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OBSERVATIONS IN TAIWAN ON THE IDENTITY OF THE CUBAN LAUREL THRIPS (THYSANOPTERA, PHLAEOTHRIPIDAE)

LAURENCE A. MOUND, CHIN-LING WANG AND SHUJI OKAJIMA

Entomology Department, The Natural History Museum, London, U.K.;
Taiwan Agricultural Research Institute, Taichung, Taiwan; and
Laboratory of Entomology, Tokyo University of Agriculture,
Sakuragaoka, Tokyo, 156 Japan

Abstract.—The name *Gynaikothrips ficorum* is retained for the leaf-galling thrips species on decorative *Ficus* trees that has been distributed worldwide by the horticultural trade. Observations on this species and the closely similar species *Gynaikothrips uzeli* suggest that they are largely distinct and host-limited, although co-existing in Southeast Asia even within a single gall.

The Cuban Laurel Thrips, the common name in North American entomology for *Gynaikothrips ficorum* (Marchal), was first used in print by the Florida entomologist J. R. Watson (1918). Despite this name, neither the thrips nor its host plant, *Ficus microcarpa,* is native to the Western Hemisphere, both the tree and the insect having been introduced from Southeast Asia. The tree is widely cultivated throughout the tropics and subtropics. It provides shade in thousands of market places throughout much of Latin America, and is planted in various parts of southern Europe, several coastal resorts of Australia, and even urban shopping malls in north America. Wherever the tree is grown, it rarely lacks the simple leaf-fold or leaf-roll galls induced by the thrips (Denmark, 1967), and as with many such migrants, considerable identification and nomenclatural problems occur.

Phloeothrips ficorum Marchal (1908) was described from Algeria, on material collected from *Ficus microcarpa* (as *nitida*). At various times since then it has been considered to be the same species as *Mesothrips uzeli* Zimmermann (1900) from Java, the type-species of the genus *Gynaikothrips.* In contrast, Priesner (1939) and del Cañizo (1945) distinguished the adults as two species on the basis of the length of the pronotal posteroangular pair of setae, and most workers have accepted this distinction. Jacot-Guillarmod and Brothers (1986) included five specific names in synonymy under *G. ficorum,* and a further two names under *G. uzeli.*

Material available in various museum collections suggests that *G. uzeli* occurs only in Asia, and that it is restricted to *Ficus benjamina.* Despite this, routine identification of *G. ficorum,* a widespread pest of some importance in the horticultural trade on the many cultivars of *Ficus microcarpa* trees, is sometimes not easy because of the morphological variation that is commonly observed. Mound and Marullo (1996), in their overview of the Thysanoptera of Latin America, pointed out that further studies in Southeast Asia were needed to understand the patterns of variation found in the thrips associated with leaf galls on the common *Ficus* trees, and the observations reported here are a first step in that direction.

The nomenclature of the host plants of these *Gynaikothrips* species is also confused in the entomological literature. *G. ficorum* appears to be specific to *Ficus microcarpa,* but this is also commonly referred to by various synonymic names including *F. nitida* and *F. retusa.* Unfortunately, *Ficus benjamina* is also sometimes confused with *microcarpa,* although *benjamina* has rather more glossy and drooping leaves and, moreover, is fertilised by different cynipoid wasps (teste Dr. William Ramirez).

A further problem is that in Southeast Asia the leaf galis of *Gynaikothrips ficorum* and *G. uzeli* often contain individuals or colonies of *Mesothrips jordani* and *M. pyctes,* and members of this genus are commonly considered to be gall-formers (Ananthakrishnan and Raman, 1989). However, judging from the published records, each of the described species of *Mesothrips* has usually been collected together with some other gall-inducing thrips. If *Mesothrips* species really are gall-inducers, then it is curious that they have not accompanied the gall-inducing *Gynaikothrips* around the world on *Ficus microcarpa.*

RECOGNITION OF *GYNAIKOTHRIPS FICORUM* AND *G. UZELI*

Priesner (1939), in an identification key to the members of *Gynaikothrips,* distinguished these two species on the basis that *G. uzeli* has the pronotal posteroangular pair of setae almost as long as the epimeral pair of setae, whereas *G. ficorum* has the posteroangular setae very short. The same character was used by del Cañizo (1945). Our observations on females from many parts of the world indicate that in *G. ficorum* the pronotal posteroangular setae are never more than 0.5 times as long as the epimerals, and usually no longer than the discal setae. In contrast, in Asian material identified as *G. uzeli* the posteroangular setae are usually at least 0.7 times as long as the epimeral setae (rarely less than 0.5), and always longer than the discal setae. These differences are far less reliable in males, possibly because the males are smaller in body size than females and setal lengths are correlated in part with body size. Many males can thus be allocated to species only by their association with females.

Dr Richard zur Strassen (pers. comm.) has pointed out that on abdominal tergites II–IV the pair of major marginal setae close to the wing-retaining setae are usually brown in *G. ficorum,* whereas these setae are pale in specimens from south east Asia that are identified as *G. uzeli.* Although the brown colour of these setae is relatively constant in samples from many other parts of the world, in Taiwan the major lateral setae on tergites II–IV vary both within and between samples of *G. ficorum* from *F. microcarpa.* No consistent pattern of variation was apparent within or between recently collected samples, and the colour ranged from brown to colourless.

In Taiwan, samples of *G. uzeli* with the pronotal posteroangular setae elongate that were collected recently from *Ficus benjamina* have the forewings much more deeply shaded than specimens of *G. ficorum* collected from other parts of the world. These specimens have the forewings considerably darker distally than in the basal third, and the dark area has a strongly marked granular appearance; in *G. ficorum* the forewing is uniformly pale or very weakly shaded around the margins. In some Taiwan populations of *G. uzeli* this wing shading was particularly evident and stable,

although one female was observed with the basal area of the fore wings darker than the distal area (the hind wings were normal).

GYNAIKOTHRIPS ON *FICUS MICROCARPA* IN TAIWAN

Ficus microcarpa is cultivated widely in Taiwan. For example, a yellow leaved form *aurea* is used as a hedge along the central reservation of many major roads. Other cultivars have bicoloured leaves or soft, drooping leaves; many are the subject of elaborate topiary, and bonsai forms are common. All of these cultivars are usually attacked by typical *G. ficorum.* The horticultural trade in Taiwan does not seem to regard the thrips as a serious pest, indeed the reddish folded or rolled leaves might be considered an added attraction. Major plant nurseries in Taiwan are thus a constant source of the thrips, certainly for the local market and presumably also for export markets, and numerous samples were collected recently.

The lengths of the pronotal setae of *G. ficorum* in Taiwan are unusually variable for a member of the Phlaeothripidae. Of the five pairs of major pronotal setae normally found in species of this family, the anteromarginals in this species are never longer than the pronotal discal setae. The anteroangular setae are sometimes longer and stouter than the discal setae, but only in about 10% of the available specimens. The midlateral pair is more commonly enlarged (although difficult to observe), but in no more than than 30% of available specimens. The epimeral setae are always elongate, but the length of the posteroangular pair varies from no longer than the discal setae to almost 0.5 times the length of the epimerals. Moreover, bilateral asymmetry in the development and lengths of the pronotal setae is common.

The setae on the head of *G. ficorum* are also variable. The major pair of postocular setae is usually about 50 microns (although sometimes as much as 70 microns) long, and the pair of setae on the vertex between the postoculars is usually no more than 30 microns long. However, both pairs of setae vary in position as well as length, such that some individuals have no elongate postocular setae, whereas other specimens, even from the same leaf, may have up to four setae that are 50 microns long. These setae are commonly asymmetric in length and position.

The fore tarsal tooth varies in size and curvature, decreasing in size with body size such that in the smallest specimens it is scarcely visible. The forewings are usually clear, but in many specimens they are distinctly shaded around the margins. These variations in body size, setal lengths, forewing colour and fore tarsal tooth size suggests that some of the nominal species described by Priesner (1939), such as *G. edentatus* and *G. insulsus,* may not be valid.

GYNAIKOTHRIPS ON *FICUS BENJAMINA* IN TAIWAN

Ficus benjamina seems to be less commonly cultivated in Taiwan than *F. microcarpa.* A row of young *F. benjamina* trees at the Taiwan Agricultural Research Institute, Taichung, grows within 5 metres of an equal number of *F. microcarpa* form *aurea* bushes. In 1993 these *F. benjamina* trees did not have any thrips galls, whereas rolled-leaf galls containing *G. ficorum* were common on the *aurea* bushes. In March 1995 the same *F. benjamina* trees were observed to have many folded-leaf galls containing *Gynaikothrips* specimens, and therefore a sample of 60 galls was collected and their contents recorded individually. The galls were collected to

Table 1. Thrips in *Ficus benjamina* galls.

Gall stage	*G. uzeli*	*G. ficorum*	*Mesothrips*	*Liothrips*	*Androthrips*
Early (20)	41♀ 6♂	—	5♀ 1♂	2♀	1♀
Young (14)	25♀ 8♂	2♀ 1♂	5♀	1♀	—
Mature (20)	79♀ 47♂	4♀ 17♂	13♀	2♀	1♀

represent three stages of gall development; early stage, with the leaf softly folded but lacking eggs and feeding scars (20 galls); young stage, with the leaf firmly folded, eggs and feeding scars present but leaf tissue still soft (14 galls); mature galls, with extensive feeding scars and the leaf tissue brittle (20 galls).

The mature galls proved difficult to select, because heavy rain in previous weeks had caused considerable thrips mortality; dead thrips and larval exuviae had been swept down into the narrow tip of each gall above the drip-point of the leaf. Also many mature galls contained few thrips but several adults or nymphs of a predatory anthocorid bug. Even several of the second stage galls selected in the field proved to be empty, possibly because the galls had been abandoned or the gall initiator had been eaten. However, thrips species that form simple leaf-roll and leaf-fold galls, like those on *Ficus,* have been observed previously to move in and out of galls during the course of any day; the dynamics of such movements need further study. Since the objective of taking the samples was to determine the thrips species present, mature galls were selected only when containing live thrips. The totals are given in Table 1.

The figures in Table 1 suggest that *G. uzeli* alone was responsible for gall induction on these *F. benjamina* trees. In 14 of the 20 early stage galls *G. uzeli* was found alone, although the more abundant species in the area, *G. ficorum,* apparently entered some older galls. Three of the young stage galls contained a single mature adult *G. ficorum,* eight of the mature galls contained one to three adult *G. ficorum,* and one gall contained 2♀ 7♂ of *G. ficorum* together with 5♀ 7♂ of *G. uzeli.* In this gall, the *G. ficorum* had evidently bred, because some of the males were still teneral.

In none of the galls, including all of the early stage galls, was a *Mesothrips* specimen present alone, although six of these galls contained a single adult *Mesothrips* together with *G. uzeli.* This species is either *Mesothrips jordani* or *M. pyctes,* or these two species may be synonyms. Further studies are needed to establish its identity, but it is notable in having the females variable in body size, with the fore tarsal teeth varying from small and weak to massive. This variation in body form is known to be associated in some thrips species with competitive behaviour, either in defense of a mate (Crespi, 1990) or in defense of a gall (Crespi and Mound, 1996). Since *Mesothrips* were not found alone in any early stage gall, and considering their variation in body structure, this species is probably a gall- invader (kleptoparasite) rather than a gall-inducer.

DISCUSSION AND CONCLUSION

These observations raise as many questions as they provide answers. Can the reverse invasion occur, that is, *G. uzeli* entering *G. ficorum* galls? At the time of these observations the *G. ficorum* leaf-roll galls on the local *aurea* bushes contained

only dead thrips, and as the bushes were not producing young leaves new galls could not be induced. What is the significance of the gall form, whether leaf-fold or leaf-roll? Currently it seems that leaf-folds are more commonly associated with *G. uzeli* on *F. benjamina,* and leaf-rolls with *G. ficorum* on *F. microcarpa,* but there is no clear evidence of a species specific reaction by either the plant or insect. The thrips behaviour also requires further study. To what extent do *Gynaikothrips* individuals remain within, or move between, individual galls? Does the *Mesothrips* species exhibit aggressive behaviour toward the *Gynaikothrips* when invading a gall? Two further unrelated thrips occur commonly in these galls (Table 1). The *Androthrips* species is considered to be predatory (Ananthakrishnan and Raman, 1989), but does the *Liothrips* species lay eggs within the galls, or is it simply sheltering there?—as its behaviour in running away very fast when disturbed might suggest.

Mound and Marullo (1996) suggested the possibility that *G. ficorum* represents an inbred strain distributed artificially by the horticultural trade, and that *G. uzeli* and *G. ficorum* might represent different parts of the natural variation of a single species that is naturally widespread in Southeast Asia. Given that the two forms co-exist within galls in Taiwan, the possibility of some inter-breeding cannot be excluded. However, the available samples suggest that even in that country the two are largely distinct. Therefore, at present, it seems useful to retain the name *Gynaikothrips ficorum* (Marchal) for the 'trade form' of pest thrips found so commonly on *Ficus microcarpa* and its cultivars in the worldwide horticultural trade, and to retain the name *G. uzeli* (Zimmermann) for the Southeast Asian form with elongate pronotal posteroangular setae.

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