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Key to the winter crane flies of North America (Diptera: Trichoceridae)

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Abstract. A key to twenty five North American species of winter crane flies in the family Trichoceridae: *Paracladura trichoptera* (OSTEN SACKEN), *Diazosma hirtipennis* (SIEBKE), 7 species of *Trichocera (Metatrichocera): colei* ALEXANDER, *garretti* ALEXANDER, *lutea* BECHER, *mackenzie* DAHL, *salmani* ALEXANDER, *tetonensis* ALEXANDER, and *ursamajor* ALEXANDER; and 16 species of *Trichocera (Trichocera): annulata* MEIGEN, *arctica* LUNDSTROM, *bimacula* WALKER, *bituberculata* ALEXANDER, *borealis* LACKSCHEWITZ, *brevicornis* ALEXANDER, *columbiana* ALEXANDER, *fattigiana* ALEXANDER, *hiemalis* (DEGEER), *japonica* MATSUMURA, *longisetosa* ALEXANDER, *maculipennis* MEIGEN, *major* EDWARDS, *pallens* ALEXANDER, *parva* MEIGEN, and *regelationis* (LINNAEUS).

Key words: key, winter crane flies, Trichoceridae of North America.

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Winter crane flies of the genus *Trichocera* are often found on warm, sunny afternoons during fall, winter, and spring in the United States, Canada, and Alaska. On the other hand, adults of *Diazosma hirtipennis* (SIEBKE) are collected from June to September, the only trichocerid on wing in summer, found transcontinentally in nothern United States and Canada. *Paracladura trichoptera* (OSTEN SACKEN) are found from August through the winter to spring in British Columbia, Washington, Oregon, and California. Swarms of *Trichocera* males are often seen dancing in the late afternoon sunlight, sometimes thousands of individuals in hundreds of swarms over many acres of lawns and open woodlands. Biologists also have noticed these coldhardy insects swarming above the snow, or individuals crawling on the snow, when temperatures were between 0° C and 10° C.

At the present time there is no key to the species of winter crane flies in the family Trichoceridae of North America. The following key incorporates many elements from other publications on the Trichoceridae: keys to the three genera of Trichoceridae by ALEXANDER (1934, 1981): keys to the species of the eastern United States by ALEXANDER

(1919, 1942) and PRATT and PRATT (1984); keys to the species of the western United States by ALEXANDER (1967); and keys to species of Sweden and the Arctic and Subarctic by DAHL (1966, 1967). The world catalogue of Trichoceridae by DAHL and ALEXANDER (1976) lists all the species, reference to their original description, and known location of the type of most species.

In this key I use the terminology of ALEXANDER (1981) with regard to wing venation and male genitalia that is different from that of ALEXANDER in his many other, earlier, fine publications.

Key to the winter crane flies (Trichoceridae) of North America

1. Tarsi with first segment (basitarsus) very short, about one-eighth as long as second segment; wing with m-cu crossvein on M_3, some distance beyond origin of M_3 (B.C., Wash., Ore, Cal.) (Figs. 1, 4, 6) . . . . . genus *Paracladura*: *Paracladura trichoptera* (OSTEN SACKEN)

–. Tarsi with first segment longer than second; wing with m-cu cross-vein before, at, or close to fork of M_{1+2} and M_3 2

2. Wing with A_2 vein long, subsinuous, not curved evenly into wing margin; tibial spurs absent; ovipositor short, oval, fleshy (B.C. to N.B. south to Cal., Vt., and N.Y) (Figs. 2, 7) . . . . . genus *Diazosma: Diazosma hirtipennis* (SIEBKE)

–. Wing with A_2 vein short, curved evenly and gently to wing margin; tibial spurs present; ovipositor short or long, tapering markedly to tip, curvature downward, well sclerotized . . . . . genus *Trichocera* (MEIGEN) . . . 3

3. Gonostylus complex, with one or more lobes or swellings; gonocoxites frequently enlarged; bridge connecting gonocoxites complete, often with protuberance in middle . . . . . *Trichocera* (*Metatrichocera* DAHL) . . . 4

–. Gonostylus simple, or with a basal swelling or tubercle; gonocoxite not markedly enlarged; bridge connecting gonocoxites complete or incomplete, without protuberance in middle . . . . . *Trichocera (Trichocera* MEIGEN) . . . 10

Trichocera (Metatrichocera DAHL)

4. Distal portion of gonostylus cylindrical, not strongly expanded 5

–. Distal portion of gonostylus expanded, complex, often somewhat clublike 8

5. Lobe on basal portion of gonostylus short, about as wide as width of gonostylus at point of attachment 6

–. Lobe on basal portion of gonostylus long, two or more times as long as width of gonostylus at point of attachment 7

6. Bridge connecting gonocoxites without pointed protuberance in middle (Alaska, B.C., Cal. across nothern U.S. and south to Ga.)(Fig. 9) . . . . . *garretti* ALEXANDER (syn. *alexanderi* DAHL).

–. Bridge connecting gonocoxites with pointed protuberance in middle (Alaska, Canada and Northwest U.S.)(Fig. 10) . . . . *tetonensis* ALEXANDER (syn. *hyaloptera* ALEXANDER).

7. Lobe of gonostylus arising at basal fourth of gonostylus; lateral lobes of ninth tergite with dense brush of long reddish hairs (Mass., Md. to Kansas) (Fig. 11) . . . . . *salmani* ALEXANDER

–. Lobe of gonostylus arising at base of gonostylus; lateral lobes of ninth tergite with a few scarse setae (Alaska, nothern Canada)(Fig. 12) . . . . . *.mackenzie* DAHL.
8. Basal and distal portions of gonostylus each with a large rounded lobe (Greenland) (Fig. 14) . . . . . *lutea* BECHER
–. Base of gonostylus without a large rounded lobe 9
9. Tip of gonostylus with a large rounded lobe (Alaska, B.C., Wash., Ore., Cal.) (Fig. 13) . . . . . *colei* ALEXANDER.
–. Tip of gonostylus with a very complex enlargement and conspicuous brush of setae (Yukon, N.W.T.)(Fig.15) . . . . . *ursamajor* ALEXANDER.

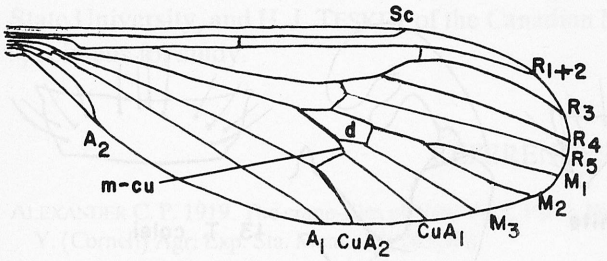
Trichocera (Trichocera MEIGEN):

10. Wing with distinct dark spot in cell R behind origin of Rs and a dark cloud over r-m crossvein (Fig. 3) 11
–. Wing without a dark spot in cell R, entirely clear or with a dark cloud over r-m crossvein 12
11. Hind femur yellowish brown without dark subterminal ring; gonostylus simple; male sternite 9 deeply concave in middle of posterior margin and without setae in middle (Eastern U.S. and Canada) . . . . . *.bimacula* WALKER (syn. *venosa* DIETZ) (syn. *fernaldi* ALEXANDER).
–. Hind femur yellowish brown with dark subterminal ring; gonostylus with small pointed basal protuberance; male sternite 9 with 2 bulges in middle of posterior margin (B.C., Alberta, Quebec) . . . . . *maculipennis* MEIGEN.
12. Abdomen distinctly annulate, tergites obscurely yellowish with posterior margins brownish (Cal., Ore., Nfd., N.Y., N.J., Va.) . . . . . *.annulata* MEIGEN.
–. Abdomen entirely dark 13
13. Wing with distinct cloud over r-m crossvein (Eastern U.S., Canada) . . . . . *.regelationis* (LINNAEUS).
–. Wing clear, sometimes with a sligth cloud in stigmal area, i.e. cell r1 14
14. Male with complete bridge joining gonocoxites 15
–. Male with incomplete bridge joining gonocoxites 20
15. Gonostylus with small compressed lobe arising about one-fourth distance from base to apex; bridge connecting gonocoxites with pointed protuberance in middle (NW U.S., Canada, and Alaska)(Fig. 10) . . . *tetonensis* ALEXANDER (syn. *hyaloptera* ALEXANDER).
–. Gonostylus simple or with basal protuberance 16
16. Gonostylus with basal tubercle or protuberance 17
–. Gonostylus simple; wing veins with long setae, those on distal portion of R_2 19
17. Male sternite 9 with a point in middle of posterior margin (Eastern U.S. and Canada) (Fig. 16) . . . . . *hiemalis* (DE GEER).
–. Male sternite 9 without a point in middle of posterior margin 18
18. From Oregon and California . . . . . *pallens* ALEXANDER.
–. From Alaska and nothern Canada . . . . . *arctica* LUNDSTROM.
19. Large species, about 6 mm, wing 8mm; male with parameres longer; (Alaska, Wash., Ore., Cal.) . . . . . *.major* EDWARDS (syn. *setosivena* ALEXANDER).
–. Smaller species, about 4 mm, wing 5.5 mm, male with parameres shorter (Wash.) . . . . . *longisetosa* ALEXANDER.
20. Gonostylus with two tubercles, one basal and another at basal third (Alaska, Mass.) . . . . . *.bituberculata* ALEXANDER.
–. Gonostylus with a basal tubercle, basal protuberance, or simple 21

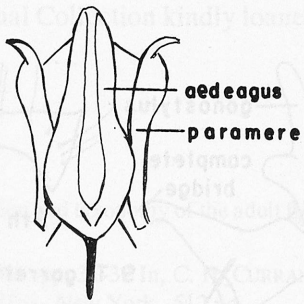
21. Last segment of palpus in both sexes not constricted in middle; male with paramere strongly angled, with a spur beyond middle to aedeagus (Eastern U.S., New England to Ga.) (Fig. 8) . . . . . *fattigiana* ALEXANDER.
–. Last segment of palpus in both sexes constricted in middle; male with paramere gently curved, somewhat scimitar-shaped 22
22. Gonostylus with basal setigerous protuberance or swelling 23
–. Gonostylus simple 26
23. Male sternite 9 with posterior margin deeply scooped or concave, usually with 4 to 8 setae along posterior margin between postero-lateral corners 24
–. Male sternite 9 with posterior margin slightly concave or straight, usually with 10 or more setae between postero-lateral corners 25
24. Gonostylus with moderate-sized protuberance at base; sternite 9 with only 4 setae in middle of posterior margin (Eastern Canada) . . . . . *parva* MEIGEN (syn. ?*gracilis* WALKER).
–. Gonostylus with small setigerous protuberance at base; sternite 9 with 8 or more setae along posterior margin between postero-lateral corners (Alaska, Canada) . . . . . *japonica* MATSUMURA (syn. *excilis* DAHL).
25. Setae along posterior margin of sternite 9 almost all of same size (Eastern U. S. and Canada) . . . . . *regelationis* (LINNAEUS)
–. Setae along posterior margin of sternite 9 of several sizes (Alaska and arctic Canada) . . . . . *borealis* LACKSCHEWITZ.
26. Male sternite 9 with posterior margin deeply concave and without setae in middle portion (Eastern U. S. and Canada) (Fig. 3) . . . . . *bimacula* WALKER.
–. Male sternite 9 shallowly concave or straight along posterior margin and with setae all along posterior margin between postero-lateral corners 27
27. Male sternite 9 with 10 or more large setae on posterior margin between postero-lateral corners (Eastern U. S. and Canada) . . . . . *regelationis* (LINNAEUS).
–. Male sternite 9 usually with 6 to 8 large setae along posterior margin between postero-lateral corners 28
28. Found in eastern U. S. . . . . *brevicornis* ALEXANDER
–. Found in western U. S. and Canada . . . . . *columbiana* ALEXANDER.

Additional study of series of specimens should be made to help solve many problems in the identification of North American Trichoceridae. More study is needed to determine if more than one species is involved in the *Trichocera bimacula* complex. Some specimens from the same swarm have spotted wings, while others have clear wings, but both have the same type of male genitalia and color pattern on the mesonotum. Good characters are needed to separate *Trichocera brevicornis* found in the eastern United States from *Trichocera columbiana* found in western United States and Canada. Are they one species? Similarly, are *Trichocera major*, and its synonym *Trichocera setosivena*, and *Trichocera longisetosa* one species? Series of *Trichocera regelationis* show considerable variation in wing pattern and structure of the gonostylus as shown in the key.

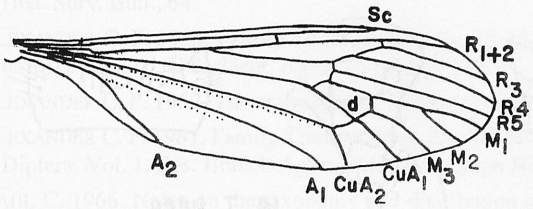
Acknowledgements. I particularly appreciate the assistance of the late C. P. ALEXANDER, Amherst, Massachusetts, Christine DAHL of Uppsala, Sweden, and G. W. BYERS of Lawrence, Kansas, who contributed specimens, checked identifications, and discussed many problems in the taxonomy of the Trichoceridae. Officials at the U. S. National Museum permitted me to study the ALEXANDER collection and other specimens there,



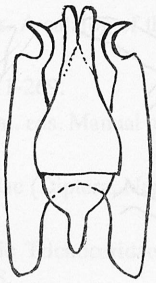
1 Paracladura trichoptera



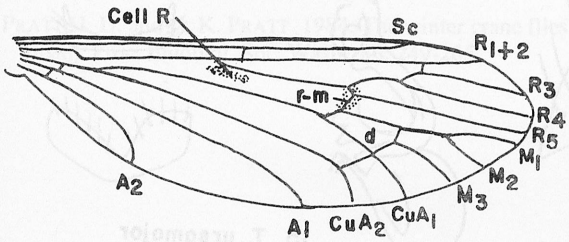
6 Paracladura trichoptera



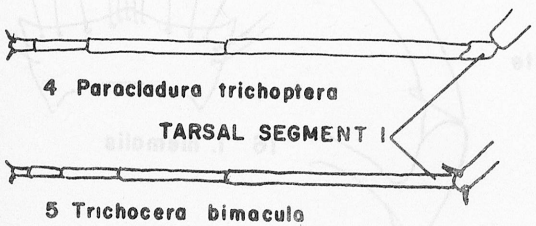
2 Diazosma hirtipennis



7 Diazosma hirtipennis



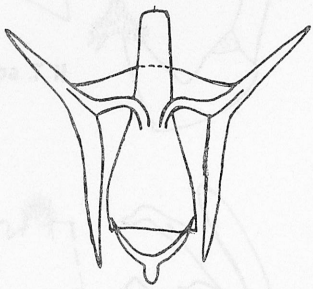
3 Trichocera bimacula



4 Paracladura trichoptera

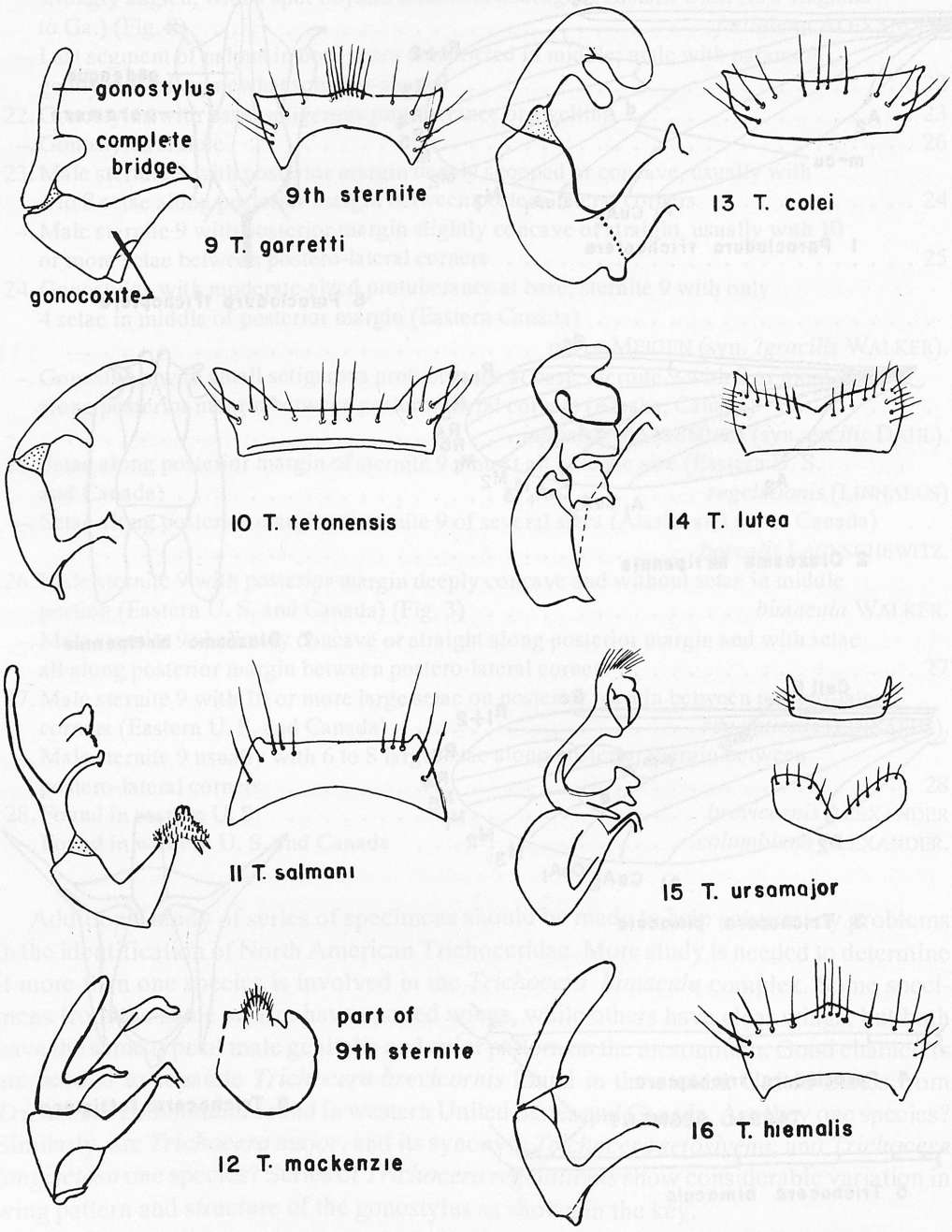
TARSAL SEGMENT I

5 Trichocera bimacula



8 Trichocera fattigiana

Figs. 1 - 8. 1: wing, *Paracladura trichoptera*, San Francisco, Cal.; 2: wing, *Diazosma hirtipennis*, Halifax Gorge, Vt.; 3: wing, *Trichocera bimacula*, Atlanta, Ga.; 4: tarsus, *Paracladura trichoptera*, San Francisco, Cal.; 5: tarsus, *Trichocera bimacula*, Atlanta, Ga.; 6: male genitalia, *Paracladura trichoptera*, San Francisco, Cal.; 7: male genitalia, *Diazosma hirtipennis*, Halifax Gorge, Vt.; 8: male genitalia, *Trichocera fattigiana*, Atlanta, Ga.



Figs. 9 - 16. Male genitalia details. 9: *T. garretti*, Atlanta, Ga.; 10: *T. tetonensis*, Waterton National Park, Alberta, Canada; 11: *T. salmani*, Amherst, Mass.; 12: *T. mackenzie*, Masseure, Sweden; 13: *T. colei*, Pullman, Wash.; 14: *T. lutea*, redrawn from DAHL 1957 and 1967; 15: *T. ursamajor*, redrawn from DAHL, 1967; 16: *T. hiemalis*, Atlanta, Ga.

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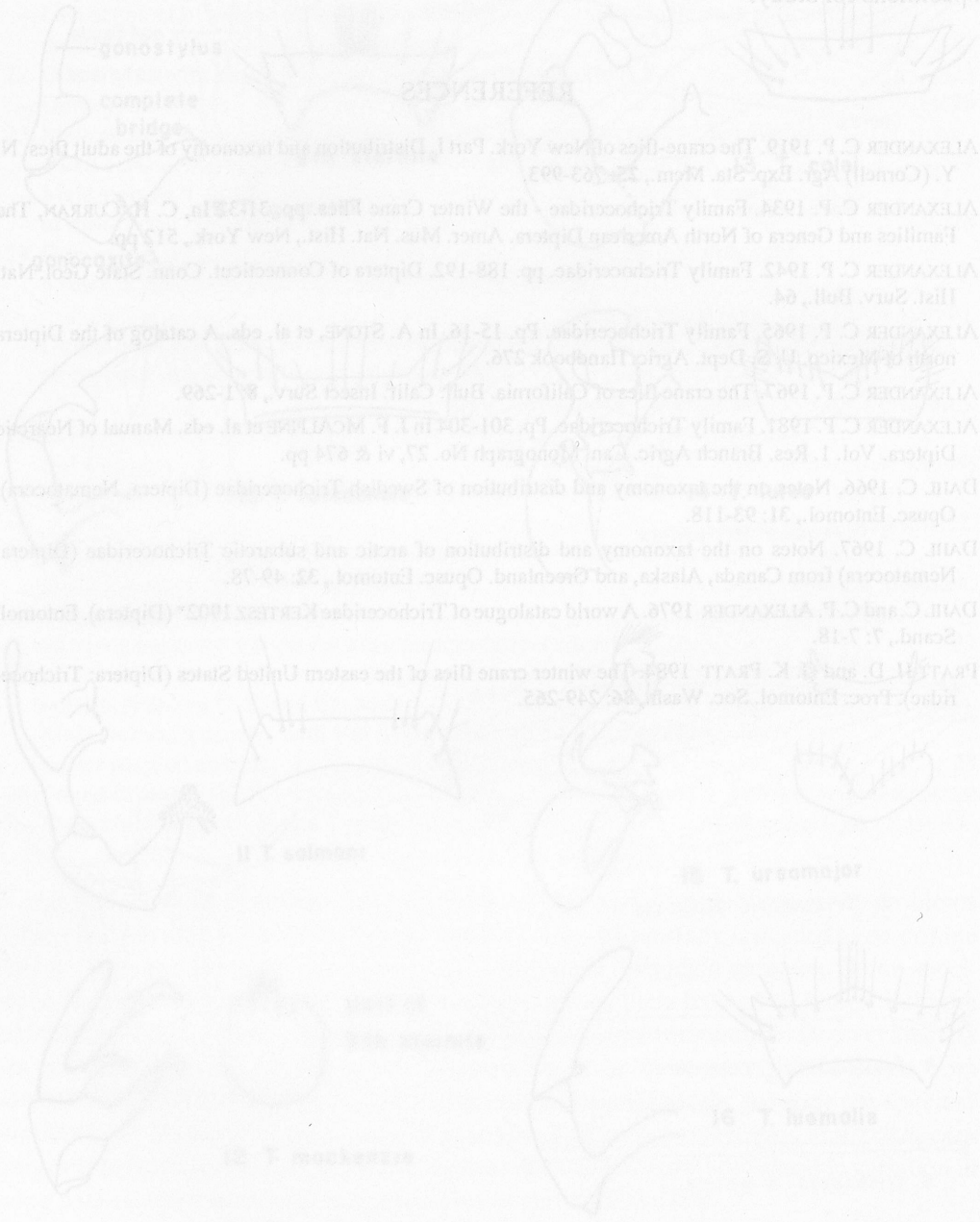

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