

CURRENT STATUS OF PINK HIBISCUS MEALYBUG IN
PUERTO RICO INCLUDING A KEY TO PARASITOID SPECIESJ. P. MICHAUD¹ AND G. A. EVANS²¹Citrus Research and Education Center

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The first report in the western hemisphere of the pink hibiscus mealybug, *Maconellicoccus hirsutus* (Green), was from Grenada in 1993 (Persad 1995). Trinidad was infested in August of 1995 (Jones 1995) and St. Kitts in October of the same year (Thomas & Thomas 1996). Sixteen islands in the Lesser Antilles were infested by August of 1997 (Meyerdirk 1997). PHMB was first reported on the Island of Viéques, Puerto Rico in the summer of 1997 and in the Ceiba and Fajardo districts in the southeastern corner of the main island in October of the same year (USDA, APHIS, PPQ personal communication). In contrast to the dramatic impact this pest has had on agricultural production in other islands of the East Indies, damage in Puerto Rico has apparently been limited to hibiscus species in urban settings. One possible explanation is establishment of the parasitoid *Anagyrus kamali* Moursi (Encyrtidae), a parasitoid that has provided excellent control of PHMB in other countries (Mani 1989). Both *A. kamali* and *Gyranusoidea indica* Shafee, Alam, and Agarwal (Encyrtidae) were released by agents of USDA, APHIS, PPQ in Puerto Rico shortly after discovery of PHMB on the mainland of Puerto Rico (L. Wiscovitch, personal communication). We surveyed PHMB in southeastern Puerto Rico in early February, 1999 with the following objectives: (1) to determine the extent of westward spread of PHMB; (2) to monitor plant damage and record plant species affected and; (3) to identify parasitoids and predators attacking the pest.

We first surveyed PHMB on Feb. 2 in the region of the original infestation (Ceiba and Fajardo). We evaluated damage and PHMB populations on hibiscus, examined other susceptible host plants, and retained samples for subsequent parasitoid emergence. On Feb. 4, in the company of USDA, APHIS, PPQ inspectors E. Rodriguez and M. Rosado, we followed the southern coast along highways No. 1 and 3 from Ponce eastward examining roadside hibiscus shrubbery. The most western infestation we discovered was in the neighborhood of La Pica, district of Yabucoa at km. 100 on highway No. 3, about 45 km east of the original infestation in Ceiba. Damage to the hedge indicated that PHMB had probably been present for a period of 2-3 weeks. Descending into the valley of Yabucoa, we observed larger, established infestations on the property of the R. J. Reynolds Tobacco Co. at the intersection of highways No. 3 and 908. More damaged hibiscus was evident on highway 3 east to Humacao, where we concluded our search.

We categorized hibiscus shrubs according to level of damage (low, moderate or high) and whether or not PHMB colonies were still alive on the shrub. In many cases, attempts had been made to prune out damaged branches on heavily infested shrubs and this may have affected our damage estimates. Table 1 summarizes our observations on damage and PHMB populations at the four sites sampled.

We observed and collected the following coccinellid species preying on PHMB in Puerto Rico: *Cycloneda sanguinea limbifer* Casey (adults and larvae), *Coelophora inaequalis* (F.) (adults), *Diomus* sp. (adults), *Cryptolaemus montrouzieri* Mulsant (adults and larvae), *Scymnus* sp. (adults), *Zilus eleutherae* (Casey) (adults). We collected a total of 24 samples of PHMB by clipping infested hibiscus twigs into venti-

TABLE 1. INCIDENCE OF PHMB DAMAGE TO HIBISCUS SHRUBS.

Location	No. shrubs examined	% with live PHMB	Damage			
			None	light	moderate	heavy
Ceiba	61	21	18	23	11	48
Fajardo	64	20	45	19	13	23
Yabucoa	40	72	50	22	15	13
La Pica	12	100	—	5	7	—

lated plastic containers: seven from the town of Ceiba and 12 from the town of Fajardo on Feb. 2, two from La Pica and three from Yabucoa on Feb. 4. Parasitoids emerged from 19 of these samples (data in Table 2). Only the two samples from La Pica and three of those from Fajardo failed to yield any parasitoids. Some samples of *M. hirsutus* had *Paracoccus marginatus* Williams and Granara de Willink present; therefore, some parasitoids may have emerged from this host.

Eulophidae

Aprostocetus minutus Howard is a widespread hyperparasitoid of encyrtids and aphelinids through coccids and pseudococcids and sometimes attacks aphidiids and pteromalids (Pachyneuron) through aphids (LaSalle 1993). It is easily distinguished from the other parasitoids reported herein by its entirely black body, elongate marginal vein of the fore wing, advanced axillae and 4-segmented tarsi. All of the other parasitoids reported herein have at least some orange or yellow coloration on the body, the marginal vein is very short, the axillae are not advanced and the tarsi are 5-segmented.

Encyrtidae

Acerophagus nubilipennis Dozier is a primary parasitoid of *Pseudococcus longispinus* (Targ.-Tozz.) [= *Pseudococcus aonidum*, misspelling of *P. adonidum*] and *Planococcus citri* (Risso) described from Puerto Rico (Dozier, 1926). This species is easily

Table 2. Abundance of parasitoids in PHMB samples.

Parasitoid species	No. samples present	Total number	Percentage of total
<i>Anagyrus kamali</i> Moursi	17 (71%)	150	70
<i>Gyranusoidea indica</i> Shafee, Alam and Agarwal	7 (29%)	37	17
<i>Acerophagus nubilipennis</i> Dozier	1 (4%)	1	<1
<i>Cheiloneurus inimicus</i> Compere	11 (46%)	19	9
<i>Aprostocetus minutus</i> (Howard)	4 (17%)	7	3

distinguished from the other parasitoids reported herein by its yellow body with dark brown bands along the posterior segments of the gaster, entirely yellow antenna with 5 transverse funicle segments, and hyaline fore wing with central, triangular-shape, infuscate spot.

Anagyrus kamali is a primary parasitoid of PHMB and *Nippaecoccus* sp. It is native to the Oriental Region and introduced into Egypt and, more recently, to the Caribbean including the islands of Grenada, Trinidad, St. Thomas and Puerto Rico. It can easily be distinguished from *A. nubilipennis* by its yellow-orange body with a brownish band along the anterior margin of the mesocutal midlobe (color of body may vary), wide antennal scape which is dark brown-black except the apex, all funicle segments longer than wide, and hyaline forewing. It is very similar to *G. indica* but can be distinguished by its very short postmarginal vein of the forewing (less than 0.5× length of stigmal vein), dark brown frons, and yellow antennae with only the first segment of the flagellum dark brown. The male of this species can be distinguished from the male of *G. indica* by its short postmarginal vein, dark brown frons, and dark brown spot at the apex of the antenna.

Cheiloneurus inimicus Compere is a hyperparasitoid of mealybugs and coccids distributed throughout much of the New World. It is easily distinguished from the other parasitoids reported herein by its coloration (infuscate fore wing, orangish thorax with wide, dark brown, transverse band along the posterior margin of the midlobe), and tuft of long setae at the apex of the scutellum.

Gyranusoidea indica is a primary parasitoid of PHMB and *Nippaecoccus viridis* (Newstead) and was described from India. This species was introduced into Puerto Rico concurrently with *A. kamali* (L. Wiscovitch, personal communication). This species can be distinguished from *A. kamali* by its elongate postmarginal vein (about 2× length of stigmal vein), orangish frons, and yellow antennae with the first 3 segments and half of the fourth segment dark brown. The male of this species can be distinguished from the male of *A. kamali* by its elongate postmarginal vein, orangish frons, and lack of the dark brown spot at the antennal apex. The reader is referred to Noyes (1998) for detailed descriptions of these and other genera of PHMB parasitoids.

It is perhaps noteworthy that the only site from which parasites were not recovered was La Pica, at the western-most edge of the expanding infestation. This site had many colonies of PHMB that appeared to be newly formed. In the nearby town of Yabucoa, the site of the next most recent infestation, we found some of the largest and most vigorous colonies. Wherever we encountered PHMB infesting hibiscus we examined adjacent trees and shrubbery of plant species reported in the literature to be alternate hosts of PHMB. These included sugar apple (*Annona* spp.), sweet orange and grapefruit (*Citrus* spp.), *Ficus* spp., mango (*Mangifera indica*), pomegranate (*Punica granatum*) and West Indian cherry (*Malpighia puniceifolia*). We did not observe PHMB or evidence of damage on any of these plant species. We suspect that these alternate host plants may be colonized by PHMB only when large populations lead to the decline of the primary host hibiscus, something which has not occurred in Puerto Rico.

SUMMARY

The invasion of Puerto Rico by PHMB has had much less economic impact than in other islands of the Caribbean such as Grenada and Trinidad (Francois, 1996). This may be due to the timely introduction of *A. kamali* and *G. indica* which demonstrate high levels of association with PHMB, although various coccinellid species may also reduce its rate of spread. It is now 18 months since the detection of PHMB in Puerto Rico and the pest has moved only 37 km to the southwest (Yabucoa) and 35 km to the

northwest (Carolinias) of its point of entry (Ceiba); more than 70% of the island remains unaffected as yet. Only hibiscus has been attacked and while a large percentage of plants have sustained damage, ca. 80% of affected shrubs in the original infestations no longer support live PHMB populations.

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Key to parasitoid species associated with PHMB in Puerto Rico

1. Body entirely black, tarsi 4-segmented.....*Aprostocetus minutus*
- 1'. Body at least partially yellow or orange, tarsi 5 segmented.....2
2. Fore wing with large, infuscate central portion, scutellum with tuft of long setae at apex..... *Cheiloneurus inimicus*
- 2'. Fore wing hyaline, or with triangular infuscate spot, scutellum without tuft of long setae at apex.....3
3. Body yellow with dark transverse band along posterior segments of gaster, antennae unicolorous with 5 transverse funicle segments, fore wing with triangular-shaped infuscate spot
.....*Acerophagus nubilipennis*
- 3'. Body color not as above, antennae with scape and at least first flagellar segment of antenna dark brown with 6 longer than wide funicle segments; forewing hyaline.....4
4. Postmarginal vein of fore wing short, less than 0.5× as long as stigmal vein, frons dark brown, flagellum yellow with first segment dark brown; male antennal club with dark spot at apex.....*Anagyrus kamali*
- 4'. Postmarginal vein of fore wing elongate, about 2× as long as stigmal vein, frons orangish, flagellum yellow with first 3 segments and half of fourth segment dark brown; male antennal club without dark brown spot at apex.....*Gyranusoidea indica*

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