

Table 1. Measurements of morphological characters in the 3 variants of *B. miliaris*.

Character	<i>miliaris</i> *	<i>robusta</i>	<i>pseudomiliaris</i>
Body length	717±92 (600-840)**	990±137 (800-1200)	751±159 (600-1000)
Body width	397±65 (300-510)	403±72 (320-540)	356±109 (200-560)
Clypeolabral shield length	96.8±9.3 (80.5-113.8)	97.8±7.5 (85.1-109.2)	89.7±11.4 (74.7-106.9)
Clypeolabral shield width	66.7±6.4 (58.6-79.3)	64.0±4.6 (56.3-70.1)	59.5±11.1 (42.5-74.7)
Labial length	24.1±1.7 (21.8-27.6)	22.3±3.3 (18.4-29.9)	21.4±4.1 (17.2-29.9)
Labial width	28.6±4.3 (23.0-35.6)	27.9±3.9 (24.1-36.4)	27.2±3.4 (23.0-32.2)
Spiracle length	24.2±2.3 (20.1-28.7)	23.1±1.7 (20.4-25.9)	21.6±2.6 (19.0-25.9)
Spiracular peritreme width	9.6±1.3 (7.5-11.5)	9.0±0.7 (8.0-10.7)	8.4±1.5 (6.1-11.2)
Antennal length	6.8±1.3 (5.7-8.6)	8.3±5.2 (3.4-18.4)	4.9±0.9 (3.4-5.7)
Antennal base width	7.5±1.3 (5.7-9.8)	7.4±1.2 (4.6-9.2)	7.3±1.4 (5.7-10.3)
Apical setal length	55.4±8.0 (41.4-60.9)	59.3±3.7 (52.9-63.2)	56.1±5.5 (49.4-65.5)
Anal ring length	11.8±2.2 (9.2-14.9)	12.1±2.1 (10.3-14.4)	8.9±1.3 (6.9-10.9)
Anal ring width	17.9±2.3 (14.9-21.8)	16.4±1.1 (13.8-17.2)	15.9±1.8 (13.8-19.5)
Arched anal bar length	23.2±1.8 (20.7-25.3)	21.9±2.4 (18.4-26.4)	22.1±2.0 (17.2-24.1)
Lateral anal bar length	11.9±2.4 (8.0-16.1)	11.2±1.2 (9.2-12.6)	12.4±2.3 (6.9-15.5)
Marginal 8-shaped pore length	6.8±0.4 (5.7-6.9)	6.2±0.2 (5.7-6.3)	5.8±0.7 (4.6-6.9)
Submarginal bilocular pore length	1.6±0.2 (1.1-1.7)	2.0±0.4 (1.7-2.9)	1.7±0.3 (1.1-2.3)
Quinquelocular pore diameter	2.2±0.5 (1.7-3.4)	2.0±0.3 (1.7-2.3)	2.1±0.5 (1.1-2.9)

* Measurements performed on 10 specimens of each variant

** Numbers represent the mean and standard variation (um) followed by the range in parentheses.

canium robustum Green, on *Bambusa* sp., West Palm Beach, Fla., 17 V 1979, R. Buchholz & J. Bennett, det. A. Hamon '79; 2(2) adult females: *Asterolecanium robustum* Green, on *Bambusa* sp., Cocoa, Fla., 10 XII 1979, R.E. Burns, det. A. Hamon; 2(2) adult females: *Asterolecanium miliaris longum* Green, host - bamboo, Tarpon Springs, Fla., 4 IX 1922, coll. F.M. O'Byrne, det. GBM, 13374; 5(5) adult females: *Asterolecanium miliaris longum* Green, host: *Bambusa* sp., Miami, Fla., 30 VIII 22, E.L. Kelly, det. H. Morrison & G.B. Merrill, 13130; 3(3) adult females: *Asterolecanium miliaris robustum* Green, on *Bambusa* sp., Winter Haven, Fla., 7 VIII 1970, W.P. Henderson, det. S. Nakahara '71, 1595, 125364; 3(3) adult *Asterolecanium miliaris robustum*

Green, on bamboo, Vero Beach, Fla., 22 V 1946, Coll. O.W. Calkins, G.B.M., 92387; 15(2) second instars and (13) adult females: *Asterolecanium miliaris* var. *robustum* Green, on *Bambusa* sp., Vero Beach, Fla., 24 VIII 1977, S.P. Beidler, det. A. Hamon '79, NY. K-746; 3(3) adult females: *Asterolecanium miliaris* var. *robustum* Green, on *Bambusa* sp., Winter Haven, Fla., 3 178, C. Roberts, det. A. Hamon '78, L-17; 1 (1) adult female: *Asterolecanium pseudomiliaris* Green, on *Bambusa* sp., Coconut Grove, Fla., 23 111970, J.F. Dillon, det., A. Hamon '80, 1-450; 3(3) adult females: *Asterolecanium pseudomiliaris* Green, on *Bambusa* sp., Okeechobee, Fla., 26 IX 1978, S.P. Beidler, det. A. Hamon '80; 2(2) adult females: *Asterolecanium miliaris robustum* Green, on *Bambusa* sp., Stuart, Fla.,

Table 2. Presence or absence of morphological characters in the 3 variants of *B. miliaris*.

Character	<i>miliaris</i> *	<i>robusta</i>	<i>pseudomiliaris</i>
Fleshy antennal setae	2 (2-3)**	2 (2-3)	2
Slender antennal setae	2 (2-3)	2 (1-3)	2
Large dorsal 8-shaped pores	0	0	17 (2-48)
Quinquelocular pores in each spiracular furrow	12 (8-17)	11 (8-14)	12 (8-16)
Submarginal setae on each side of abdomen	4 (2-6)	4 (2-6)	4 (2-4)
Inner pores on anal ring	6	6	6
Outer pores on anal ring	12 (10-14)	12 (12-14)	14 (12-16)

* Measurements performed on 10 specimens of each variant

** Numbers represent the mean and standard variation (μm) followed by the range in parentheses.

21 V 1978, S.P. Beidler, det. D.R. Miller '78, DPI# 126273a; 5(5) adult females: *Asterolecanium miliaris robustum* Green, on *Bambusa* sp., Gainesville, Fla., 28 XII 1981, A. Beck, det. A. Hamon '82; 3 (3) adult females: *Asterolecanium milaris* (Boisduval), on *Bambusa vulgaris*, Corozal, Puerto Rico, 4 11197 1, det. D.R. Miller '73, acc. # 101-71; 2(2) adult females: *Asterolecanium milaris* (Boisduval), on *Bambusa* sp., Florida: Delray Beach, Palm Beach Co., 28 XI 1988, E. Tannehill, det. A. Hamon; 2(2) adult females: *Asterolecanium robustum* Green, on *Bambusa* sp., Punta Gorda, Fla., 17 III 1980, A. Gambill, det. A. Hamon '80; 2(2) adult females: *Asterolecanium pseudomiliaris* Green, on *Bambusa* sp., Miami, Fla., 25 IX 1980, K. Martin, det. A. Hamon '80; 3(3) adult females: *Asterolecanium pseudomiliaris* Green, on *Bambusa* sp., Bonita Springs, Fla., 30 VII 1980, K. Delate, det. E. Mercer, conf. A. Hamon '80; 3(3) adult females: *Asterolecanium pseudomiliaris* Green, on *Bambusa* sp., Ft. Lauderdale, Fla., 6 III 1980, M. McCulloch, det. A. Hamon '80.

Linear measurements of 18 characters (Table 1) and counts of 7 characters (Table 2) were obtained from 30 specimens. The presence or absence of 25 characters (Table 3) was recorded from 110 specimens. All data were taken from adult females from the USNM and FSCA using a phase contrast microscope equipped with a micrometer.

Results and Discussion: Traditionally, 3 diagnostic characters have been used to separate these 3 species. They included the presence of large dorsal 8-shaped

pores (Fig. 1c, Tables 2, 3) and a marginal row of simple disk pores (Fig. 1d, Table 3) to distinguish *B. pseudomiliaris*, and the presence of a gap in the row of marginal quinquelocular pores (Fig. 1k, Table 3) to separate *B. robusta* from *B. miliaris*. We found these characters too variable to reliably separate the species. With the exception of the occasional appearance of large dorsal 8-shaped pores (Table 3) and slight differences in body shape in 35 of the 110 specimens, no substantial differences were observed or measured from the characters evaluated. The presence of large dorsal 8-shaped pores is considered the most important diagnostic character for the identification of *B. pseudomiliaris*. In specimens with such pores, the numbers range from 2 to 48. The presence or absence of large dorsal 8-shaped pores among specimens may be a result of host-induced variations as recorded in other scale insect species (Danzig 1970, Knipscher et al. 1976, Liu et al. 1989, Lupo 1943, Stafford and Barnes 1948, Takagi 1985, 1988, Takahashi 1952, Tippins and Beshear 1970). Because of the inconsistency in numbers of large dorsal 8-shaped pores and the erratic distribution pattern when present, the presence or absence of these pores alone is not a reliable key diagnostic character to distinguish *B. pseudomiliaris* from *B. robusta* and *B. miliaris*. Marginal 8-shaped pores (Fig. 1c, Table 3) occur in the same arrangement in all 3 species, which is consistent with the pattern exhibited in other pit scale species. In addition, Russell (1941) distinguished *B. pseudomiliaris* based on the presence of a complete marginal row of simple disk pores. Without exception, this character was found in each of the 110 specimens examined,

Table 3. Counts of morphological characters in the 3 variants of *B. miliaris*.

Character	<i>miliaris</i>	<i>robusta</i>	<i>pseudomiliaris</i>
Legs present	no*	no	no
Labium deltoid	yes	yes	yes
Labium without setae	yes	yes	yes
Marginal 8-shaped pores present	yes	yes	yes
Marginal 8-shaped pores end 2-4 pore lengths before anal lobe	yes	yes	yes
Large dorsal 8-shaped pores in submarginal row	no	no	yes
Small dorsal 8-shaped pores present	yes	yes	yes
Submarginal bilocular pores present	yes	yes	yes
Marginal row of quinquelocular pores complete	no	no	no
Marginal row of quinquelocular pores with gap between spiracular furrows	no	yes	yes (34) no (1)
Quinquelocular pores absent near antennal base	yes	yes	yes
Multilocular pores present on venter	no	no	no
Dorsal simple disk pores present	yes	yes	yes
Simple disk pores in row on margin	yes	yes	yes
Tubular ducts present	yes	yes	yes
Tubular ducts in 6 longitudinal rows	yes	yes	yes
Dorsal intersegmental setae present	no	no	no
3 pairs of ventral segmental setae present	yes	yes	yes
Dorsal tubes present	yes	yes	yes
Small anal cleft present	yes	yes	yes
Anal lobe with apical, subapical, and 2 pairs of ventral setae	yes	yes	yes
Anal ring complete	yes	yes	yes
Anal ring with 6 setae	yes	yes	yes
Arched anal bar present	yes	yes	yes
Lateral anal bar present	yes	yes	yes

* Characters evaluated from *B. miliaris* (16 specimens), *B. robusta* (59 specimens), and *B. pseudomiliaris* (35 specimens).

regardless of the presence or absence of large dorsal 8-shaped pores (Table 3). Furthermore, a row of quinquelocular pores (Fig. 1j, Table 2) extends from each spiracle (Fig. 1i, Table 1, 2) to the margin where it joins a marginal row of quinquelocular pores. The occurrence of a gap in this marginal row for *B. robusta* and the absence of such a gap in *B. miliaris* is generally used to separate these 2 species. The length of the gap within the row of quinquelocular pores is variable, ranging from no gap (17 specimens, 15.5%), a minute gap (9 specimens, 8.2%), or a wide gap (84 specimens, 76.4%). Of the 17 specimens without a gap, 16 (94.1 %) had previously been identified as *B. miliaris* and 1 (5.9%) as *B. pseudomiliaris* based on the presence of large dorsal 8-shaped pores. Of the 9 specimens with a minute gap, 4 (44.4%) had been determined as *B. robusta* and 5 (55.6%) as *B. pseudomiliaris*. From the 84 specimens with a wide gap, 55 (65.5%) had been identified as *B. robusta* and 29 (34.5%) as *B. pseudomiliaris*. In 1 specimen determined as *B. miliaris*, a minute gap was found on one side of the body and no gap on the other side. One type of *B. robusta* from the USNM contains 2 adult females that were identified as *B. miliaris*. In addition, different shapes have been used to illustrate *B. miliaris*, *B. robusta*, and *B. pseudomiliaris* (Russell 1941, Ferris 1955). However, body shape is often influenced by the specimen's location on the host, population density on the branch or leaf, or food source, and cannot be solely used for species identification purposes. Some morphological characters in pit scales appear to be more variable than previously considered. Location on the host plant may play an important role in morphological differentiation. For example, *Asterodiaspis minus* (Russell) and *A. quercicola* (Bouché) are host-induced variants of *A. variolosa* (Ratzeburg) (Podsiadlo 1990). In *Palmaspis urichi* (Cockerell), large dorsal 8-shaped pores may or may not be present (Russell 1941), although this species is usually described without these types of pores (Matile-Ferrero 1996).

All characters used in differential diagnoses of the 110 specimens examined either overlapped to varying degrees, or were not useful. No clear distinctions between the 3 species could be found. As a consequence, *B. robusta* and *B. pseudomiliaris* are considered junior subjective synonyms of *B. miliaris*.

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