Chapter 3
Survey of Coconut Mite Distribution and Damage

Introduction

The coconut mite, *Eriophyes guerreronis* (Keifer) (Acari: Eriophyidae) is a microscopic organism that breeds under the perianths of coconuts (*Cocos nucifera* Beccari). There it feeds on the meristematic tissue of the nut surface. Occasionally it feeds on the growing points of the seedling. The first symptom of damage is a white streak resulting from the chlorosis of the cells. The damaged cells eventually become suberized and hence appear brown (Julia and Mariau 1979, Hall 1981, Anonymous 1985). As the nut grows in size, the cells around the damaged area multiply, creating stress in the area of damage (McCoy and Albrigo 1975). This results in the development of deep fissures in the damaged area. In extreme cases, there may be up to 80% surface area damaged, accompanied by great distortion and reduction in nut size, and a decline in copra output (Julia and Mariau 1979, Hall 1981, Anonymous 1985).

Colonization of coconuts by coconut mites takes place shortly after fertilization (Moore *et al.* 1989). Coconut mite populations peak on 3- to 6-month old nuts, after which, the numbers decline sharply so that nuts over nine months old have relatively low populations (Moore and Alexander 1987). Coconut mites tend to leave nuts two to three months before the nuts are fully developed or when damage to the pericarp exceeds 15% because there is no renewal of meristematic tissues (Anonymous 1985). In addition, damaged nut surfaces tend to secrete resin which traps and kills the mites (Moore and Alexander 1987).

Although the coconut mite was first recorded in Jamaica in 1941, it was not considered a pest until 1972 (Hall 1981). After this outbreak of the coconut mite a survey was conducted throughout the island to assess its distribution (Hussey 1975). Earle (unpublished) conducted another survey in 1989 in the major coconut growing areas, in the eastern parishes of the island, Portland, St. Mary and St. Thomas. This survey determined only the presence or absence of the mite. She confirmed that the three parishes were generally infested. The objectives of this survey were to:

1. compare the extent of coconut mite damage on coconut farms in the parishes of St. Mary and St. Thomas,
2. assess the variability of coconut mite infestation among trees on a single farm, and
3. compare the extent of coconut mite damage on Maypan and Red Malayan Dwarf coconut varieties

Materials and Methods

1. The extent of coconut mite damage on coconut farms in the parishes of St. Mary and St. Thomas

Nine randomly selected Red Malayan Dwarf coconut farms in eastern Jamaica were surveyed (Figure 1). Four of these were in St. Mary and five in St. Thomas. In St. Mary the farms were located in Guys Hill, Iter Boreale, Green Castle and Richmond districts. In St. Thomas they were located in Wilmington, Belvedere, Nutt's River, Hordley and Pleasant Hill. During April 1991 observations were made on ten randomly selected trees at each farm. At Wilmington only nine trees were bearing nuts while on the Green Castle Estate all 43 trees in a single stand were observed to fulfill objective two. On each tree the bunches were numbered, starting with the youngest bunch. Bunch numbers indicate the approximate age (in months) of the bunches. Each nut was graded *in situ* based on modification of the categories used by Moore *et al.* (1989). These categories are (See Figure 2):

Grade 0 - nuts with no mite damage,

Grade 1 - nuts with 1-29% surface area damage,

Grade 2 - nuts with 30-59% surface area damage and less than 20% reduction in size,

Grade 3 - nuts with 60-80% surface area damage, 20-30% reduction in size and with some deformation,

Grade 4 - nuts with over 80% surface area damage, over 30% reduction and often greatly deformed.

Data on the extent of coconut mite damage were analyzed using a GLM procedure with a logit link to investigate the main effects of parish farm, and bunch age, and their interactions. Significance of the sources of variation of interest was determined using Chi Squared tests.

2. The variability of coconut mite infestation among trees on a single farm

On the Green Castle Estate in St. Mary, all forty-three Red Malayan Dwarf coconut trees from one stand were selected. (About three trees did not have nuts and were ignored, as well as one colonized by wasps.) Damage caused by the coconut mite was graded as described earlier. Data on the extent of coconut mite damage were analyzed using a GLM procedure with a logit link to investigate the main effects of tree and bunch age, and their interactions. Significance of the sources of variation of interest was determined using Chi Squared tests.

3. The extent of coconut mite damage on Maypan and Red Malayan Dwarf varieties

This experiment was conducted on the Green Castle Estate in St. Mary. Ten Maypan and forty-three Red Malayan Dwarf coconut trees from among pure stands were selected. Damage caused by the

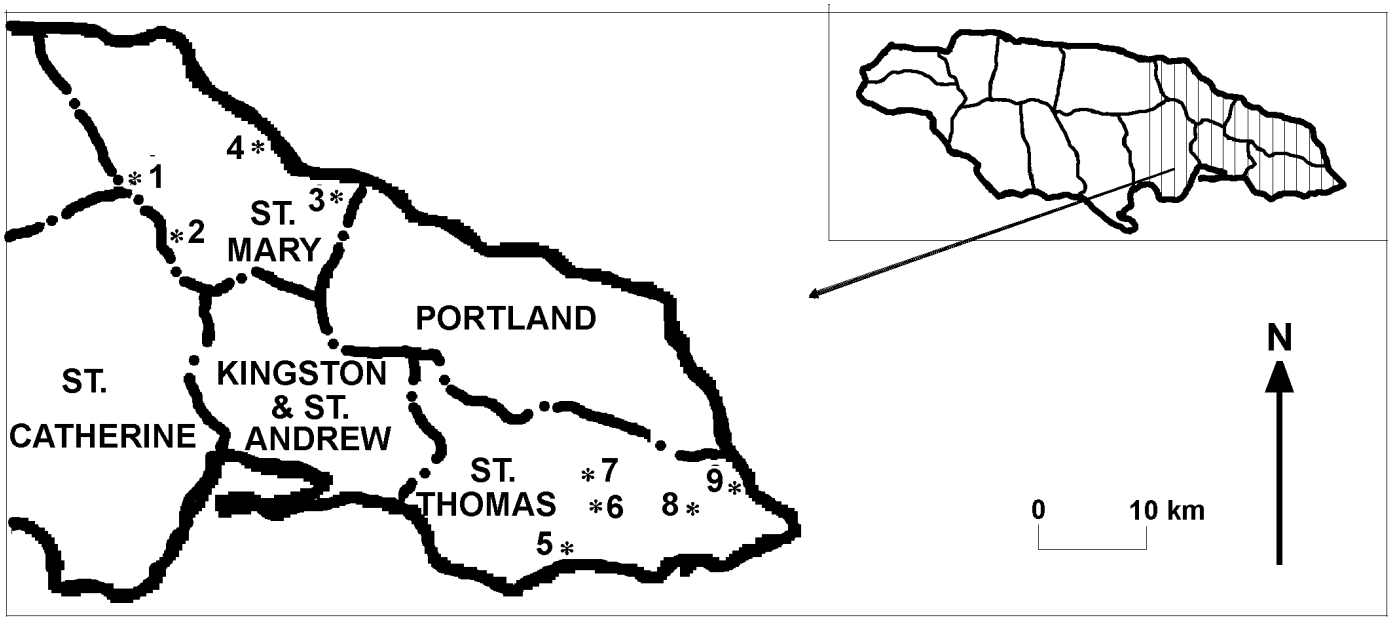

Figure 1. Farms where coconuts survey was conducted in eastern Jamaica, 1990. Numbered asteriks represent the locations of farms surveyed: 1 - Windsor Castle, 2 - Richmond, 3 - Iter Boreale, 4 - Green Castle, 5- Belvedere, 6 - Wilmington, 7 - Nutt's River, 8 - Pleasant Hill, 9 - Hordley.

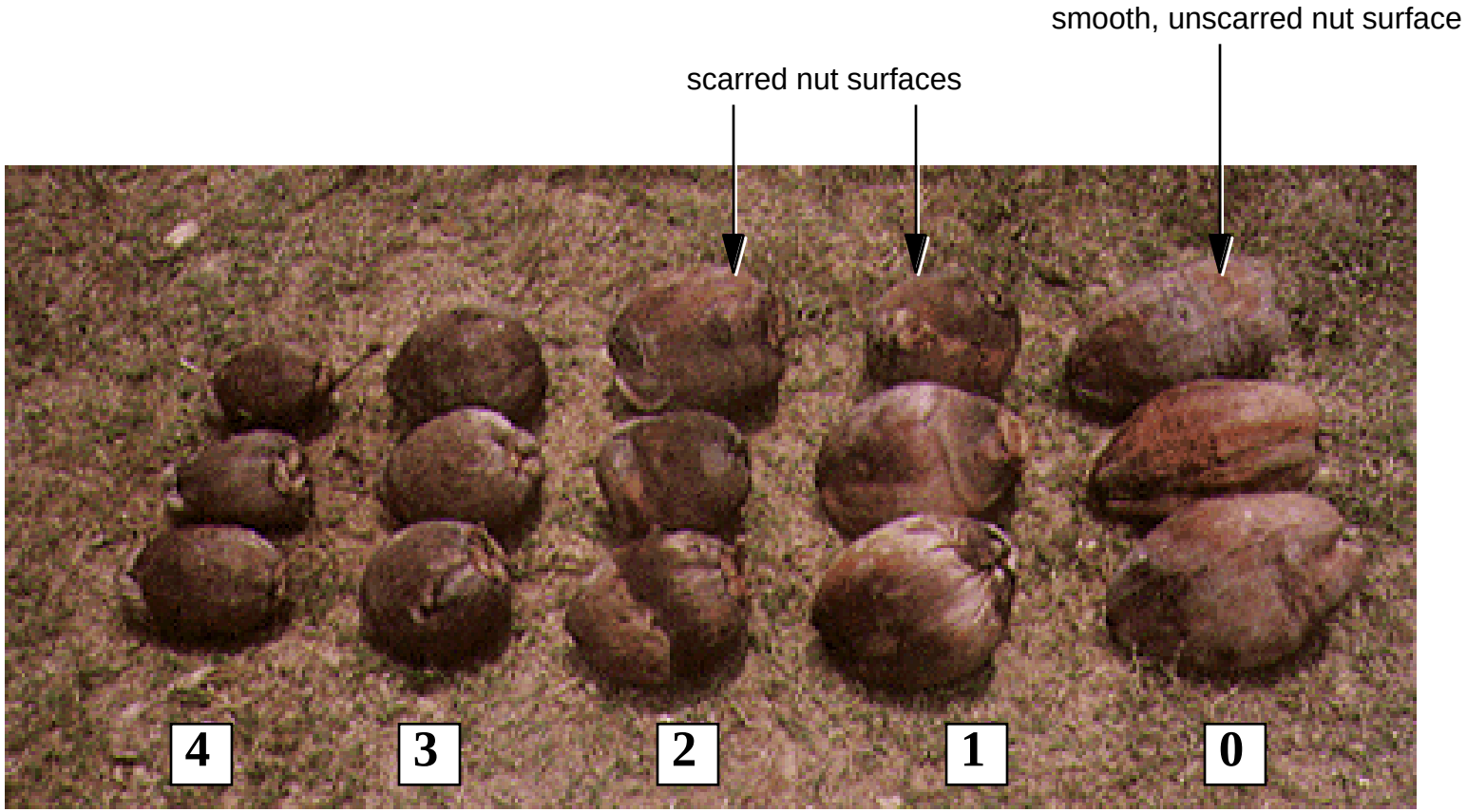

Figure 2. Nuts graded according to the extent of damage caused by the coconut mite *Eriophyes guerreronis* (Keifer). Grade 0 are nuts without coconut mite damage, grade 1 - nuts with 1-29% surface area damage, grade 2 - nuts with 30-59% surface area damage,grade 3 - nuts with 60-79% surface area damage, and grade 4 - nuts with > 80% surface area damage.

coconut mite was graded as described earlier. Data on the extent of coconut mite damage were analyzed using a GLM procedure with a logit link to investigate the main effects of variety and bunch age, and their interactions. Significance of the sources of variation of interest was determined using Chi Squared tests.

Results

1. The extent of coconut mite damage on coconut farms in the parishes of St. Mary and St. Thomas

The proportion of nuts with coconut mite damage in St. Mary was significantly ($p \leq 0.001$) less than that in St. Thomas (Figure 3). The lowest and highest infestation levels on the selected farms in St. Thomas were at least 10% higher than the lowest and highest infestation levels, respectively, in St. Mary. More of the youngest nuts were damaged in St. Thomas than in St. Mary (Figure 3). The extent of coconut mite damage varied significantly ($p \leq 0.001$) with the age of bunches. Younger bunches were less likely to be damaged than older bunches (Figures 3-5).

Inter-farm variations within these parishes were highly significant ($p < 0.001$) and the differences in the range of damage were up to 20% (Figures 4 and 5). In St. Mary damage was evident from bunch two on all farms (Figure 4). At Windsor Castle and Richmond, 50% of the damage was distributed among bunches two to six and the rest on bunches seven to nine. Less damage was distributed among the younger nuts at the Iter Boreal and Green Castle farms, 50% on bunches two to seven, and the rest on bunches eight to ten. In St. Thomas the first sign of coconut mite damage appeared on bunch two except for the Belvedere farm which had 3% damage on bunch one (Figure 5). On the farms at Wilmington, Belvedere, Pleasant Hill, and Nutt's River, 50% of all damaged nuts were found on the six youngest bunches. The remainder was distributed among bunches seven to ten. Bunches two to seven accounted for 50% of all damage on the farm at Hordley. The severity of coconut mite damage increased with nut age. Damage grades two and three appeared at bunch three, and grade four at bunch five. However, < 10% of the nuts had grades three and < 1% of the nuts had four damage (Figure 6).

2. The variability of coconut mite infestation among trees on a single farm

The Red Malayan Dwarf on the Green Castle Estate showed significant ($p < 0.001$) tree to tree variability (Figure 7). However, this was secondary to inter-bunch variability. Infestation levels ranged from 4 to 78%. Forty percent of all trees had less than 30% nuts with damage by the coconut mite while 19% had over 60%. The range of variability among trees was so wide that in three neighboring trees damage to nuts ranged from 4 to 30%.

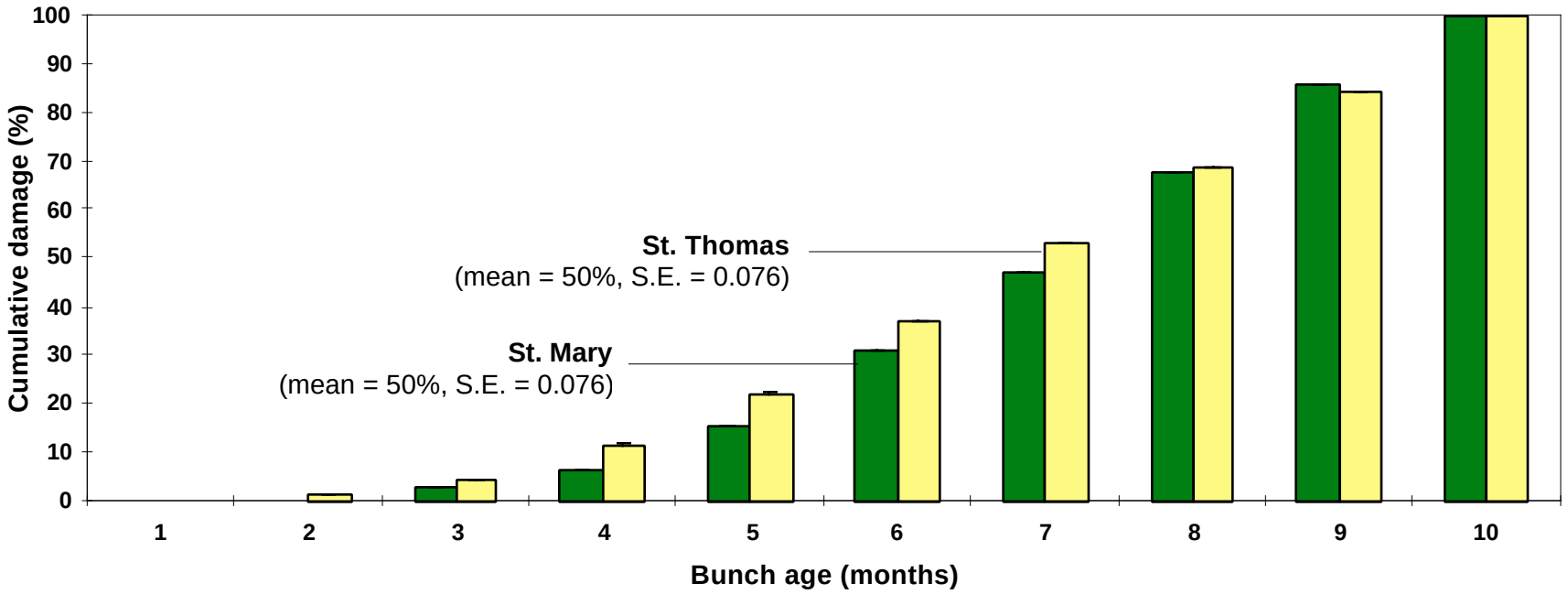

Figure 3. Cumulative damage caused by the coconut mite, ***Eriophyes guerreronis*** (Keifer), on coconuts of different ages in St. Thomas and St. Mary, Jamaica, 1990

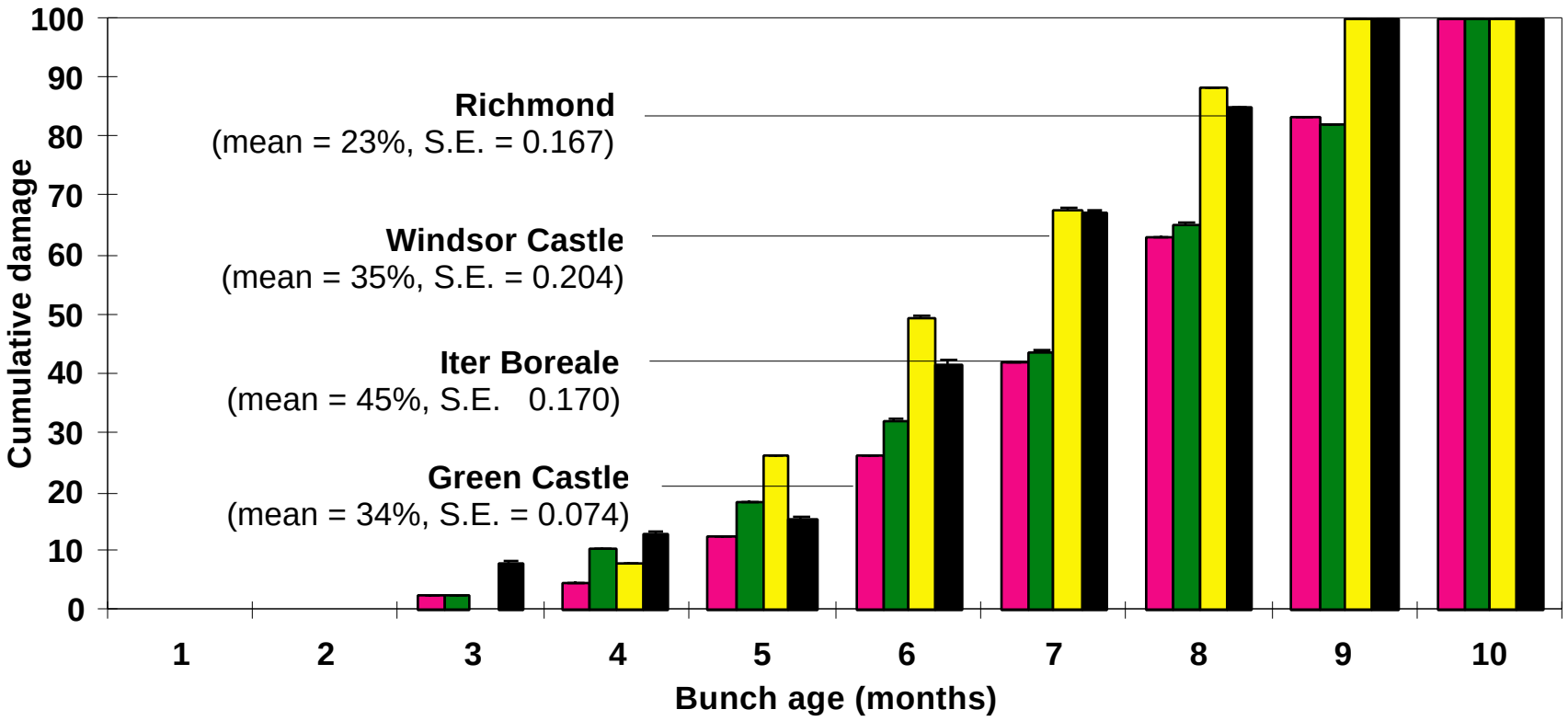

Figure 4. Cumulative damage caused by the coconut mite, ***Eriophyes guerreronis*** (Keifer), on coconuts of different ages at selected farms in St. Mary, Jamaica, 1990

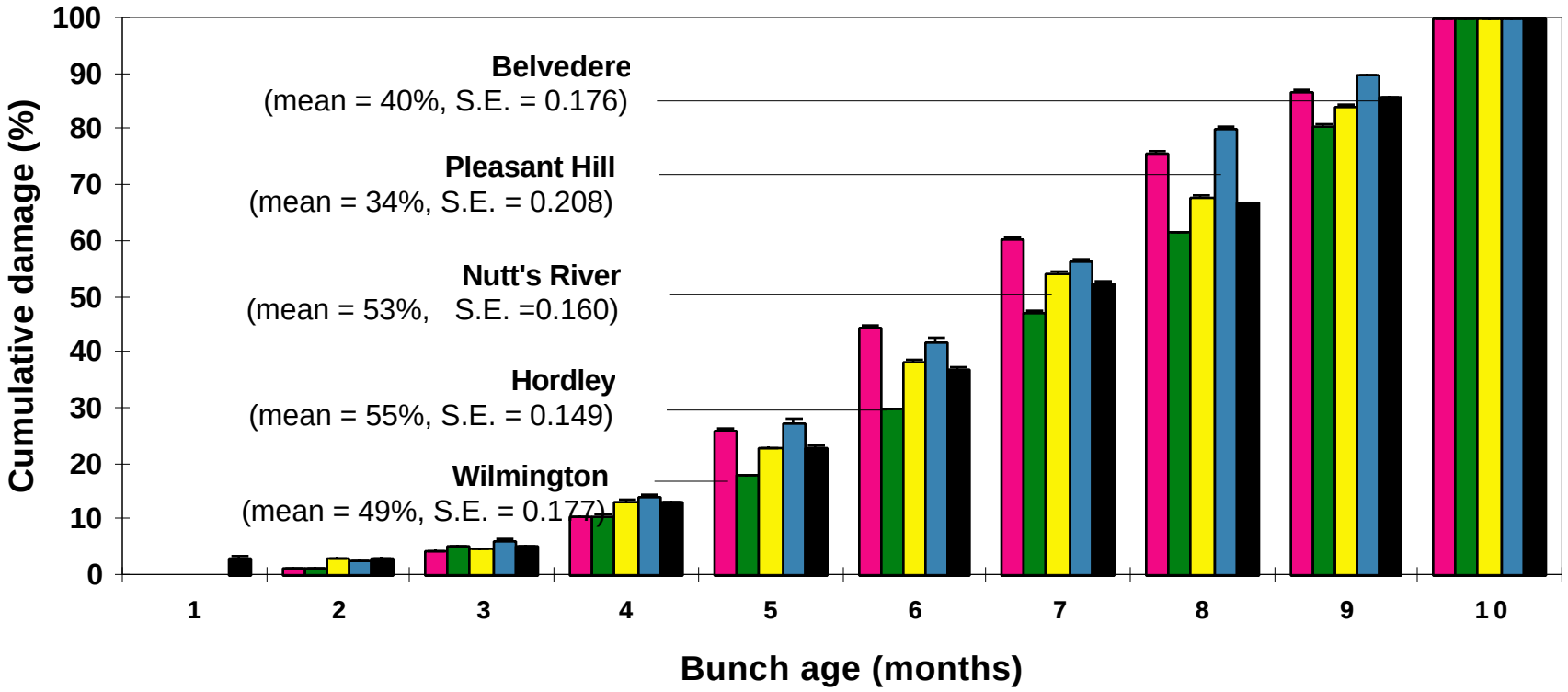

Figure 5. Cumulative damage caused by the coconut mite, ***Eriophyes guerreronis*** (Keifer), on coconuts of different ages at selected farms in St. Thomas, Jamaica, 1990

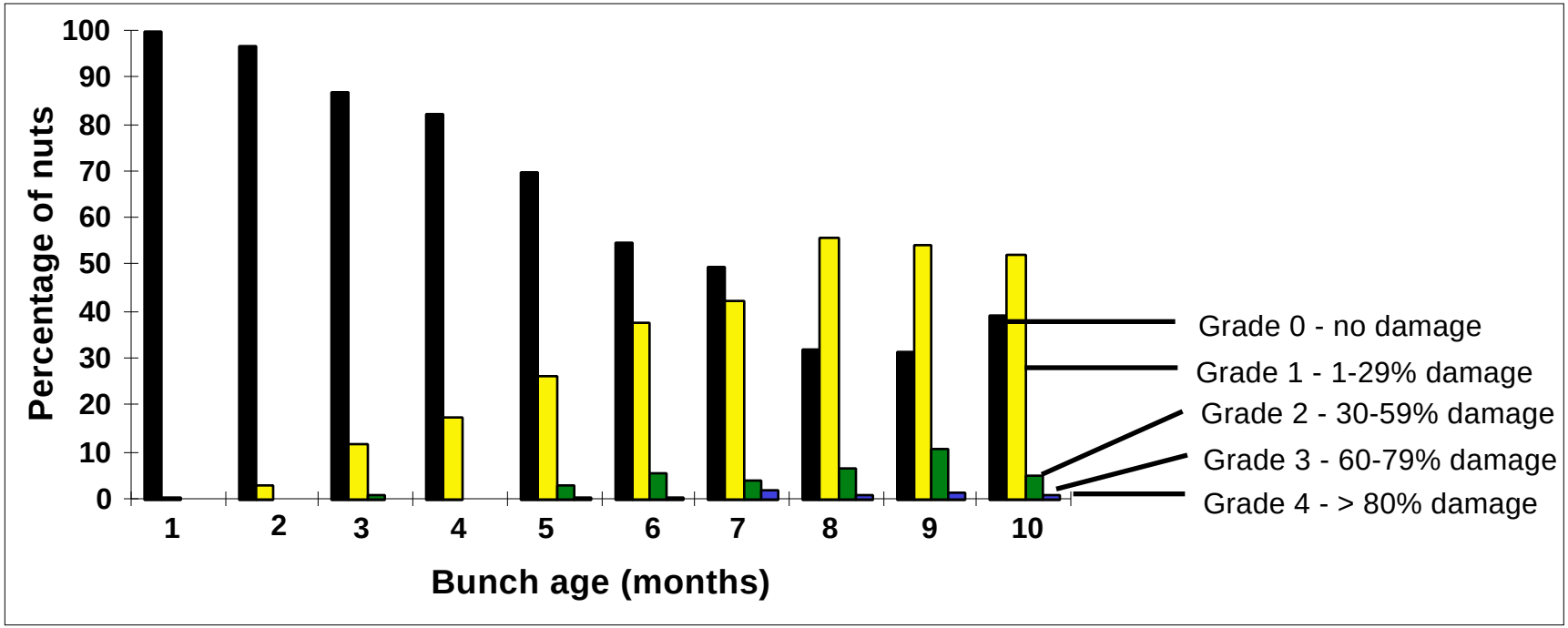

Figure 6. Distribution of damage caused by the coconut mite, ***Eriophyes guerreronis*** (Keifer), among coconuts of different ages in Jamaica, 1990

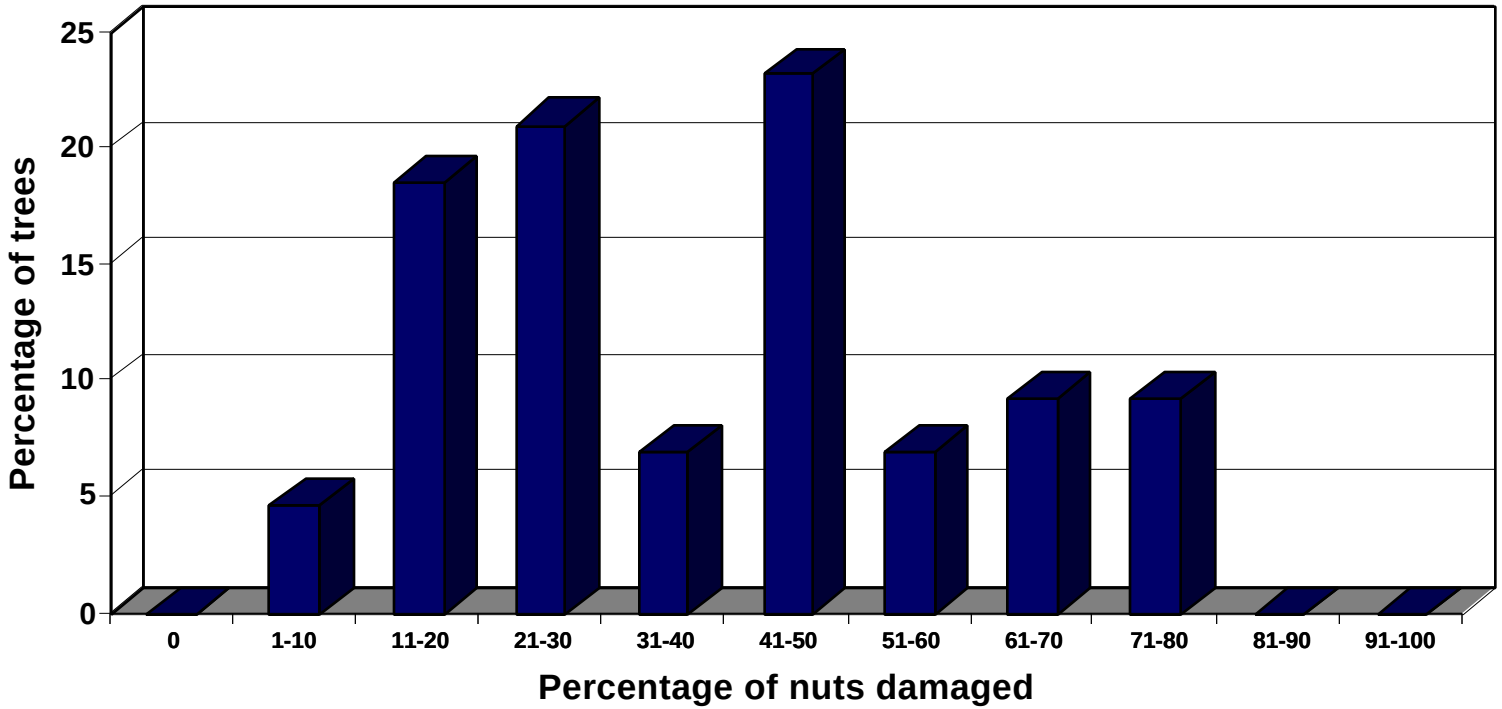

Figure 7. Differences in susceptibility among tree of the same plot to damage caused by the coconut mite, ***Eriophyes guerreronis*** (Keifer), in Jamaica, 1990

3. The extent of coconut mite damage on Maypan and Red Malayan Dwarf varieties

On the Green Castle Estate the percentage infestation was 36% on the Red Malayan Dwarf and 32% on the Maypan coconut varieties a difference significant at $p < 0.001$. There were significant differences in the pattern of infestation on the bunches ($p < 0.001$). On the Maypan variety the percentage of nuts with coconut mite damage on bunches three to five was greater than on similarly aged bunches of the Red Malayan Dwarf (Figure 8). On bunches six to eight there was greater damage on the Red Malayan Dwarf than on the Maypan variety.

Discussion

St. Thomas had greater mite infestation levels than St. Mary. This might be so because on average St. Thomas receives less rainfall than St. Mary per year. Intra-parish differences were also significant. There were differences in the age of the trees and the production practices of each farm. Mite infestation is expected to be high within older stands of coconut as the mite would have had plenty of time to disperse. The opposite is expected for young stands of coconut. The farm at Pleasant Hill had the youngest bearing trees of all the farms. It also had the lowest percentage infestation within the parish of St. Thomas. The coconut farms in Richmond and Guys Hill were operated on a mixed cropping system. This type of farming system might have contributed to the low mite infestation on these farms (Moore *et al.* 1989). The coconut plants might have benefited from fertilization of the intercrop while the latter hampered the dispersal of the mite.

Young bunches are comprised of flowers and early stages of the developing nut (Moore *et al.* 1989). Normally, it is on these bunches that the mite population is just being established. By the time externally visible damage symptoms appear, most nuts would be more than two months old. The offset of the scarring process requires multiple puncture of epidermal cells by hundreds of these microscopic mites to produce sufficient injury for the cells to die (McCoy and Albrigo 1975). This is followed by loss of cell contents, cork formation and browning of the damaged surface. Fissures then develop on the nut surface as stress is created when the undamaged, neighboring cells begin to multiply (McCoy and Albrigo 1975). As time is needed for the damage symptoms to develop, they would be more evident as the nut gets older. Thus, one can appreciate why the general trend of damage on the bunches is similar, irrespective of variety or geographical location.

A high level of inter-tree variability was found within the Red Malayan Dwarf variety. This variability within individual varieties is thought to be an expression of distinct physiological and genetic characteristics (Mariau 1977 1986, Julia and Mariau 1979, Moore 1986, Hall 1986, Moore and

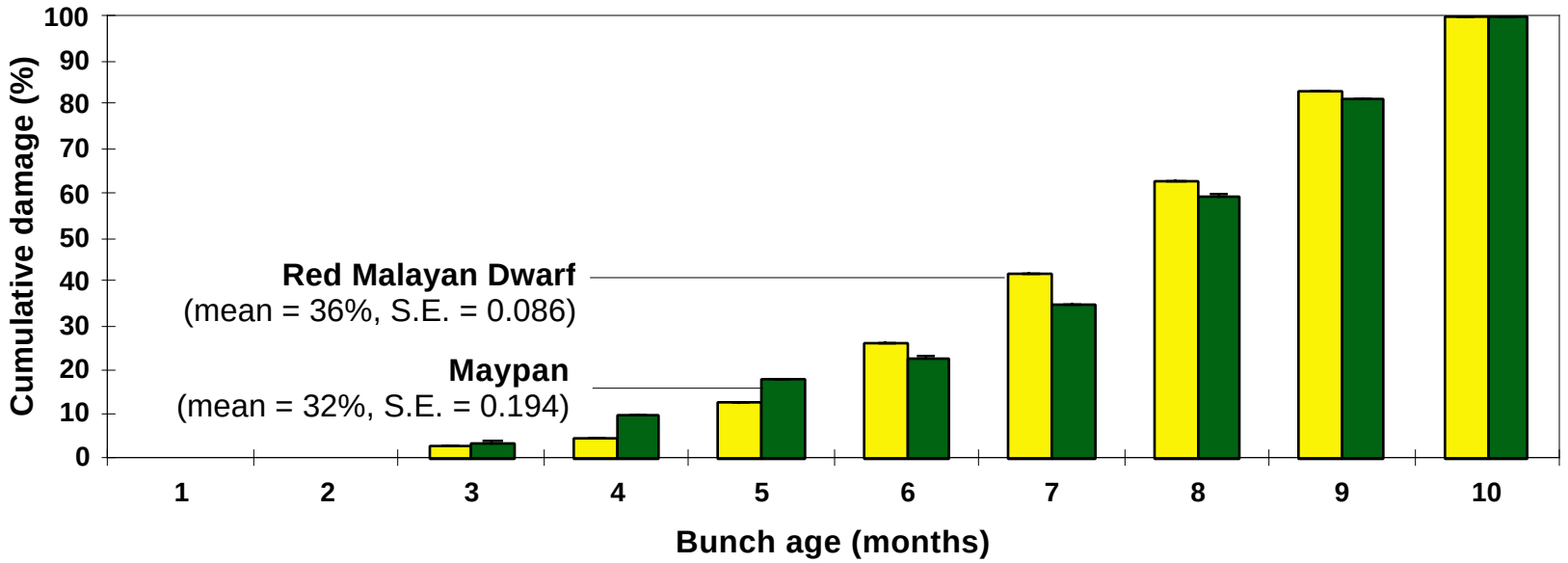

Figure 8. Cumulative damage caused by the coconut mite, ***Eriophyes guerreronis*** (Keifer), on Mayan and Red Malayan Dwarf coconuts of different ages on the same farm in St. Mary, Jamaica, 1990

Alexander 1990). The Maypan variety had less damage than the Red Malayan Dwarf. It is likely that breeding studies will identify mite resistant coconut varieties for incorporation into an IPM program.

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