severely damaged plantations. Its small size, rapid reproduction and the protection provided by its webs have made its control with chemical or biological agents more difficult. Thus, the development of varietal resistance may offer a practical solution to the spider mite problem. This may be a long-term process but it is more economical and profitable in the long run.

Varietal screening may be performed either by measuring the plant responses to the pest or by determining the effect of the plants on the biology of the pests. Plant

damage, as a result of pest feeding and/or colonization, is more often a direct measure of resistance (Maxwell and Jennings, 1980). However, it is difficult to assess plant response to sucking pests since the damage they inflict is not as readily detectable as that caused by chewing insects. Also, coconut seedlings do not readily succumb to pest damage because of their relatively large size, hence, plant mortality cannot be a criterion for resistance. The most practical criterion to use is the adverse effect of the test varieties on the biology of the spider mite. Crop varieties have been shown to greatly influence the fecundity and life history of arthropod pests which are not very mobile, has short life cycle and great reproductive potential (Painter, 1951).

Among the important requirements for varietal evaluation against any pest are the presence of sufficient pest population to ensure adequate infestation of the test varieties, reliable criteria for identifying resistant plants, and sufficient test plants to adequately represent the reaction of a given variety. The last requirement is particularly important for open-pollinated crops like coconut when great genetic variability among individual plants can be expected.

This study was conducted to establish the effect of 3 coconut varieties on the biology of the spider mite and to determine the minimum number of coconut seedlings that can reliably reflect the general reaction of a variety to spider mite.

MATERIALS AND METHODS

Preparation of Test Plants. — Three coconut varieties were used, namely; Baybay Tall, Malayan Orange Dwarf (MOD) and MAWA (hybrid between Yellow Malayan Dwarf and West African Tall). A total of 30 seven to eight month-old coconut seedlings were placed in the screenhouse before testing. Testing started as soon as the fronds were fully opened. Handweeding and mechanical removal of insect pests were done to keep the seedlings pest-free.

Mass Rearing of Mites. — Spider mites collected from infested coconut seedlings in the nursery were reared continuously in the screenhouse using MOD seedlings. Pieces of infested leaflets were attached to the undersurfaces of uninfested leaflets (Fig. 1). Artificial infestation of new host plants was done when necessary to maintain the stock culture and have enough supply of mites for testing. Infested fronds were covered with pillowcase nets made of finely meshed nylon cloth to prevent predators from feeding on the mite culture (Fig. 2).

Effect of Coconut Variety on Spider Mite Biology. — The third youngest fronds of 10 seedlings per variety were infested with spider mites. Mites were confined in rearing blocks assembled from 3 pieces of acrylic plastic attached to coconut leaflets (Fig. 3). Each block measured 2.54 cm x 7.62 cm x 1.67 cm. The central block was provided with

a 1-cm diameter observation hole at the center.

One first instar nymph was introduced per culture block, and following the recommendation of Monreal (1981), at least 20 cultures were successfully reared on each seedling. Twenty-five cultures were reared on Baybay Tall seedlings (Fig. 4), 30 cultures on Malayan Orange Dwarf (MOD), and 20 on MAWA. Infestations of Baybay Tall and MOD were made simultaneously while that of MAWA was made 1 month after because of the late splitting of some leaflets. The cultures were observed daily with the use of a 20x achromatic hand lens. Data on life cycle of mites from egg hatching to adult emergence, fecundity of females, adult longevity, sex ratio and mortality of immatures were collected.

Fig. 1. Spider mite-infested coconut leaf pieces brought in contact with the underside of healthy leaflets.

Fig. 2. Malayan Orange Dwarf coconut seedlings used in the mass rearing of spider mites. Note the pillowcase nets used for protecting colonies against predators.

Determination of the Minimum Number of Seedlings Needed. — The same data collected from the preceding section were statistically analyzed for the determination of the minimum number of test seedlings needed. The total life cycle of the insect and other biological parameters excluding sex ratio and mortality of immatures in the 3 varieties were compared.

The sets which corresponded to the number of seedlings used, i.e., information on biological parameters derived from 20-30 individual cultures on each of the 10 seedlings were compared. Changes in coefficients of variation (C.V.) between the sets were computed. The minimum number of plants for each

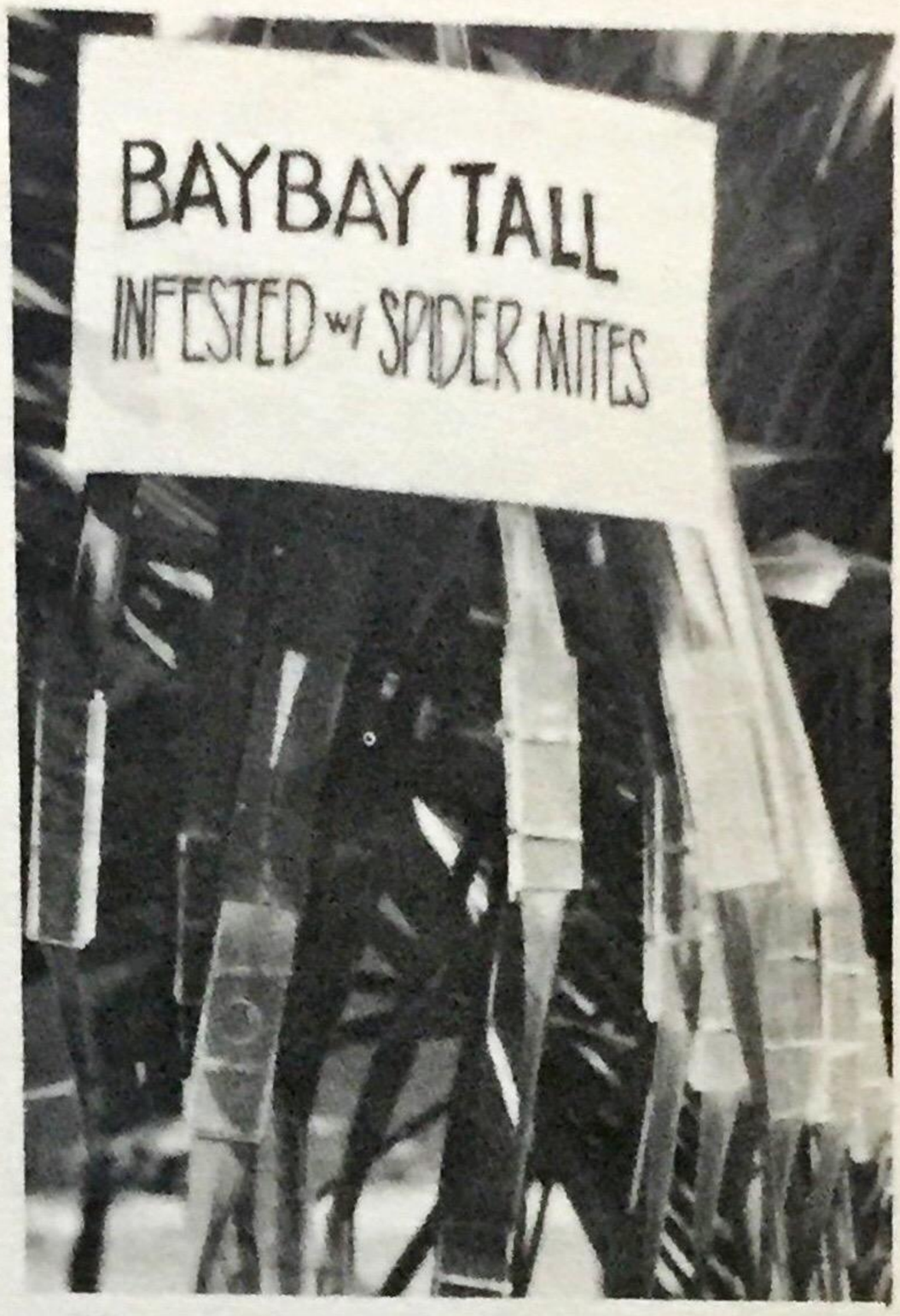

Fig. 3. Plastic blocks attached to coconut leaflets used in rearing spider mites.

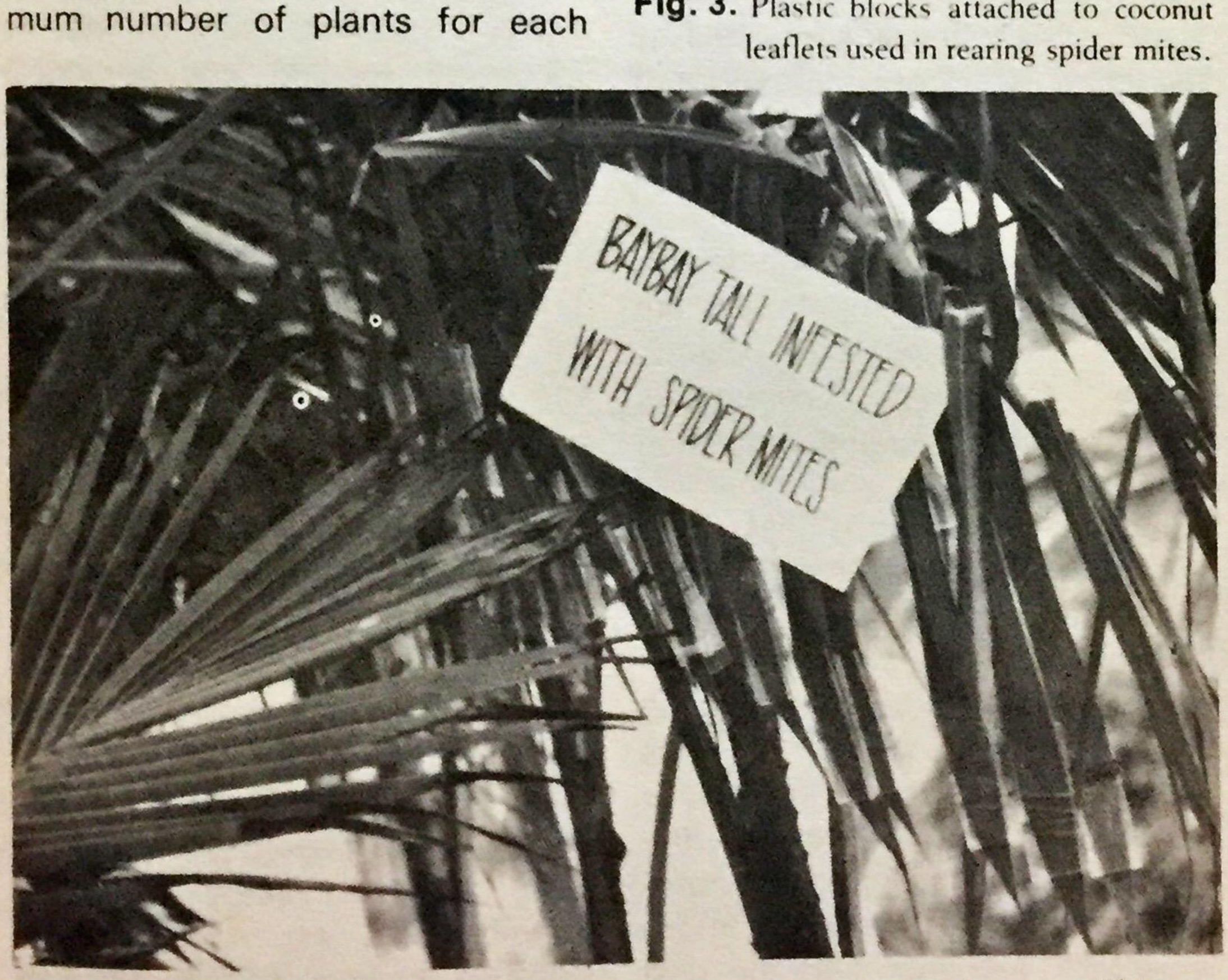

Fig. 4. A frond of Baybay Tall coconut seedling used in rearing 25 spider mites. This was done to determine the minimum number of plants for evaluating varietal reaction based on the biology of the mites.

variety using the aforementioned parameters was then determined. The minimum number of seedlings on which to rear 20-30 spider mites per seedling that would reliably reflect the reaction of the coconut variety under study to spider mites was the number immediately following the greatest changes in C.V. values (Le Clerg *et al.*, 1962).

RESULTS AND DISCUSSION

Biological Data .

Based on the biological parameters used, Baybay Tall was the most susceptible variety to spider mites (Table 1). MAWA hybrid was found to be the most unsuitable host for the mites as suggested by the longer developmental period of males and females, shorter longevity and lesser eggs laid by each female. It should be noted that short developmental period, high fecundity and high longevity of mites are detrimental to the host plants. These mite-based parameters generally indicate a rapid population build-up and could result in more extensive damage to the host.

The length of the developmental period, longevity and fecundity are biological parameters that are greatly influenced by nutrition during the developmental stages. It thus appears that among the 3 varieties tested, Baybay Tall provided the most suitable combination of nutrients required by the spider mites while MOD seedlings were the least suitable hosts.

The performance of male and female mites reared on MOD and MAWA hybrid seedlings suggests less suitability of these varieties as hosts. Since the nutritive value of a host is dependent on both the qualitative and quantitative combination of nutrients, it appears that the composition of the sap of these 2 varieties is less acceptable to the mites. Fecundity and adult longevity are parameters that are highly influenced by the qualitative food requirements of the organism. Thus, the fecundity of one essential component in the plant could markedly decrease the values of the 2 parameters.

The quantitative food requirements of mites reared on MOD and MAWA varieties could be met by increased feeding and/or longer duration of developmental stages. A longer developmental period was observed for both male and female mites reared on these varieties (Table 1). This may thus be taken as an indication of a compensatory mechanism to obtain the required amount of essential nutrients.

A high mortality of immatures was noted on MOD suggesting that this variety has an antibiotic component present in its sap.

Male-female ratio of mites reared on the 3 varieties showed that the highest number of females was observed in cultures using MAWA. However, it appears that the host plant or the variety does not influence the sex ratio of mites because sex is genetically established as early as the egg stage.

Table 1. Biological data of coconut spider mites reared on 3 coconut varieties. [1]

Coconut Variety	Biological Parameters						
	Total Developmental Period		Fecundity	Adult Longevity		Mortality of Immatures	Sex Ratio (M:F)
	Female	Male		Female	Male		
Baybay Tall	9.92a	10.02a	19.94a	31.16a	39.97a	2.50a	1:2.26
Malayan Orange Dwarf	11.70b	12.03	17.56ab	24.10b	22.36b	32.0b	1:2.05
MAWA	13.57c	13.72c	13.24b	24.50b	23.16b	4.50a	1:2.52

[1] Based on 10 seedlings with at least 20 mites per seedling.
Means followed by the same letter are not significantly different at 5% level based on LSD.

Minimum Number of Plants and Varietal Reaction to the Mites.

The prescribed minimum number of seedlings (Table 2) differed with the varieties used and the biological parameters considered. The minimum number ranged from 3-10 for mites reared on Baybay Tall and MAWA, and 4-10 for those reared on MOD seedlings.

It should be pointed out that the minimum number of seedlings for assessing varietal reaction to pest should be the highest number prescribed for the given parameter; otherwise, the data obtained would not be reliable.

Differences in the prescribed minimum number of seedlings for a given parameter in the 3 varieties may be explained by their different

Table 2. Minimum number of seedlings on which the prescribed number of spider mites must be reared to reliably reflect varietal reaction based on Maximum Curvature Method (MCM) or Coefficient of Variation (C.V.) [1]

Parameter	Coconut Varieties		
	Baybay Tall	MOD	MAWA
Total Developmental Period			
Female	3	4	10
Male	9	6	3
Female Fecundity	10	10	3
Adult Longevity			
Female	5	5	10
Male	10	4	3

[1] Based on at least 20 coconut spider mites used for each variety.

genetic compositions. Based on genetic components of the 3 varieties, Baybay Tall is the most genetically variable and MOD, the most stable. MAWA hybrid, an F_1 is intermediate in genetic stability having a more homogeneous genetic make-up (Tung Ly, personal communication).

More than 10 seedlings are needed to reflect varietal reaction of Baybay Tall and MOD on the fecundity of mites as this parameter is readily affected by the type of nutrition provided by the host plants. Coconut is a cross-pollinated crop, hence high genetic heterogeneity exists among individual plants and the nutritive value of each plant is expected to vary within the variety.

The minimum number of seedlings used to measure parameters like total developmental period and adult longevity was higher in females than in males for MAWA hybrid but otherwise for Baybay Tall (Table 2). This could be attributed to the intermediate genetic stability of MAWA. MAWA belongs to the F_1 generation such that the hybrid's genetic make-up is highly influenced by those of the parents. If the parents were heterozygous, it is likely that the dominant characters carried by one parent would mask the opposing recessive characters of the other. In this case, greater variability among individual F_1 plants may be expected. The prescribed minimum number for MAWA seedlings must therefore be considered as rough estimates only.

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