Some Flowering Plants of the Devon Island Lowlands

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Illustrated by Katherine Mackenzie

When the massive ice sheet of the last Pleistocene glacier melted 10,000 years ago, land which had been forced below sea level under its weight began to rise, and the receding water left behind rows of beach ridges and shallow depressions. On the northern shore of Devon Island in the Canadian Arctic, there is an area of such lowland about 40 square kilometres in extent. It is bounded in the north and west by Jones Sound and in the south by the Truelove Inlet and River, while to its east lies an escarpment 1000 ft (300 m) high separating it from the upland plateau of the interior of the Island and the remains of its ice cap (see Fig. 1).

From the base of the escarpment to the sea, this lowland area is a treeless terrain of lakes and ponds separated by grassy meadows and rocky beach ridges, dissected by meandering melt streams. During the summer, many of the meadows are wet and muddy, retaining a good deal of standing water during the short growing season. The raised beach ridges are dry and pebbly along their tops, becoming progressively moister as they slope down towards the meadows and ponds. The flowers described and illustrated in this article are all to be found growing in this lowland area.

Arctic seasons are raw and harsh. Winter seems never-ending, with weeks of complete darkness and temperatures which fall to as low as $-50°C$. The heaviest snowfalls occur in March and April, when the tundra is blanketed in white, and high winds build drifts behind ridges and rocks. By May the sun is above the horizon all day, exposing a white undulating landscape. Temperatures begin to rise, but even with continuous daylight it is not until June that the ground emerges from beneath the snow. The elevated beach ridges are the first areas to become free of snow, while the meadows do not lose their cover until early July. From then until late August there is a flurry of growth, with some plants blossoming within two weeks of their first exposure to the sun. During September, the first lasting snows of winter arrive as temperatures drop, and the sun remains below the horizon for longer periods of time.

Arctic plants are adapted to survive and grow under conditions different from those to which their temperate relatives are subject. They face a short, cold growing season, a soil providing little nutrition, special conditions of moisture, and continuous daylight. Nearly all of them are perennials.

The plants adapt themselves in various ways to the short arctic growing season, which averages only seven to ten weeks. Some pass the winter in a wintergreen or semi-evergreen state, retaining their food-producing chemical systems basically

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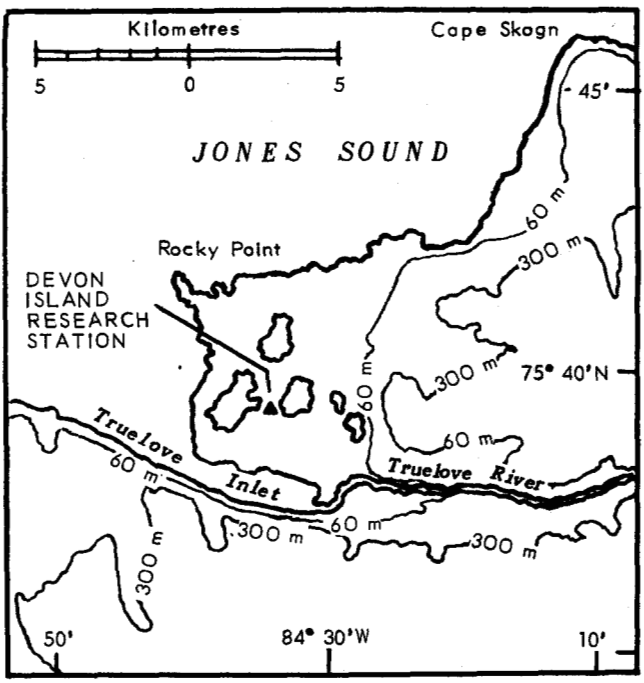

FIG. 1.
Study area.

intact in the green parts of their leaves, so that as soon as conditions are favourable they can begin to produce food for growth. Others store food left over from the previous growing season so that they may have reserves of energy for new growth in the spring. Limitation of growth and development in spite of favourable conditions is a means by which certain plants protect themselves against sudden late-season weather changes which could injure or kill them in an immature state. The plants grow buds during one season, which lie dormant over winter and then bloom under optimum conditions the following summer.

Arctic plants perform their vital metabolic functions under the difficult conditions of air temperatures that average below 5°C during the growing season, but in their patterns of growth take advantage of ground-level temperatures that are a great deal higher. Many plants, therefore, grow close to the ground in tight, dense clumps or cushions which help reduce wind speed among the leaves and trap the warm air. Growing low also serves to protect delicate buds from blowing winter snows, and so to ensure the survival of plants.

The Arctic is often regarded as a desert because many parts receive less than 400 mm of precipitation yearly. Despite low summer precipitation, however, many tundra areas are swampy because of frozen subsoil. Beneath an active layer of soil lies permafrost — the name given to any ground material which is perennially frozen. Permafrost acts as an impermeable barrier to the flowing of water away from plant roots. Since permafrost is closest to the surface in the wet meadow area, the plants there are adapted to moist, wet conditions. On the beach ridges,

however, where the active layer is deep and the soil coarser, the ground dries out rapidly after melt, and plants which grow there must withstand desert-like conditions of drought. Permafrost directly influences plant growth when it lies near the surface, preventing deep root penetration and keeping the soil temperatures low.

Arctic plants are adapted to receiving only small amounts of nutrients, especially nitrogen which is necessary for growth because it is a component of proteins and other vital constituents of plants. When the soil is artificially enriched with nitrogen, many of the plants may have a greatly-increased vegetative growth, while others may lose their characteristic shapes or be delayed in flowering.

Finally, arctic plants exist under a unique regime of 24 hours of daylight during the summer months. Many plants from temperate areas flower only when subjected to a limited duration of light. Northern flora, in contrast, must be either insensitive to length of day, or else be able to respond to changes in the intensity or quality of light.

During the arctic spring, when the snow begins to melt, the tops of the raised beach ridges are the first land surfaces to be exposed. These buff-coloured strands of soil wind their patterned way across the lowland. They are a conglomerate of sand and pebbles which easily absorbs the sun's warmth and quickly dries out as the melt progresses. The ground is seemingly bare, though much of the surface is covered with tiny multi-coloured lichens which cling to the rocks and pebbles. Small mosses can be found in the interstices of the carpet of pebbles. The flowering plants, which commence blooming less than two weeks after being freed from the snow, are arrayed in scattered groups, rising little more than 4-5 cm into the air.

The flowers of *Saxifraga oppositifolia* (Fig. 2) are among the first to appear. Probably the most abundant of the lowland, they are small, measuring only 10-15 mm across. Their five petals appear in a wide assortment of pink, violet and purple, and carpet the beach ridges over the period from late June into July. They vary considerably in shape, from the round and stubby to the thin elongate, and in texture from the smooth and light to ones like crinkled crepe paper. Inside this whorl of petals the pollen-laden anthers turn bright yellow as they mature. There are two horn-like stigmas and styles which await the deposition of pollen. The flowers lie on a cushion of tightly-arranged reddish-green leathery leaves which grow to only 3-4 mm in length.

FIG. 2.
Saxifraga oppositifolia.

FIG. 3.
Papaver radicatum.

As the season progresses, the arctic poppy, *Papaver radicatum* (Fig. 3) begins to bloom. This is a rosette plant. All its dark green leaves are attached to a short central stem in the form of spokes on a wheel. They are pinnately dissected and covered with thick rusty hairs. The flower bud is enclosed in two hairy black sepals, resembling a bristly club. As the time of blossoming approaches, the short flowering stalk elongates and pushes the nodding bud 10-15 cm into the air to become one of the tallest flowers on the lowland. The four ovate petals of the opened flower have an average length of 3 cm and range in colour from a brilliant sulphur yellow to pale white. Its interior is dominated by a hairy black capsule, the size of a small marble, on top of which is a fuzzy yellow stigmatic disc where pollen must land, if seeds are to be produced. When the seeds are fully developed, the capsule dries and small holes form along its upper edge. The wind shakes the capsule like a rattle, and seeds are sifted out and dispersed.

FIG. 4.
Dryas integrifolia.

One of the later-flowering beach-ridge plants is *Dryas integrifolia,* the mountain avens (Fig. 4). It is a species characteristic of its environment. A dwarf woody shrub, it grows directly on the soil surface, producing short horizontal rooting branches on which thick lance-shaped leaves are staggered. Their upper surface is a deep, shiny green, while the underside is covered with woolly white hairs. The flower is saucer-shaped with many pale yellow lanceolate petals 10-15 mm in length. Belonging to the rose family, the flower has many stamens where pollen is produced. When the seeds are fully developed, a feathery plumule attached to them is caught by the wind and blown to a new location. Like the arctic poppy, the mountain avens is heliotropic, and so on sunny days it keeps turned towards the sun, with the result that insect pollinators are attracted by its warmth and seeds develop apace.

By early July, the snows of the downslope meadows have begun to melt and large patches of vegetation become exposed to the sun. The melted snow flows

FIG. 5.
Pedicularis sudetica.

in sheets across the meadows, finally draining into swiftly-flowing meltwater streams. In contrast to the beach ridges, the meadows are totally covered with vegetation. Grasses and grass-like sedges grow in deep moist layers of moss. The meadow is not totally flat and often consists of short hummocks, thickly carpeted with vascular plants. These drier hummocks stand in wet depressions like castles surrounded by moats. Growing among the grasses and moss are woody and herbaceous plants. *Salix arctica* (see front cover), the arctic willow, is found among the grass of the hummocks. Like the mountain avens, it is one of the few woody species found on the Devon Island lowland. Though a shrub, it has to grow close to the ground, and its smooth trailing branches wind among other plants. When conditions become favourable, its smooth-edged oval leaves, 2-5 cm long, quickly open to the sun. The male and female flowers, found on separate plants, are both produced in dense groups forming woolly grey catkins. The flowers have no conspicuous petals and are protected by thick scaly bracts with long hairs. These hairs and the dark colour of the bracts help trap the sun's warmth. The female catkins are distinguished by their bright red, fork-shaped stigmas and styles. The male catkins contain many protruding beadlike black anthers which turn bright yellow as the pollen matures and is released. The arctic willow is one of the few northern plants to shed its leaves every year. In the fall, the leaves become red and orange before they die and fall off.

Another colourful plant of the moist meadows is *Pedicularis sudetica* (Fig. 5), the lousewort or fernweed. It is called a fernweed because its leaves resemble miniature fern fronds. The plants grow in patches, poking through the grass and sedges. The tall (10-25 cm high) stems are topped by a spike of pink flowers, tipped and veined with maroon. They are asymmetrical, their petals being fused into the form of a long tube. The lower portion of this is cleft into three lobes, while the upper portion forms an inflated helmet-like structure. Within this helmet are found the male anthers and female stigma. These flowers provide food for grazing muskoxen, while Eskimos eat the pale yellow tap root or suck the sweet nectar from the base of the corolla tube.

FIG. 6.
Oxyria digyna.

FIG. 7.
Ranunculus sulphureus.

The last areas to become snow-free are the beach foreslopes where wind-blown snow becomes deeply packed during early spring storms. As the snow melts, the plants are exposed to the sun, and the receding snowbank assures them of a constant supply of water during the growing season. An important herbaceous plant of this habitat is the mountain sorrel or Eskimo rhubarb, *Oxyria digyna* (Fig. 6). This low-growing herb has thick fleshy leaves on long petioles protruding from a compressed central stalk. Its deep reddish leaves are shaped like small kidneys. The entire flowering stalk and the numerous spherical flowers are all a deep red. The acidic leaves, which are a rich source of vitamin C, may be eaten either raw or cooked as greens. Because they grow in such local abundance, they were formerly used as a dietary supplement by the Eskimos who either ate them fresh or else preserved them for the winter in seal oil.

At the bottom of the slope, where the foreslope community shades into the plant assemblages of the meadow, is found *Ranunculus sulphureus* (Fig. 7), the arctic buttercup, which resembles the buttercup of temperate regions, but is less delicate and much squatter. It is found in extensive patches where the ground is always moist. Its succulent leaves are a deep green, and are divided into lobes. The thick stalk supports a single shiny yellow flower of five petals in the form of a shallow disc, 2-4 cm in diameter. This receptacle, which bears the organs of the flower, is covered with coarse brown hairs. Numerous stamens surround the mounded central axis which is covered with simple female pistils.

The flowering plants just described are but a few of the many different types to be found on the Devon Island lowland. Some, restricted by ecological requirements, are found only in certain areas; others, such as the arctic willow and pink saxifrage, may be found throughout the lowland. All, however, are adapted to grow and survive under the unique conditions of the Arctic.

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