Is *Haplothrips clarisetis* Priesner (Thysanoptera: Tubulifera) an Economic Threat to Table Grapes in the Lower Orange River Production Region of South Africa?

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Table grape producers and consultants in the Lower Orange River region, Northern Cape province, have been reporting conspicuous, fairly large, black thrips on new growth and inflorescences early in the growing season in recent years. These thrips were identified as *Haplothrips clarisetis* Priesner and *H. nigricornis* Bagnall, both indigenous species widely distributed in South Africa and Africa. The aim of this investigation was to determine if *H. clarisetis* causes any damage to table grapes and if it poses an economic threat to the industry in the Northern Cape province. Inspections were conducted over two seasons during flowering and fruit set, prior to and after harvest in four vineyards near Augrabies (28.7630 S, 20.5668 E) and four in the Blouputs Valley (28.4631 S, 20.0789 E) where *Haplothrips* had previously been reported. Developing inflorescences, bunches, leaves and shoot tips were inspected for the presence of *Haplothrips* and for any signs of feeding damage. Very few thrips were found and no signs of feeding were observed. Adult *H. clarisetis* were collected from flowering grape bunches and from flowers of *Osteospermum microcarpum* (Asteraceae) and *Mesembryanthemum crystallinum* (Aizoaceae) growing wild adjacent to the vineyards and confined on grapevine flowering bunches, leaves and a single shoot tip. Daily inspections showed no signs of feeding damage on the shoot tip, leaves or inflorescences and thrips did not survive for more than three days on average. We therefore conclude that *H. clarisetis* does not pose an economic threat to table grapes in the Lower Orange River region.

INTRODUCTION

From about 2015, table grape producers and consultants in the Lower Orange River region in the Northern Cape province reported numerous conspicuous black thrips on new growth and inflorescences of table grapes early in the growing season. Table grape production in this region is primarily aimed at export, and markets set strict standards regarding the cosmetic appearance of grapes and agrochemical residue levels. Berry scarring due to thrips feeding and halo spots caused by egg-laying can render table grapes unfit for export (Allsopp, 2010). To make informed decisions about thrips control, producers must know whether the thrips they see in the vineyards are causing economic damage and at which stage the grapes are susceptible to damage.

Previous research conducted on thrips attacking table grapes in South Africa was confined to the Western Cape, where western flower thrips, *Frankliniella occidentalis* (Pergande), dominates during flowering (De Villiers & Pringle, 2007; Allsopp, 2010). *Neoheliothrips* (= *Heliothrips*) *sylvanus* (Faure) has been shown to cause extensive feeding damage on mature leaves towards the end of the season (March/April) when most grapes have been harvested (Schwartz, 1989). In the northern table grape region (Mpumalanga and Limpopo provinces) feeding by *Scirtothrips aurantii* Faure (citrus thrips) is known to cause severe scarring damage on young grapevine shoots, leaves and even grape berries shortly before and after harvest (Grout & Moore, 2015; Allsopp, 2019). Late season citrus thrips damage is also increasingly problematic in the Hex, Breede and Olifants River Valleys in the Western Cape. No studies have been conducted on thrips occurring on table grapes in the Northern Cape.

Specimens of the black thrips collected from grapevines in the Lower Orange River region were identified by M. Stiller as mostly *Haplothrips clarisetis* Priesner and some as *H. nigricornis* Bagnall (Thysanoptera: Tubulifera), both widely distributed species in South Africa (Zur Strassen,

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2006). While *Haplothrips bedfordi* Jacot-Guillarmod is known as a predator of citrus thrips in South Africa (Jacot-Guillarmod, 1941; Grout, 2003), there are no records of either *H. clarisetis* or *H. nigricornis* causing crop damage to date. Female thrips in the sub-order Tubulifera have a tubular ovipositor with which they lay eggs on the surface of a substrate or host plant, therefore *H. clarisetis* and *H. nigricornis* will not cause the halo spot damage typical of thrips in the sub-order Terebrantia, for example western flower thrips. The biology of *H. clarisetis* and *H. nigricornis*, including whether they cause feeding damage on grapevines, is still unknown.

The aim of this investigation was to determine if *H. clarisetis* causes any damage to table grapes and if it poses an economic threat to the industry in the Lower Orange River region of the Northern Cape province.

MATERIALS AND METHODS

Vineyard inspection

During the 2018/19 and 2019/20 seasons vineyard inspections were conducted during flowering and fruit set, prior to harvest and after harvest in four vineyards near Augrabies (28.7630 S, 20.5668 E) and four in the Blouputs Valley (28.4631 S, 20.0789 E), Northern Cape province. Cultivars included early maturing cultivars Tawny, Flame Seedless and Prime Seedless, as well as later ripening Ralli, Early Sweet and Sweet Celebration (all cultivars on which large numbers of *Haplothrips* were reported previously). Developing inflorescences, bunches, leaves and shoot tips were inspected for the presence of *Haplothrips* and for any signs of feeding damage. Yellow and blue sticky traps were placed in the vineyards and in the adjacent natural vegetation to monitor thrips activity year-round.

Collection of thrips

Grapevine flowering bunches, as well as flowers of *Osteospermum microcarpum* (Asteraceae) and *Mesembryanthemum crystallinum* (Aizoaceae), commonly known as crystalline ice plant or brakslaai, were collected in and adjacent to the trial vineyards on 9 October and 8 November 2019. Flowers of *O. microcarpum* were collected on 28 October 2020 because almost no *Haplothrips* could be found on the flowering grapevines. The irrigated grapevines were fully hydrated when the collections were made. The flowering bunches and wildflowers were placed in gauze bags, which were sealed inside plastic bags together with paper towels to absorb excess moisture and prevent dessication. The plant material with thrips was transported in a cooler box with ice packs and kept in a refrigerator overnight to reduce thrips activity. Within 24h after collection, the samples were flown to Cape Town and taken to ARC Infruitec-Nietvoorbij in Stellenbosch, where they were kept in a refrigerator at ±7°C to reduce thrips activity until used in the bioassays.

Haplothrips confined on grape flowering bunches

November 2019: Five Perspex cages fitted with gauze "windows" for ventilation were prepared, each containing two flowering bunches of 'Barlinka' in small bottles of water. Bunches were cut before 09:00 from a vineyard on Nietvoorbij Research Farm (33.9141 S, 18.8639 E) in Stellenbosch and immediately secured in small bottles of water with Parafilm M tape. Bunches were selected to contain a mixture of fully opened flowers with ample pollen and berries just beginning to set. Adult *Haplothrips* were collected from *O. microcarpum* flowers into glass vials, using a manually operated Pooter. The vials were transferred into the cages and the stoppers removed. Two cages received 25 adult *Haplothrips* each and the other three cages received 20 each.

November 2020: Five cages were prepared as described above, each containing one flowering bunch of 'Ralli' and one of 'Sultana' collected on Nietvoorbij Research Farm as described above. Bunches contained fully opened flowers with ample pollen and berries just beginning to set. Each cage received 10 adult *Haplothrips* extracted from *O. microcarpum* flowers.

For all bioassays the cages were kept in a breeding room with natural light and ambient temperature of ±24 °C. Cages were inspected daily to record thrips survival and to check for signs of feeding damage.

Haplothrips confined on grapevine shoots and leaves

Fifteen *Haplothrips* adults extracted from flowering grape bunches were confined on a shoot of a potted grapevine ('Tawny') obtained from SA Plant, using an organza bag on 15 October 2019. Ten adult *Haplothrips* extracted from *O. microcarpum* flowers were confined on one leaf of a potted grapevine ('Tawny') and five on another leaf, using small organza bags, on 11 November 2019. All cages were inspected daily to record thrips survival and to check for signs of feeding damage.

RESULTS AND DISCUSSION

Vineyard inspections

No thrips feeding damage was observed on the berries, leaves or shoots in the vineyards during vineyard inspections over two seasons. Few *Haplothrips* were observed on the grapevines during these inspections, even though *H. clarisetis* and *H. nigricornis* were adundant on flowers of some plants adjacent to the vineyards, particularly the yellow daisy *O. microcarpum* and the succulent *M. crystallinum* (crystalline ice plant).

The sticky traps showed that several thrips species, including *F. occidentalis, F. schultzei, S. aurantii, H. clarisetis* and *H. nigricornis* were active in the natural vegetation adjacent to the vineyards during the growing season and also during winter. There was virtually no thrips activity in the vineyards during winter, as the vines were dormant and no winter cover crops were cultivated in these vineyards. Once the grapevines began to bud and grow in spring, there was a marked increase in thrips activity in the vineyards. The close proximity of the natural vegetation to the vineyards provided for easy movement of thrips between wildflowers and grapevines.

Haplothrips confined on grape flowering bunches

Upon completion of the laboratory trials, the dead thrips were collected and their identity confirmed by M. Stiller as *H. clarisetis*. In both the 2019 and 2020 trials, only a few thrips were observed on the flowering bunches after 24 h,

while most were sitting or walking on the walls and floors of the cages. Within three days there were no surviving thrips in any of the cages, even though the flowering bunches were still looking fresh and turgid, with abundant pollen. Inspection of the flowering bunches under a dissection microscope revealed no signs of thrips feeding. On 15 November 2020, when all the thrips confined on grape flowering bunches had died, *H. clarisetis* adults on the yellow daisies collected on 28 October 2020 were still alive and active when removed from the fridge and allowed to warm up. These thrips did not have shrunken abdomens or other signs of dehydration.

***Haplothrips* confined on grapevine shoots and leaves**

After three days there was one surviving adult in one leaf cage and four in the other. Inspection under a binocular microscope showed that all were lethargic with abdomens shrunken, indicating that they had not been feeding. Despite probing the leaf surface with their antennae, none inserted their stylets to feed. After seven days there were two surviving thrips on the shoot tip, but they both had shrunken abdomens and died within another day. Inspection of the shoot and leaves under a microscope revealed no signs of feeding or egg laying.

During the extraction of thrips from grapevine flowering bunches and from wildflowers for the bioassays and examination of the thrips to confirm that only *Haplothrips* were used, it was evident that the thrips were active as soon as they warmed up and that they did not exhibit shrunken abdomens indicating dehydration. Neither the *H. clarisetis* extracted from grape flowering bunches nor those from wildflowers appeared to feed or survived for any length of time on the grapevines.

According to Faure (1955) and Zur Strassen (1960, 2006), *H. clarisetis* and *H. nigricornis* occur in all provinces of South Africa. Both species are widely distributed across Southern and East Africa and have even been recorded in India (http://thripsnet.zoologie.uni-halle.de/; http://www.thrips-id.com/en/haplothrips-trybomiella-nigricornis/, accessed 5 January 2022). Faure (1955) and Zur Strassen (1960, 2006) reported that both species have been collected from a wide range of plants (mostly when in flower) from diverse plant families, for example Aizoaceae (ice plants), Asteraceae, Amarantaceae, Leguminosae and Graminae, and even on cabbage, citrus, potato and apple. However, the actual host plant status of these plants was not determined and these authors did not report any records of either species causing crop damage. As explained by Mound *et al.* (2022), collectors in the past tended to record all plants on which a thrips species was collected as a host plant, without determining if it actually fed and reproduced on these plants. This has proven to be problematic, and it also does not account for thrips that are predatory. Lewis (1997) states that the genus *Haplothrips* includes predatory species, namely *H. bedfordi, H. cahirensis* (Trybom)*, H. kurdjumovi* Karny and *H. victoriensis* Bagnall that prey mainly on other thrips, as well as pollen feeding and phytophagous species, of which several are recognised as crop pests. For example, *H. aculeatus* (Fabricius)*, H. tritici* Kurdjumov and *H. ganglebaueri* (Schmutz) are pests on wheat, barley and rice.

Ishikawa and Kuwayama (2020) found *H. nigricornis* (apparently introduced via imported plant material) on numerous Asteraceous weeds in Japan, but it was not linked to damage on any of the 23 plant species that they investigated. In South Africa, *H. clarisetis* has been found on citrus fruit (Gilbert, 1990), as well as mango flowers and leaves (Grové *et al*., 2001), but it was not associated with crop damage. These findings concur with our observations and results, which showed no causal link between *H. clarisetis* and grapevine damage. Further investigation into the biology of *H. clarisetis* on its wildflower hosts is recommended to provide clarity as to whether it feeds on pollen (although it did not feed on grape pollen in the bioassays), other flower structures or is a predator of mites or other thrips.

CONCLUSIONS

We found no evidence of feeding damage on grapevines in the bioassays or vineyard inspections over two seasons and therefore conclude that *H. clarisetis* does not pose an economic threat to table grapes in the Lower Orange River region of the Northern Cape province. This means that producers do not have to apply insecticides when these thrips are seen on grapevines, even though they are very conspicuous. Avoiding unnecessary insecticide applications reduces input costs as well as the environmental impact of farming.

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