

Status of False Rue-anemone, *Isopyrum biternatum* (Ranunculaceae), in Canada*

MADELINE J. W. AUSTEN

P.O. Box 103, Campbellville, Ontario L0P 1B0

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False Rue-anemone (*Isopyrum biternatum*) is a spring-flowering perennial herb distributed from southern Ontario to Minnesota, south to Florida and Texas. In Canada, extant populations are known only from the St. Thomas — Port Stanley area in Elgin County, the London area in Middlesex County, and near Arkona in Lambton County. *Isopyrum biternatum* is considered vulnerable in Canada due to the relatively specialized wooded floodplain habitat that it requires and its restricted range in the Carolinian zone of Ontario.

Key Words: *Isopyrum biternatum*, False Rue-anemone, Ontario, vulnerable, habitat, distribution, population size.

False Rue-anemone, *Isopyrum biternatum* (Raf.) T. & G. has a limited distribution in Canada, only occurring in southern Ontario. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was interested in determining the current status of this species in Canada. Therefore, the author conducted field work during April — June, 1988 to determine the location and number of *I. biternatum* populations in Ontario.

Isopyrum biternatum is an erect, perennial herb (Figure 1) found in woodlands with moist, rich calcareous soils. Plants grow to a height of 10–40 cm. Stems are ribbed, glabrous and originate from a tuberous rootstalk. Basal leaves are usually biternate with long petioles. Stem leaves are short petioled or sessile and biternate; occasionally the uppermost stem leaves are triternate. Leaflets are usually 2–3 lobed and glabrous, with shallow to deep sinuses. *Isopyrum biternatum* is apetalous, the flower being comprised of five white, round-tipped sepals and born singly, either in an axillary or terminal position. Flowers are bisexual. Mitchell and Dean (1982) provide a good technical description of *Isopyrum biternatum*.

Superficially, *Isopyrum biternatum* resembles Rue-anemone (*Anemonella thalictroides* (L.) Spach) in the division of its leaves and its delicate white flowers. However, *Isopyrum biternatum* has alternate leaves; divided leaves and deeply lobed leaflets; roots with scattered small tubers (Wherry 1948); and an erect stature. *Anemonella thalictroides* has whorled leaves, shallow-lobed leaves, a cluster of tubers, and a low-growing stature. *Isopyrum biternatum* may be easily overlooked in the field due to its early flowering time and its resemblance to *Anemonella thalictroides*. *Isopyrum biternatum*

could also be confused with *Thalictrum* spp., particularly Early Meadow-rue (*Thalictrum dioicum* L.), on the basis of vegetative characters. *Isopyrum biternatum* has more deeply lobed leaflets, a slightly reddish stem (in Ontario populations at least), brighter green leaves and a different flower structure.

Distribution

The distribution of *Isopyrum biternatum* in North America, shown in Figure 2, is based on herbarium records from Ontario and the United States (herbaria consulted are listed in the COSEWIC status report). *Isopyrum biternatum* occurs from southern Ontario to Minnesota, south to northeastern Texas, Arkansas, Alabama and northwestern Florida (Radford et al. 1965; Gleason 1968; Correll and Johnston 1970; McGregor and Barkley 1977; Mitchell and Dean 1982; Argus and White 1983). *I. biternatum* is recorded infrequently east of the Appalachian Mountains, but recent sightings in Virginia, North Carolina and South Carolina suggest that it may be more common than previously believed (Boufford and Massey 1976).

In Canada, the known distribution of *Isopyrum biternatum* is restricted to three counties in southwestern Ontario: Middlesex, Elgin and Lambton (Figure 2). Herbarium specimens indicate that *Isopyrum biternatum* was known to occur historically at several sites in Elgin County (Southwold and Yarmouth townships), Middlesex Co. (Williams Township), and Lambton Co. (Bosanquet and Stephen townships) Ontario; see COSEWIC status report by the author. Specimens of *Isopyrum biternatum* are found in the following Ontario herbaria: Department of Agriculture, Ottawa (DAO); University of Guelph, Guelph (OAC); University of Toronto (TRT);

*Based on a COSEWIC status report by the author. Copies of the complete report are available at cost from the Canadian Nature Federation, 453 Sussex Drive, Ottawa K1N 6Z4. Vulnerable status was approved and assigned by COSEWIC on 11 April 1990.

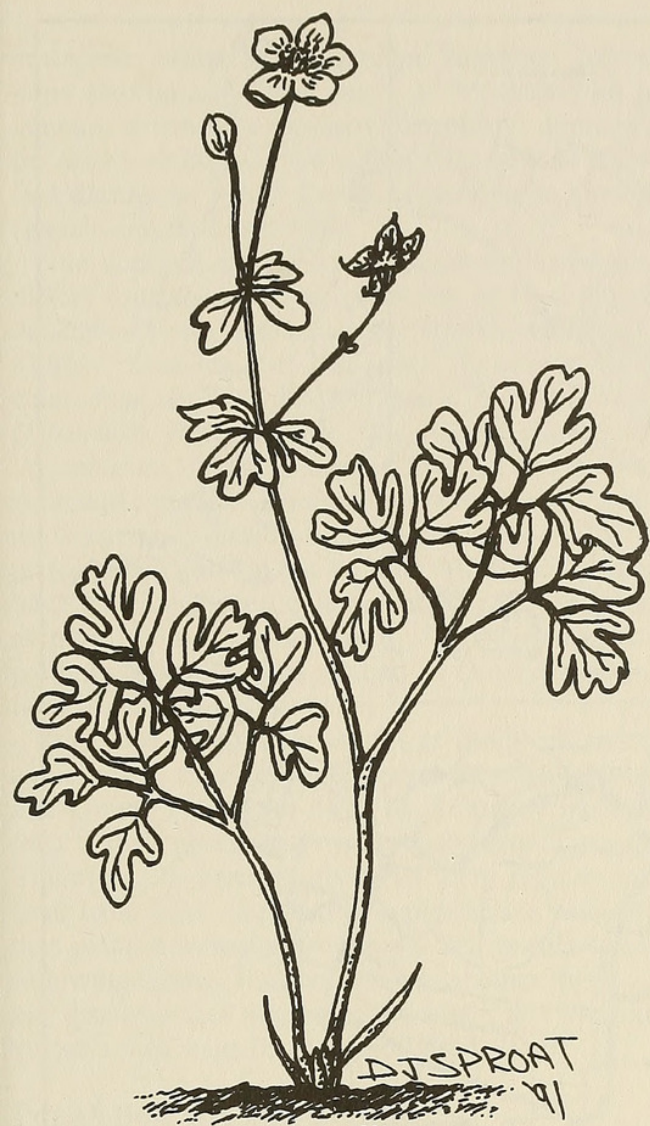


FIGURE 1. Flower and foliage of False Rue-anemone (*Isopyrum biternatum*).

Erindale College (TRTE); and the University of Western Ontario (UWO). No recent records of *Isopyrum biternatum* have been reported in Norfolk County, suggesting that *I. biternatum* has been extirpated in its historical location near Lynn Valley east of Simcoe (Soper 1962). *Isopyrum biternatum* was not found during field investigations conducted near Parkhill (Middlesex County), Ontario in May 1989. A more intensive search effort in the Parkhill area may reveal a remnant population of *Isopyrum biternatum* in suitable habitat along Mud Creek.

Habitat

Throughout its range, *Isopyrum biternatum* grows in shaded woods and thickets, often on rich, wooded slopes in floodplain zones. This species is often found in close proximity to streams; Melampy and Hayworth (1980) found, respectively, 50% and 74% of 147 *I. biternatum* clumps within 10 and 25 m of streams in Illinois.

Populations of *Isopyrum biternatum* are restricted in Canada to the Carolinian Floral Region (Scoggan 1978). In Ontario, the species occurs in areas dominated by gray brown luvisolic soils which are rich in calcareous till and lacustrine deposits from limestone and dolostone (Hoffman 1989). *Isopyrum biternatum* is generally found in shady areas within mature maple-beech forests on gradual slopes; it is not found on steep slopes or in open, highly disturbed sites. Populations in Ontario were generally found in mixed hardwood Carolinian Forests, dominated by Sugar Maple (*Acer saccharum* Marsh.), in combination with other species including, Hop-hornbeam (*Ostrya virginiana* (Mill.) K. Koch), Blue-beech (*Carpinus caroliniana* Walt.), American Beech (*Fagus grandifolia* Ehrh.), Bitternut Hickory (*Carya cordiformis* (Wang.) K. Koch), Shagbark Hickory (*C. ovata* (Mill.) K. Koch), American Basswood (*Tilia americana* L.), Butternut (*Juglans cinerea* L.) and White Ash (*Fraxinus americana* L.). *Isopyrum biternatum* is found growing with Bloodroot (*Sanguinaria canadensis* L.), trilliums (*Trillium* spp.), Cut-leaved Toothwort (*Dentaria laciniata* Muhl.), Wood Anemone (*Anemone quinquefolia* L.), violets (*Viola* spp.), and Trout Lily (*Erythronium americanum* Ker.). *Isopyrum biternatum* has also been found in association with some rare plants in Ontario, including Virginia Bluebells (*Mertensia virginica* (L.) Pers.) and Green Dragon (*Arisaema dracontium* (L.) Schott) (Keddy 1984, 1987).

General Biology

Isopyrum biternatum is a hermaphrodite and grows in clumps that probably represent clones (Melampy and Hayworth 1980). *Isopyrum biternatum* is self compatible, but not autogamous; autogamy appears to be prevented by protogyny, with stigmas becoming non-receptive by the time the anthers dehisce (Melampy and Hayworth 1980).

Flowering begins when temperatures are suitable for plant growth and pollinator activity, and ends before closure of the canopy (Schemske et al. 1978). In Ontario and Illinois (Melampy and Hayworth 1980; Mitchell and Dean 1982), *Isopyrum biternatum* flowers in late April or May and is in fruit by early June. Flowering lasts 7-10 days; three to four days are spent in the female phase (Schemske et al. 1978). Delayed flowering peaks can be detrimental to seed set of *Isopyrum biternatum* (Schemske et al. 1978). In Ontario, seeds mature by late May/early June. Seeds have no known special means of dispersal (Schemske et al. 1978). Leaves begin to turn yellow or brown as seeds ripen, and by early to mid-June all have senesced (Baskin and Baskin 1986).

Isopyrum biternatum is pollinated by insects. No nocturnal pollinators were noted on *I. biternatum* (Melampy and Hayworth 1980); this is probably related to the cool nights during early spring when

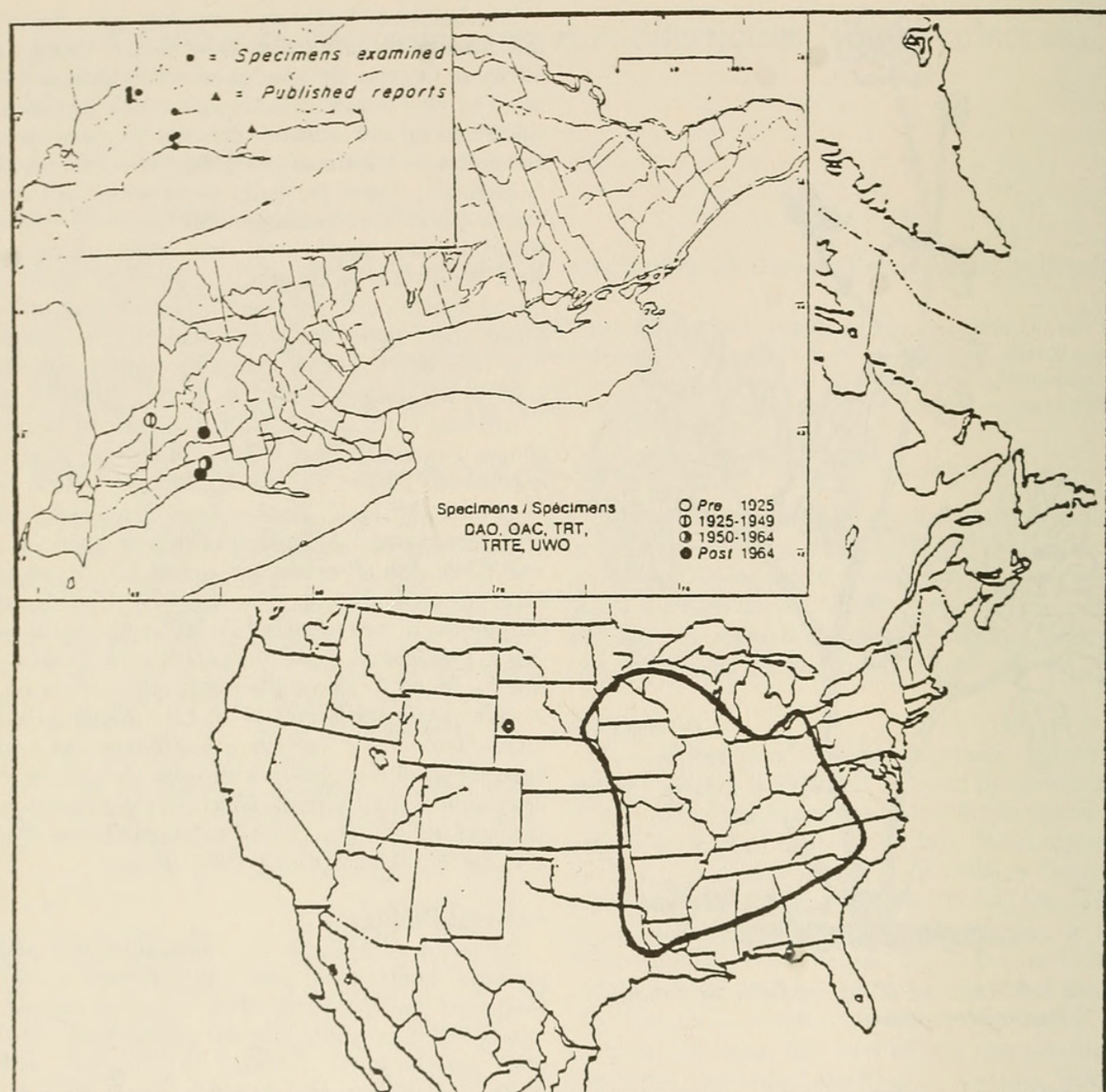


FIGURE 2. The distribution of False Rue-anemone (*Isopyrum biternatum*) in Ontario (insert) and North America. Ontario distribution taken from Argus and White (1983).

this species flowers. A variety of insects visit *I. biternatum* flowers (e.g., *Apis mellifera*, andrenid bees, halictid bees, syrphid flies, other flies, and beetles), however, the rate of visitation of these pollinators to *I. biternatum* plants is low, even when *I. biternatum* is in flower (Melampy and Hayworth 1980). *Isopyrum biternatum*, which is a nectarless plant, is not a preferred resource for insect pollinators when the nectar-bearing flowers of plants such as Spring Beauty (*Claytonia virginica* L.) and *Dentaria laciniata* are nearby (Melampy and Hayworth 1980). Nectarless plants, such as *I. biternatum*, may receive insect visits by extending their flowering season to include intervals when few nectar-producing plants are flowering (Melampy and Hayworth 1980). A shortage of pollinators could

limit seed production in *Isopyrum biternatum* (Melampy and Hayworth 1980). Wind appears to play a minor role in the pollination of *Isopyrum biternatum* (Melampy and Hayworth 1980).

Embryos of *Isopyrum biternatum* are non-dormant and seeds of *I. biternatum* require a long time at high temperatures to complete embryo growth and germinate (Baskin and Baskin 1986). Laboratory studies suggest that exposing seeds of *I. biternatum* to high summer temperatures may enhance germination at early autumn temperatures (Baskin and Baskin 1986). Germination of *I. biternatum* is similar to that of species exhibiting epicotyl dormancy (i.e. radicles are dormant and require a period of warm stratification during the summer before they emerge at favourable autumn temperatures) because radicle

emergence occurs in the autumn. However, cotyledons also emerge from seeds of *I. biterdatum* in autumn, whereas in species with epicotyl dormancy the seed with an emerged radicle must be cold stratified during the winter for the cotyledons to emerge (Baskin and Baskin 1986).

The germination pattern of *Isopyrum biterdatum* differs from that of other perennial herbs of mesic deciduous forests studied to date (Baskin and Baskin 1986). Species of *Asarum*, *Caulophyllum*, *Cimicifuga*, *Erythronium*, *Hepatica*, *Hydrophyllum*, *Osmorhiza*, *Polygonatum*, *Sanguinaria*, *Smilacina*, *Stylophorum*, *Trillium* and *Uvularia* are deeply dormant and complete germination in the spring, whereas *Isopyrum biterdatum* is non-dormant and completes germination in the autumn. All of these plants have underdeveloped embryos at seed maturity and dispersal (Baskin and Baskin 1986). Germination patterns have not been studied in Ontario populations of *Isopyrum biterdatum*.

Isopyrum biterdatum seedlings produced in the autumn have a much longer period for establishment and growth before the onset of dormancy in June, than if their germination were delayed until spring. Therefore, *Isopyrum biterdatum* may require less time from seed dispersal to reproductive maturity than plants developing from seeds that germinate the following spring. It is not known whether there are any disadvantages to passing the winter in a seedling versus a seed stage (Baskin and Baskin 1986).

Population Size and Trends

Comprehensive studies have not been conducted on the demography, phenology and reproductive ecology of *Isopyrum biterdatum* in Ontario. *Isopyrum biterdatum* is a perennial with considerable vegetative propagation, and therefore, this may diminish to some extent the importance of high seed production in any one year (Schemske et al. 1978). Abundant seeds were produced by plants observed in Elgin County during early June. Populations in Ontario vary from small patches, less than 1 m X 1 m (approximately 50 plants), to very large patches with plants numbering in the thousands.

Twenty-one populations of *Isopyrum biterdatum* are known from southwestern Ontario. Ten populations are found within a 15 km stretch of Kettle Creek and its tributaries between St. Thomas and Port Stanley (Elgin County). *Isopyrum biterdatum* plants from these ten populations are estimated to number in the hundreds of thousands. The largest single population found by the author was located along the Elgin Trail, south of St. Thomas, Ontario. Two other populations are known from Yarmouth Township, Elgin County; these populations were not observed during a 1989 field study, but have been confirmed within the last five years (W. G. Stewart, personal communication).

Eight populations are known to occur along the Medway Creek near London (Middlesex County), Ontario. Other Medway Creek populations occur in the Arva area, Medway Heights, Huron College, and near the confluence of Snake and Medway Creeks. The latter population has scattered clumps of *I. biterdatum* totalling approximately 500 000 to 700 000 plants; patches of plants ranged in size from 1 m²-225 m². One small population, containing approximately 200 plants and covering an area of 3 m² was found at The University of Western Ontario, adjacent to the Thames River in May 1989. *I. biterdatum* populations in this area appear to have been reduced due to the encroachment of Goutweed (*Aegopodium podagraria* L.) along this section of the Thames River.

Another population consisting of several scattered clumps of plants, and estimated to contain 2500-3000 plants, was found along the Ausable River, north of Rock Glen Conservation Area near Arkona (Lambton County), Ontario.

Limiting Factors

Isopyrum biterdatum is found in floodplain habitats within the Carolinian Zone and has a restricted geographical range (Port Stanley, St. Thomas, London and Arkona) in Ontario. This species does not thrive in edge habitats or open areas, which now dominate the landscape of southwestern Ontario.

Many populations of *I. biterdatum* are threatened by their proximity to public areas and trails. In these areas, plants are subject to spring wildflower-picking, soil compacting, and trampling due to recreational activities (e.g., hiking, cycling, camping, and recreational vehicles). Additional populations are threatened by the encroachment of other plants, such as *Aegopodium podagraria* and Garlic Mustard (*Alliaria officinalis* Andr.), wood cutting practices, soil erosion, mowing, pesticide spraying and road salting.

Some populations of *Isopyrum biterdatum* were found growing in conditions considered to be atypical for the species (e.g., adjacent to windfalls and tree cuts; in edge habitats; and among large growths of *Alliaria officinalis*, *Aegopodium podagraria*, or tall grasses). It is assumed that plant populations in these areas are on the decline, however, research is necessary to determine how seedling growth, seed output and germination in these populations differ from populations growing in more typical habitats.

Special Significance of the Species

I. biterdatum is the only member of the genus represented in central and eastern North America; three other species of *Isopyrum* are native to the Pacific Coast of North America (Gleason 1968) and one species (*I. savilei* Calder & Taylor) is endemic to the Queen Charlotte Islands (Calder and Taylor 1963). *Isopyrum biterdatum* has no known natural, medical or economic significance.

Protection

In the United States, *Isopyrum biterdatum* is not considered federally endangered. However, it is considered rare in South Carolina, Virginia and Florida, and endangered in South Dakota (S. Maina, personal communication). In South Carolina, *Isopyrum biterdatum* is known from only one location (Stevens Creek, Modoc, McCormick County), which is protected by South Carolina's Natural Heritage Program (S. R. Hill, personal communication). *Isopyrum biterdatum* may now be extirpated in New York State; only a single pre-1840 specimen is known for New York (Mitchell and Dean 1982).

Evaluation of Status

Isopyrum biterdatum is considered vulnerable in Canada due to the relatively specialized wooded floodplain habitat that this species requires, its restricted geographical range in the Carolinian Zone of Ontario, and the presence of the majority of known populations in public use areas. Several thousand *I. biterdatum* plants can survive on small plots of land. Therefore, populations should survive in Ontario if floodplain areas along Kettle Creek, the Medway River, the Thames River, and Ausable River are preserved. Populations of *Isopyrum biterdatum* found on conservation property may be protected from urban development, however, public access into these areas still poses a threat to these populations.

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