

Chemical Control of the Ficus Whitefly, *Singhiella simplex* (Hemiptera: Aleyrodidae), a Major Pest of *Ficus* Hedges in Florida

Muhammad Z Ahmed¹, Cindy L McKenzie¹,
Alexandra M Revynthi², Catharine M Mannion²,
Lance S Osborne³

¹Subtropical Insects and Horticulture Research,
Agricultural Research Service, U.S. Department of Agriculture,
2001 South Rock Road, Fort Pierce, FL 34945, USA

²Department of Entomology & Nematology, Tropical Research
and Education Center, University of Florida,
Homestead, FL 33031, USA

³Department of Entomology and Nematology, Mid-Florida
Research and Education Center, University of Florida,
Apopka, FL 32703, USA

*Muhammad.Ahmed@usda.gov, cindy.mckenzie@usda.gov,
arevynthi@ufl.edu & lsosborn@ufl.edu



Introduction:

There is no quantitative approach to determine high or low infestation levels for ficus whitefly. It would depend on several factors, including the mindset and pest tolerance of homeowners, the aesthetic value of the *Ficus* hedge, etc. Regular scouting is key for ficus whitefly management to avoid economic damage. We recommend that *Ficus* hedges should be inspected on a weekly and/or biweekly basis during summer and biweekly and/or monthly basis during winter depending on the infestation levels.

Damage:

The most apparent sign of ficus whitefly infestation is defoliation. An unintended infestation of 2–3 months old would result in 2–3 generations of ficus whitefly which can lead to defoliation.

Eggs:

A 10–30x hand lens is required to see eggs. Eggs are almost transparent, elongate in shape, and are found along the midvein on the underside of leaves. Eggs require 11 days from oviposition to hatching, and then the remainder of the life cycle (from nymph to adult) lasts 19–20 days.

Crawlers:

First instar nymphs (crawlers) do not feed, rather they move around on the same leaf they hatched and settle down upon finding a suitable feeding site. They insert needle-like mouthparts into leaf tissue, remain in this location, and feed throughout the 2nd and 3rd instars.

Early Nymphal Instars:

The 2nd instars are flat, oval, translucent, have red eyes, and appear more like the early nymphal instars of soft scale insects than typical whitefly nymphs on *Ficus* plants. They can be found on both the lower and upper surfaces of leaves, unlike many whitefly species that only live on the underside of their host leaf.

Late Nymphal Instars:

The 2nd and 3rd instars are oval in shape and tan to light green in color, often semitransparent, camouflaging with the surroundings. However, they turn more opaque and pale yellow as they grow. The 4th instar (also known as puparium) is about 1.1–1.3 mm long, tan to light green, continues to feed until the adult body begins to develop inside the puparium. The red eyes of the adults become visible at this stage. The adult then breaks the T-shaped slit of the puparial case and emerges.

Pupae:

Puparial cases (exuviae) of ficus whitefly often stay on leaves for weeks if they do not happen to be washed away by rain and can help trace adults.

Adult:

Adults fly around when leaves are disturbed or shaken. Adults live for 4–5 days in summer and up to 10 days in winter. The presence of adults mandates immediate scouting. The foliar spray should be conducted depending on scouting results and the density of natural enemies.

Introduction: (Continued)

Scouting:

Overlapping generations of the ficus whitefly are commonly found in untreated populations, and scouting for the life stages that are higher in density can help plan ficus whitefly chemical control. In some cases, only adults and eggs are found in treated plants as a result of a new flush of adults moving from infested hedges in a neighborhood. Early detection, determining the infestation level, and scouting for the life stages before and after chemical control to evaluate insecticide efficacy are critical factors for successful management. Early instar nymphs and adults are the most susceptible to foliar applications. The pupal stage can be challenging to control. For best results against ficus whitefly, applications should be planned according to the life stages present and level of infestation on plants.

Application Interval:

The application of foliar insecticides, insecticidal soap or horticultural oil can be repeated in 7–10 days depending on product and level of infestation. The application of systemic insecticides can be repeated in 6–12 months depending on the product. Before applying any insecticide, always refer to the most current label.

Ficus Whitefly Resistance Management:

The back-to-back application of insecticides with the same mode of action eventually causes resistance to develop in whiteflies. In some cases, we find live immature whiteflies on treated hedges that have escaped the chemical application due to several factors, including incomplete spray coverage, lack of chemical efficacy, or potential resistance. We are concerned about the potential for insecticide resistance development in ficus whitefly due to the application of different insecticide products with the same mode of action being applied repeatedly. In south Florida, it is common for one neonicotinoid product to be applied early in the spring as a soil drench, followed by a different neonicotinoid product applied as a foliar spray. Although growers are rotating products, they are not rotating products from a different class of insecticide with a different mode of action.

Insecticide Application Timing:

Systemic insecticide like Mainspring GNL SC is applied by drenching to the root system of plants and translocated upward in the plant. The systemic upward movement in herbaceous plants will be quicker than in those of woody plants, such as trees and shrubs. Soil applications should be made prior to anticipated pest infestation to allow adequate systemic movement to achieve optimum levels of control. Insecticide should be applied in the spring. The whitefly does not need to be present for this type of application; however, this should only be done when it is known that the whitefly is in the area and your trees/hedges are at risk. Once applied to soil, systemic insecticides ideally move through the plant within 7–14 days or longer depending on the size of the plant and other factors. This gives enough time for systemic insecticides to work if they are applied between eggs–2nd instar stages. However, there are systemic insecticides that state in their label that they need up to 60 d. Their results might only be observed after a couple of generations of ficus whitefly. The application of one of systemic insecticides could provide approximately one year control.

Insecticide Coverage:

Complete coverage is essential for effective control. Foliar insecticide should be applied with enough water volume to obtain thorough and uniform spray coverage of the plants. It is essential to have complete coverage to avoid a resurgence of ficus whitefly and rotate insecticides depending on their mode of action to prevent insecticide resistance. More water-soluble neonicotinoids should be used for faster control, depending on the size of the hedge. The finished spray volume should be according to the size of the plants and the amount of foliage to provide thorough coverage throughout the canopy. Foliar spray should be applied to the point of drip or runoff. Foliar application against nymphs should be directed to the undersides of leaves. For drench application, the number of plants per hedge row should be counted and multiplied by the average height and rate to be applied per foot of height.

Conservation of Natural Enemies:

We recommend conserving natural enemies while applying insecticides if the defoliated area is contained. If possible, alternatives to neonicotinoids should be considered, even though *Ficus* hedges do not bloom and the application of neonicotinoids to *Ficus* hedges might not disturb pollinators.

Introduction: (Continued)

Heavy Infestation:

- In the case of heavy infestation of ficus whitefly that has resulted in defoliation of *F. benjamina* hedges, we suggest remaining patient, pruning out the dead branches, checking the suppleness of twigs. We observed that in most cases, defoliated ficus hedges that appear to be dying can still re-foliate and grow new leaves if the twigs remain supple. However, excessive defoliation can lead to branch dieback if ficus whitefly is not managed promptly. The amount of dieback could depend overall on the level of infestation and the health of the *F. benjamina* hedges.
- Use the higher rate when insect pressure is high.

The label is the law:

- Please read the labels before the application of any insecticide.
- Always follow the label directions and use of labeled rates at specified spray intervals.
- No matter what insecticide is selected, it is very important to check the insecticide label to determine if the insecticide can be used in the landscape, in production, or both.

Fertilizing & Pruning:

Pruning plants, in general, can be a source of reducing whitefly infestation. However, in the case of *Ficus* spp., primarily *F. benjamina* hedge that drops leaves with slight ficus whitefly infestation, pruning can further reduce the leaves and add physiological stress on the hedge. Nitrogen, in general, can increase whitefly infestation. However, here fertilizing will help strengthen *Ficus* plants against ficus whitefly-associated defoliation.

Future Consultation:

Local Cooperative Extension Service should be consulted for resistance management strategies and pest management practices for the area.

Table 1 Registered Insecticide Labeled for Whitefly Control in Greenhouse/Nursery Page 4
Production and Residential and Commercial Landscapes.

Trade Names Formulation (Manufacturer)	Active Ingredient(s)	MoA Class*	Application Method	Label Rate** (Ornamental Plants)	Minimum Application Interval (Days)	Site
I. Chemicals registered for use in landscape (L) and ornamental production (P)						
Sevin® SL (Bayer)	Carbaryl	1A	F	0.75 fl oz/1,000 sq ft	7	P
Orthene® SL (AMVAC)	Acephate	1B	F	4.0–8.0 oz/100 gal	7–14	P
Malathion 8 F (Gowan)	Malathion	1B	F	1 pint/100 gal	10, 2 Applications/ Year	P***
Fendona™ CS (BASF)	Alpha- Cypermethrin	3A	F	4–6 fl oz/100 gal	3	L
Talstar® P (FMC)	Bifenthrin	3A	F	10.8–21.7 fl oz/100 gal	5–7	P
Demand® CS (Sygenta)	Lambda- cyhalothrin	3A	F	3.0–5.0 fl oz/100 gal	7	L
Permethrin (Loveland)	Permethrin	3A	F	4.0–8.0 oz/100 gal	7	P
Pyrethrins 6 EC (BASF)	Pyrethrins	3A	F	12–24 fl oz/100 gal	7	L & P***
TriStar® 8.5 SL (Cleary)	Acetamiprid	4A	F	8.5–16.5 oz/100 gal	7 ¹	L & P
Arena® 50 WDG (Valent)	Clothianidin	4A	F D	0.9–1.26 oz/100 gal 0.38–0.78 oz/10 CFH	10 ²¹	L & P
Celero™ 16 WSG (Arvesta)	Clothianidin	4A	F D	4.0 oz/100 gal 4.0 oz/100 gal ²	1–2 Applications/ Season	L & P
Safari® 20 SG (Valent)	Dinotefuran	4A	F D	4.0–8.0 oz/100 gal 1.0–2.1 oz/FSH ³	14–21 ⁴	L & P
CoreTect® T (Bayer)	Imidacloprid	4A	Tablets	2–3 T/”DBH or FSH ⁵	365	L & P
Dominion 2L (Control Solution)	Imidacloprid	4A	F D	1.5 fl oz/100 gal 0.1–0.2 fl oz/FHS	As Needed	L
Marathon® F (OHP)	Imidacloprid	4A	F D	1.7 fl oz/100 gal 0.1–0.2 fl oz/”DBH or FSH	-	P
Merit® 2F (Bayer)	Imidacloprid	4A	F D	1.5 fl oz/100 gal 0.1–0.2 fl oz/”DBH or FSH ⁶	10–14 ⁷	L & P
Flagship® 25WG (Syngenta)	Thiamethoxam	4A	F D	4.0–8.5 oz/100 gal 4.0–8.5 oz/100 gal	7 ¹⁶	P

Trade Names Formulation (Manufacturer)	Active Ingredient(s)	MoA Class*	Application Method	Label Rate** (Ornamental Plants)	Minimum Application Interval (Days)	Site
I. Chemicals registered for use in landscape (L) and ornamental production (P) (Continued)						
Meridian® 25WG (Syngenta)	Thiamethoxam	4A	F D	4.0–8.5 oz/100 gal 16 fl oz/in DBH or FSH	7	L & P
Altus™ SL (Bayer)	Flupyradifurone	4D	F D	10.5–14.0 fl oz/A 21.0–28.0 fl oz/A ⁸	7 365	L & P
Avid® 0.15 EC (Syngenta)	Abamectin	6	F	8.0 fl oz/100 gal ⁹	7	P
Enstar® AQ WB (Central Grower) [#]	Kinoprene	7A	D D	6.0 fl oz/100 gal (Pre) 32 fl oz /100 gal (Cur)	7 ¹⁸	P
Preclude® TR (BASF) [#]	Fenoxycarb	7B	Fumigation	2 oz can /3,000 sq ft	2–3	P
Distance® EC (Valent)	Pyriproxyfen	7C	F	6.0–8.0 fl oz/100 gal	14–28 ¹¹	L & P
Endeavor® WDG (Syngenta)	Pymetrozine	9B	F D	2.5–5.0 oz/100 gal 5.0 oz/100 gal ¹⁰	7–14 ¹²	L & P
Rycar® SC (Sepro) [#]	Pyrifluquinazon	9B	F	1.6–3.2 fl oz/100 gal	14 ¹⁹	P
Ventigra™ DC (BASF)	Afidopyropen	9D	F	4.8–7.0 fl oz/100 gal	7 ¹⁷	L & P
Talus® 70 DF (Sepro)	Buprofezin	16	F	6.0 oz/100 gal	2 Applications/ Season	L & P
Magus® SC (Gowan)	Fenazaquin	21A	F	18–24 fl oz/100 gal	1 Application/ Cropping ²²	L
Sanmite® SC (Gowan)	Pyridaben	21A	F	6.4–9.6 oz/100–400 gal	30 ²⁰	P
Kontos® SC (OHP)	Spirotetramat	23	F D	1.7–3.4 fl oz/100 gal 1.7– 3.4 fl oz/ 2000–3000 of 2" Pots	14–28	P
Forbid® 4F (Bayer)	Spiromesifen	23	F	2.0–4.0 fl oz/100 gal	3 Applications/ Season	L
Judo® SC (OHP)	Spiromesifen	23	F	2.0–4.0 fl oz/100 gal	-	P
Mainspring® GNL SC (Syngenta) ¹³	Cyantraniliprole	28	F D	2.0–8.0 fl oz/100 gal 8.0–12.0 fl oz/100 gal	7–14 ¹⁴	L & P
Aria® WDG (FMC)	Flonicamid	29	F	2.9–4.3 oz/100 gal	7–28 ²⁴	L & P

Trade Names Formulation (Manufacturer)	Active Ingredient(s)	MoA Class*	Application Method	Label Rate** (Ornamental Plants)	Minimum Application Interval	Site
II. Chemicals with more than one active ingredient registered for use in landscape (L) and ornamental production (P)						
Discus™ (OHP)	Cyfluthrin + Imidacloprid	3A+ 4A	F D	25.0 fl oz/100 gal 0.75–1.5 fl oz/”DBH or FSH	-	P
Allectus SC (Bayer)	Bifenthrin + Imidacloprid	3A+ 4A	F D	6.7–21.3 fl oz/100 gal 0.45–0.9 fl oz/FSH²³	7	L
Triple Crown™ T&O (FMC)	Zeta- Cypermethrin + Bifenthrin + Imidacloprid	3A+ 4A	F	2.5–7.5 fl oz/100 gal	7	L
Xxpire® WG (Corteva)	Spinetoram + Sulfoxaflor	5 + 4C	F	2.75 oz/100 gal	14	P
III. Entomopathogenic fungi to use in landscape (L) and ornamental production (P)						
PFR-97™ (Certis)	<i>Isaria fumosorosea</i> Apopka Strain 97	UNM	F	14–28 oz/100 gal	3–10	L & P
Ancora™ (OHP)	<i>Isaria fumosorosea</i> Apopka Strain 97	UNM	F	14 oz/100 gal²⁵	3–5	
Beauveria bassiana Strain GHA 2% ES (LAM)	<i>Beauveria</i> <i>bassiana</i> strain GHA	UNM	F	0.5–1.5 qt/100 gal	2–5	L & P
IV. Other chemicals to use in landscape (L) and ornamental production (P)						
Azatin® O (OHP)	Azadirachtin	UNM	F	6–16 fl oz/ 100 gal	7	L & P
Ultra-Pure® Oil (BASF)	Mineral Oil	UNM	F	1.0–2.5 oz/ gal	7	L & P
Ultra-Fine® Oil (WMGR)	Paraffinic Oil	UNM	F	1–3 gal/100 gal	14	L & P
Safer® (OMRI)	Potassium Salts of Fatty Acids	UNM	F	2.5 oz/1 gal	7 As Needed	L & P
M-Pede® (OMRI)	Potassium Salts of Fatty Acids	UNM	F	1–2 % v/v¹⁵	7 As Needed	L & P
Disclaimer: Trade names, formulation, manufacturers, application methods, label rates, intervals, and application sites of the products in Table 1 are based on US EPA pesticide labels available at the time. The labels and products usually get updated now and then. This is the first version of our draft. We tried our best to maintain accuracy. Don't hesitate to contact us if you find any errors or omissions in the draft.						

¹Do not apply more than 4 applications per year.

²Do not apply more than a total of 40 oz of CELERO 16 WSG (0.4 lbs active ingredient) per acre per season.

³One gallon of spray solution will typically cover 325–425" of cumulative trunk diameter.

⁴Do not make more than one soil drench and one foliar or broadcast spray with Safari for resistance management, make the first foliar application just before pest populations reach an economic threshold, if necessary, make a second application after 14–21 days.

⁵Or 2 tablets per plant - a higher rate for heavy pest population.

⁶Do not apply more than a total of 1.6 pints (0.4 lb of active ingredient) per acre per year.

⁷Do not apply more than 1.6 pt (0.4 lb of active ingredient) per acre per year.

⁸Minimum volume for drench application is 750 gallons/Acre.

⁹Do not apply less than 8 fl oz or more than 16 fl oz per acre.

¹⁰Maximum annual rate for outdoor is 48 oz/A/year (1.5 lb ai/A/year of pymetrozine- containing products), and for indoor is 100 oz/A/year (3.13 lb ai/A/year of pymetrozine-containing products).

¹¹Do not apply more than two times per cropping cycle or more than two times per six months. If an additional application is needed less than 14 days after the first treatment, use an IGR (Insect Growth Regulator) with another mode of action or another chemical class of insecticide. Use lower rate and longer interval for newly established infestations and when plants are not rapidly flushing new growth. Use higher rates and shorter interval for established infestations and/or when plants are rapidly flushing new growth. Distance Insect Growth Regulator is intended for use in Integrated Pest Management (IPM) or Insect Resistance Management (IRM) programs. Distance Insect Growth Regulator will not control adult insects, and it is recommended to be used in combination and/or rotation with other IPM or IRM materials.

¹²Do not apply when conditions favor drift beyond the target area.

¹³May observe less activity on *Trialeurodes* sp.

¹⁴For crops and plants grown indoors, do not apply more than 32 fl oz Mainspring GNL per acre per crop per year (equivalent to 0.4 lb of active ingredient per acre per crop per year) and for crops and plants grown outdoors, do not apply more than 32 fl oz Mainspring GNL per acre per year (equivalent to 0.4 lb of active ingredient per acre per year).

¹⁵Use a 1 to 2% v/v solution of this product in combination with a specified rate of another labeled product.

¹⁶Do not exceed 17 oz/A per crop or year.

¹⁷Do not apply more than the annual maximum use rate of 42 fl ozs of Ventigra (0.27 lb afidopyropen ai) per acre per calendar year.

¹⁸Two weeks later, begin the Preventative Program by using 16 fl oz ENSTAR[®] AQ per 100 gallons of water to spray 20,000 square feet.

¹⁹Do not apply more than 2 applications per crop.

²⁰Do not apply more than 34.14 oz of product per acre, per year or more than 2 applications per crop per year or more than 12.8 oz of product per crop per season.

²¹Regardless of the application method do not apply more than 0.4 lb active ingredient clothianidin per acre per year.

²²Do not exceed 24 oz per acre per year for outdoor applications or 48 oz per acre per year for indoor applications.

²³Uniformly apply the dosage in no less than 10 gallons of water per 1000 square feet as a drench around the base of the tree, directed to the root zone. Remove plastic or any other barrier that will stop solution from reaching the root zone.

²⁴Do not apply this product more than two times consecutively before rotating to another chemistry. No minimum interval is needed between the second application of this product and an application of another insecticide from a different resistance management group. However, allow at least a one week interval between the application of an alternate insecticide and a third application of Aria Insecticide. For greenhouse use, do not exceed 16 applications per crop or year whichever is shorter.

²⁵It is recommended to use it with 6 to 8 fl oz of Fulcrum[®] at first day. Please read the label for subsequent sprays.

²⁶The current species name is *Cordyceps javanica*.

*The IRAC mode of action classification: <https://irac-online.org/mode-of-action/classification-online/>

**The label rates were taken from the labels provided at page 8 along with their links. The most recent available label should be checked for the updated rate recommendation.

***Agricultural Insecticide.

#Indoor greenhouse use only.

##Chemicals registered in Florida: http://npirspublic.ceris.purdue.edu/state/state_menu.aspx?state=FL

###Ir4 Whitefly Efficacy Data Summary:

<https://ir4.cals.ncsu.edu/ehc/RegSupport/ResearchSummary/WhiteflyEfficacy2014.pdf>

####The products that contain more than one insecticide such as Allectus (imidacloprid + bifenthrin) and Discus (imidacloprid + cyfluthrin) are useful because you get the benefits of two different insecticides, however, it is still important to consider how these products will affect the natural enemies.

#####Note that many of the products containing a systemic insecticide also have restrictions about using near water (ponds, lakes, rivers, etc.).

#####Applications should be made as late in the day as possible.

#####100 gallons of finished spray solution usually cover 1 acre.

Abbreviations:

A=Acre, DBH=Diameter of Breast Height, CFH=Cumulative Feet of Height, Cur=Curative, D=Drench, Fl=Fluid, F=Foliar, FSH=Foot of Shrub Height, ft=feet, gal=gallon(s), L=Landscape, MoA=Mode of Action, oz=Ounces, P=Production, Pre=Preventive, qt=Quarts, Sq=Square, T=Tablets, UNM=Unknown or uncertain, V=Volume, WB=Water-based formulation, WG=Water Dispersible Granule.

Formulations:

CR=Controlled Release, DC=Dispersible Concentrate, DF=Dry Flowable, F=Flowable, SC=Suspension Concentrate, TR=Total Release, WDG=Water Dispersible Granular, SG=Soluble Granular, WSG=Water Soluble Granular. Fluid ounces (fl oz) measure volume (e.g., liquid formulation), while ounces (oz) measure weight (e.g., dry formulation).

Symbol:

"=Inch

Insecticide Rotation:

If additional insecticide applications are required for control, use another color (class) from Table 1. Different colors represent different Mode of Action (MoA) in Table 1. Do not use insecticides with the same MoA (color) one after the other to reduce resistance development. The more colors you have in your spray program, the harder it will be for a whitefly to develop resistance to any one compound. Alternations, rotations, or sequences of different classes of insecticides with different MoA can prevent insecticide resistance from developing and preserve a product's effectiveness. For example, if the *Ficus* hedge received a neonicotinoid drench, its foliar spray during this phase should be avoided.

Disclaimer:

All pesticides must be applied in strict accordance with their labels. Mentioning a trademark or proprietary product does not constitute a guarantee or warranty of the product by the University of Florida or the United States Department of Agriculture. It does not imply its approval to the exclusion of other products that may also be suitable. Pay close attention to pollinator safety guidelines, legal use sites, rates, and application methods.

Reference:

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Online Links to the US EPA Pesticide Labels of the Products used in Table 1 Accessed August 2022

1. Allectus SC (Bayer) https://www3.epa.gov/pesticides/chem_search/ppls/000432-01415-20060706.pdf
2. Altus SL (Bayer) <https://www.environmentalscience.bayer.us/-/media/prf/unitedstates/documents/resource-library/product-labels/specimen-labels/altus-specimen-label.ashx>
3. AncoraTM (OHP) https://www.ohp.com/PIB/PDF/ancora_165_pib.pdf
4. Arena 50 WDG (Valent) <https://www.cdms.net/ldat/ld8N9008.pdf>
5. Aria WDG (FMC) http://horizon.wiki/images/a/a6/FMC_Corporation_Aria_Insecticide_Label.pdf
6. Avid 0.15 EC (Syngenta) <https://www.greencastonline.com/current-label/avid%200.15%20ec>
7. Azatin O (OHP) https://www.ohp.com/Labels_MSDS/PDF/azatin_o_label.pdf
8. Beauveria bassiana Strain GHA 2% ES (LAM) https://www3.epa.gov/pesticides/chem_search/ppls/082074-00017-20210318.pdf
9. Celero 16 WSG (Arvesta) https://www3.epa.gov/pesticides/chem_search/ppls/066330-00052-20070228.pdf
10. CoreTect T (Bayer) <https://www.environmentalscience.bayer.us/-/media/prf/unitedstates/documents/resource-library/product-labels/coretect-tree-and-shrub-tablets.ashx>
11. Demand CS (Syngenta) <https://www.syngentapmp.com/current-label/demand-cs>
12. Discus (OHP) https://www.ohp.com/Labels_MSDS/PDF/discus_label.pdf
13. Distance EC (Valent) https://label.westernpest.com/files_techservices/live/valent.distanceIGR080119.label.pdf
14. Dominion 2L (CSI) <https://f.hubspotusercontent30.net/hubfs/4028833/Specimen%20Labels/Specimen-Dominion2L-53883-229.pdf>
15. Endeavor WDG (Syngenta) <https://www.greencastonline.com/current-label/endeavor>
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