

A south east Asian pest species newly recorded from Europe: *Thrips parvispinus* (Thysanoptera: Thripidae), its confused identity and potential quarantine significance

LAURENCE A. MOUND¹ and DOMINIQUE W. COLLINS²

¹CSIRO Entomology, GPO Box 1700, Canberra, ACT 2601, Australia; e-mail: laurence@ento.csiro.au

²Invertebrate Identification Team, Central Science Laboratory, Sand Hutton, York YO41 1LZ, UK; e-mail: d.collins@csl.gov.uk

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Abstract. The south east Asian pest thrips, *Thrips parvispinus* is recorded breeding in Europe for the first time, damaging *Gardenia* plants in Greece. Morphological variation in this species from various Asian countries is recorded and compared to the type specimens. As a result *Isoneurothrips jenseni* Karny, 1925 and *Thrips (Isoneurothrips) taiwanus* Takahashi, 1936 are placed as synonyms of *Thrips parvispinus* (Karny, 1922). In contrast, *Thrips compressicornis* (Sakimura), a species from the Marquesa Islands of the Pacific that has previously been associated with these taxa, represents a very different species. The quarantine significance of *T. parvispinus* is emphasised.

INTRODUCTION

Species which become designated as pests must originate from naturally-occurring populations of harmless species. However, predicting the potential evolution of pests from currently harmless species is fraught with problems. Nevertheless, if quarantine services worldwide are to do more than simply react to pest problems as they arise, then some level of awareness must be developed of those species that have attributes which might enable them to become pests. This becomes particularly urgent if the species has already achieved a level of pest status in its area of origin and begins to enter international trade in plant products.

The purpose of this paper is to record the first occurrence in Europe of the species *Thrips parvispinus* (Karny), a widespread insect in south east Asia but one whose identity is unclear in the current literature. This paper seeks to clarify the taxonomic identity of this thrips, an important consideration for plant quarantine services who must operate within the precise terms of a legal framework. This clarification suggests that this species shares characteristics with two pest thrips species that have recently spread around the world, *Frankliniella occidentalis* Pergande and *Thrips palmi* Karny, and should therefore be considered a quarantine risk with the potential to affect world trade and crop production.

A south east Asian thrips new to Europe

During October 1998 one of the authors (LAM) was informed that *Thrips australis* Bagnall had caused damage to *Gardenia* plants in the laboratory of Prof. John Tsitsipis at the University of Thessaly, Greece. This infestation was related to infestations in two commercial glasshouses near Volos, Greece. Since this report was contrary to what is known of the biology of *T. australis*, a request was made for specimens from the damaged *Gar-*

denia plants to be sent to Canberra for confirmation of the identification. Kostas Zarpas kindly sent preserved larvae and adults of both sexes, together with photographs of extensive leaf damage with which they were associated.

The thrips species involved was clearly not European in origin, nor one previously recorded from that continent. The adults bear a complete row of setae on both forewing veins, a character state not found in any European member of the genus *Thrips*, but widespread amongst species from Asia, Australia and the Pacific, including *T. australis*. A preliminary examination of the material from Greece, using the most recently available taxonomic revision (Palmer, 1992), suggested that the species involved was *Thrips taiwanus* Takahashi. We later learnt that thrips identified as *T. taiwanus* had been intercepted in transit by the Dutch authorities in 1996 on a consignment of *Gardenia* cut flowers from Indonesia (Bert Vierbergen, pers. commun.). However, consideration of more extensive material of *Thrips* species from south east Asia and Australia, deposited in museum collections in London, Frankfurt and Canberra, indicated that the distinction of *T. taiwanus* from *T. parvispinus*, and also *T. compressicornis* Sakimura, might not be entirely reliable. We therefore decided to record a range of character states on as many specimens as possible of this group of species, from a wide range of localities, to determine how many segregates might be recognisable. We then compared this structural variation with the original type specimens of the nominal species, to determine the appropriate names to apply.

TAXONOMY

The *Thrips parvispinus* species-group

Palmer (1992) recognised 91 species in the genus *Thrips*, from the area between Pakistan and the Pacific

Islands. On the basis of shared states of particular structural characters, these species were arrayed into five groups. Group III comprised the following seven species, that differ from other members of the genus in having discal setae on abdominal sterna III–VI but not VII:

T. compressicornis Sakimura [Marquesa Is]
T. decens Palmer [Malaya]
T. extensicornis Priesner [Java, Taiwan, Philippines]
T. orientalis (Bagnall) [India to Tahiti]
T. parvispinus (Karny) [Thailand to Australia]
T. setipennis (Bagnall) [Australia]
T. taiwanus Takahashi [Taiwan, Thailand to Philippines]

Amongst these seven species, the Australian *T. setipennis* is clearly divergent, the antennae having eight, not seven segments, tergum VIII having the posteromarginal comb of microtrichia complete, not incomplete or absent, and the discal setae on the abdominal sterna arising exceptionally close to the posterior margin. The remaining six species appear to be closely related, but *T. decens* and *T. extensicornis* differ in that their adults have the ocellar setae close together behind the first ocellus, and the setal row on the first vein of the forewing incomplete distally. This leaves four species for closer consideration, three from south east Asia and one from the eastern Pacific.

The identity of *Thrips compressicornis*

Palmer (1992) stated that the holotype female of *T. compressicornis* Sakimura, 1969 from the Marquesa Islands was examined during her studies, and this same specimen has now been re-examined. Contrary to Palmer, but in accordance with the original description (under the homonymic name *Isoneurothrips brevicornis* Moulton & Steinweden, 1932), this specimen is particularly dark brown, with uniformly dark wings bearing almost black setae, and the antennae dark brown with the base and apex of segment III sharply pale. In this colouration the species is quite unlike the other members of the *T. parvispinus* group. Moreover, the metanotum has a pair of campaniform sensilla with the median reticulations elongate. Most significantly, the sternal chaetotaxy is unique within the genus *Thrips*. There are no discal setae on sterna II–IV; on V there are two pairs, but these are placed close to the lateral margins of the sternum, with none medially; on VI there are two discal setae on one side, but apparently only one on the other; on VII there are two discal setae near each lateral margin, plus a single seta near the middle of the sternum. This distribution of the sternal discal setae indicates that *T. compressicornis* cannot belong in Group III as defined by Palmer (1992).

Although *T. compressicornis* is not closely related to the Group III species, its relationships to other members of the genus are not obvious. However, the pronotum is broad and rather flattened, with few discal setae and no lines of sculpture medially. This pronotal structure resembles that of the western Pacific species, *T. longicaudatus* Bianchi, in which, moreover, the sternal discal setae are placed laterally on each sternum. Thus it seems likely that these two species are part of a truly Pacific Island fauna,

and that this fauna is not closely related to that of south east Asia. A series from Malaya of poorly preserved specimens was identified by Palmer (1992) as *T. compressicornis*. These specimens have now been re-examined, but they do not have the character states found on the holotype, being instead almost certainly *T. parvispinus*.

The identity of *Thrips orientalis*

Among the remaining three species in Group III, *T. orientalis* is commonly associated with the flowers of *Jasminum*, and has been introduced to the Caribbean area (Mound & Marullo, 1996). In this species the forewing is uniformly dark, with no pale band at the base, the adult females have few sternal discal setae, and the metanotal sculptured reticles have numerous internal markings. However, neither of these latter two character states fully discriminate *T. orientalis* from *T. parvispinus* and *T. taiwanus*.

Variation within *Thrips parvispinus*

During this study, 113 slide-mounted specimens (101 females, 12 males) were examined, all of which had been identified previously in various museum collections either as *T. parvispinus* or as *T. taiwanus*. Besides those from Greece, these specimens came from throughout south east Asia – Thailand, Malaysia, Singapore, Indonesia, Taiwan, also northern Australia and the Solomon Islands. All of these specimens share the following character states: females uniformly light brown (males paler), antennae with seven segments, forewing with setal row on first vein complete, forewing dark with a pale band at the base, metanotum with polygonal reticulate sculpturing, tergum II with four lateral marginal setae (seta 4 usually displaced to the pleurotergite), and tergum VIII with the posterior comb of microtrichia either absent or represented by a few, very small microtrichia at the edges.

Palmer concluded that *T. parvispinus* and *T. taiwanus* could be distinguished by means of differences in the states of four characters: colour of antennal segments III–V, number of sternal discal setae, position of ocellar setae, and position of median metanotal setae. In *T. parvispinus* the antennae were described as “brown, segment III with base pale”, and abdominal sterna III–VI were stated to have “10–12 discal setae”. In contrast, in *T. taiwanus* the antennae have “segment III and bases of IV and V pale”, and abdominal sterna III–VI have “about 8–10 discal setae”. Unfortunately, the statements by Palmer concerning the sternal discal setae can be interpreted in various ways; the quoted numbers could indicate the mean number of setae for the four sterna, or they could indicate that at least one of these sterna has this number, or they could indicate that each of the four sterna have this number.

In every specimen examined during the study reported here, all of antennal segment III and the bases of IV and V are pale. That is, all of the specimens show the condition reported for *T. taiwanus*. The number of discal setae on sterna III–VI could be counted accurately in 81 females, and was found to be remarkably variable both

between individuals within samples, and between sterna on single individuals. Because of this we first recorded the number of setae on each sternum of each individual. We then calculated the mean number of setae per sternum for each individual. Using this method, 15 specimens averaged fewer than 8 discal setae per sternum, 59 specimens averaged between 8 and 9.75, and 7 specimens averaged more than 10 setae per sternum. The highest mean figure recorded was 10.75. In 39 specimens, not a single sternum was found to bear as many as 10 discal setae. Considerable variation was found within populations as represented by specimens bearing identical collection data. For example, the mean number of setae per sternum varies from 6.75 to 9.25 in one series from Java, from 8 to 10.75 in a second series from Java, and from 4.25 to 10.5 in a series from Thailand.

Considering the number of sternal discal setae, only 6 of 52 specimens labelled in collections as *T. parvispinus*, and 7 of 16 labelled as *T. taiwanus*, meet with Palmer's criteria for those species. Alternatively, if the discriminating statement is interpreted as meaning that in *T. parvispinus* one or more sterna have 10–12 discal setae, then 42 of the 52 specimens can be identified as that species. However, none of these conform to Palmer's description of antennal segment colour for *T. parvispinus*.

Similar problems were found in trying to distinguish two segregates by means of either the position of ocellar setae III, or the position of the median metanotal setae. Ocellar setae III are usually located just outside the anterior margin of the ocellar triangle, although sometimes apparently on the margin, but this difference is subjective due to the curvature of the head. Variation in the location of the median metanotal setae relative to the anterior margin of the metanotum does not fall into two easily recognisable and opposed character states. Indeed, contrary to Palmer's statement, specimens with the median metanotal setae sited furthest from the anterior margin were labelled as *T. parvispinus*.

In the original description of *T. taiwanus* (under the homonymic name *Isoneurothrips pallipes* Moulton, 1928), it was noted that overall the species is similar to *Isoneurothrips jenseni* Karny but with the meso- and metanotal sculpture more similar to that of *I. parvispinus*. However, *I. jenseni* was later synonymised with *T. parvispinus* by Priesner (1934). Amongst the 113 specimens examined during this study the metanotal sculptured reticles vary from having no internal markings to having numerous internal markings. This variation is also present in specimens from the same series, and the appearance of the metanotal reticles overlapped in specimens previously identified as both *T. parvispinus* and *T. taiwanus*. However, in none of these specimens were the internal markings as dense nor as numerous as in typical *T. orientalis*. No correlation could be established between the frequency of reticles with internal markings and the mean number of discal setae per sternum. Both character states appear to show continuous ranges of variation, but independent of each other in their expression.

All the males examined appeared very similar: smaller and paler than the females, with antennal segments I–III pale and IV–V pale at the bases, and the mean number of discal setae per sternum between 2 and 3.25.

Finally, in order to apply the appropriate name to this variable thrips, the holotype females of *T. taiwanus*, *T. parvispinus* and *I. jenseni* were re-examined. The latter two are particularly poor quality microscope slide preparations, on which antennal segments III–VII are not preserved. In the holotypes of both *T. parvispinus* and *T. taiwanus* the sterna are slightly rolled laterally, so that the number of sternal discal setae cannot be determined precisely. On the *T. taiwanus* holotype the total number of sternal setae is possibly as low as 21; on the *T. parvispinus* holotype between 25 and 29; and on the *I. jenseni* holotype either 31 or 33. The metanotal reticles of the *T. taiwanus* holotype are entirely free of internal markings, those of the *I. jenseni* holotype have a small number with internal markings, but the *T. parvispinus* holotype is mounted ventral side uppermost and the metanotal features cannot be viewed clearly. The three type specimens are similar to each other in general appearance, and no evidence could be found to suggest that they represent different species. Based on the observations recorded above on variation within and between samples, it is concluded that only one species is represented by all this material.

TAXONOMIC SUMMARY

Thrips parvispinus (Karny, 1922)

Isoneurothrips parvispinus Karny, 1922: 106.

Isoneurothrips jenseni Karny, 1925: 7–10.

Isoneurothrips pallipes Moulton, 1928: 296–297.

Thrips (Isoneurothrips) taiwanus Takahashi, 1936: 440, syn. n.

Diagnosis. Colour, body of females uniformly light brown (males almost yellow), antennal segment III and bases of IV and V pale; forewing dark with pale band at base. Antennae 7-segmented; head with ocellar setae III on or just outside anterior margins of ocellar triangle; forewing with setal row on first vein complete, forewing clavus with terminal seta longer than sub-terminal seta; metanotum with polygonal reticulate sculpturing, markings within reticles variable, median setae near anterior margin; tergum II with four lateral marginal setae (seta 4 usually on pleurotergite); tergum VIII with posterior comb of microtrichia either absent or represented by few, very small microtrichia laterally; sternum VII with no discal setae; female with number of discal setae on sterna III–VI highly variable, total number of discal setae on these four sterna ranging from 17 to 43.

DISCUSSION

Quarantine significance

Most pest species of thrips are polyphagous. There are very few examples of pest thrips with a restricted host range. Even thrips that are regarded as pests of a single crop, such as the Californian citrus thrips (*Scirtothrips citri* Moulton), often breed on a wide range of host plants. In contrast, *Thrips tabaci* Lindemann, although primarily

associated with plants of the genus *Allium* including onions and garlic, is a pest on crops as diverse as young cereals, pineapples and lettuces, both through direct feeding damage and as a tospovirus vector. Both of the pest species that have spread around the world in the last two decades, western flower thrips (*Frankliniella occidentalis* Pergande) and the melon thrips (*Thrips palmi* Karny), are highly polyphagous.

Frankliniella occidentalis has a naturally wide host and habitat range in its native area of south-western North America, but emerged as an international pest in association with intensive horticulture in California and Europe. *Thrips palmi* emerged as a pest initially within its presumed area of origin in south east Asia, but again within intensive crop production systems.

Thrips parvispinus is known to be polyphagous. In Java, the species has been reported as a major pest of *Capsicum* (Vos & Frinking, 1998), and in Thailand as a pest of a number of other vegetable crops (Bansiddhi & Poonchaisri, 1991). In Malaysia, feeding damage by *T. parvispinus* has been associated with secondary damage attack by the normally saprophytic fungus *Cladosporium oxysporum* Berkeley & Curtis on papaya fruit (Lim, 1989). It has also been recorded as a vector of tobacco streak ilarvirus, transmitting the virus from infected tomato pollen to seedlings of *Chenopodium amaranticolor* Coste & Reynier (Klose et al., 1996).

Thrips parvispinus therefore shares at least two characteristics with *F. occidentalis* and *T. palmi* which have contributed to their emergence as major worldwide pests of crops, polyphagy and exposure to intensive agricultural systems including heavy insecticide use. Whilst it would be simplistic to suggest that these are the only factors that predispose a species to develop as international pests of concern, the report here of imported *T. parvispinus* causing damage to *Gardenia* plants in Greece should be viewed by quarantine authorities with concern.

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