2. **Puccinia heketara** n. sp. (Fig. 129.) Compositae.

0. Spermogones unknown.

I. Aecidia hypophyllous and caulicolous; on leaves aggregated into irregular closely-packed groups on distorted spots, visible on the upper surface as discoloured areas; on stems scattered over irregular inflated areas which may attain a length of 25 mm., bright orange. Peridia embedded or slightly erumpent, cupulate, 0·5 mm. diam., margin lacerate, slightly reflexed, standing above the leaf-surface about 0·25 mm. Spores elliptical or obovate, 25–35 × 18–22 mmm.; epispore moderately and finely verrucose, 2 mmm. thick, hyaline; cell-contents orange, vacuolate.

III. Teleutosori hypophyllous, seated on minute spots which may or may not be visible on the upper surface, chocolate-brown, circular or irregular in outline, up to 1 mm. diam., frequently less, erumpent, pulverulent. Teleutospores elliptical, 45–55 × 20–26 mmm.; apex rounded

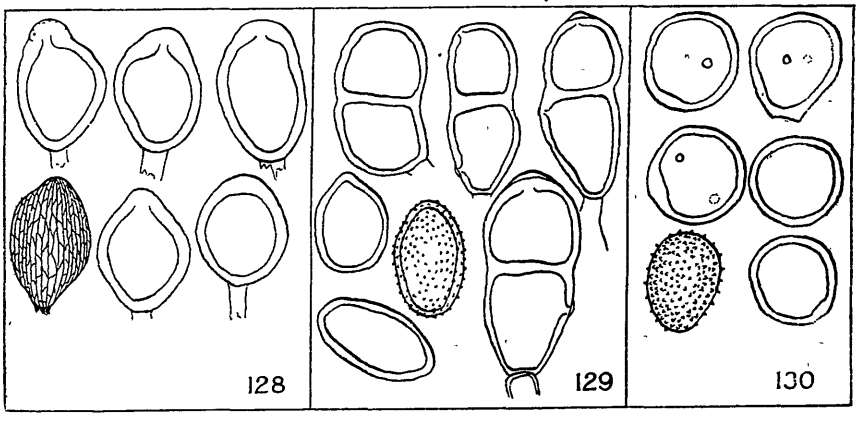

FIG. 128.—*Uromyces Edwardsiae* n. sp.
FIG. 129.—*Puccinia heketara* n. sp.
FIG. 130.—*Uredo Forsterae* n. sp.

or bluntly acuminate, not or slightly (3 mmm.) thickened, base attenuate, lower cell slightly longer and narrower than the upper; constricted at the septum; epispore smooth, 1·5–2 mmm. thick, pallid chestnut-brown, cell-contents vacuolate; pedicel deciduous, hyaline, stout, up to 25 × 8 mmm.; germ-pore of the upper cell apical, basal pore between one-third and two-thirds below septum, both conspicuous and papillate.

X. Mesospores rare, obovate, 28–40 × 16–23 mmm.

Host: *Olearia Cunninghamii* Hook. f. On leaves, petioles, and stems. Herb. No. 1244. I–III. York Bay (Wellington), 100 m., *E. H. Atkinson!* (Type.)

The host is endemic, and abundant throughout the North Island and lowland forests of Marlborough and Nelson (Cheeseman, 1906, p. 286).

This rust closely resembles *Puccinia Atkinsonii* G. H. Cunn. (on *Olearia excorticata* Buch.), but differs in many minor characters, especially in the non-retuse apex, thinner epispore, and smaller size of the teleutospores.

3. **Uredo Forsterae** n. sp. (Fig. 130.) Candolleaceae.

II. Uredosori hypophyllous, on irregular yellow spots, scattered, elliptical, 1–2 mm. long, dark chestnut-brown, bullate, pulverulent, surrounded by the ruptured epidermis. Uredospores globose to obovate, 24–31 × 18–25 mmm.; epispore finely bluntly and moderately echinulate, chestnut-brown, 1·5–2 mmm. thick, with 2–3 obscure equatorial germ-pores.

Host: *Forstera Bidwillii* Hook. f. On leaves. Herb. No. 1272. II. Mount Egmont (Taranaki), 1,000 m., *E. H. Atkinson!* 2 Feb., 1923.

The host is endemic, and distributed through the mountain-ranges of both Islands (Cheeseman, 1906, p. 393).

These three species bring the total of species collected in New Zealand to 124, this number being distributed in the following genera: *Uromyces*, 14; *Uromycladium*, 4; *Puccinia*, 68; *Gymnoconia*, 1; *Phragmidium*, 5; *Hamaspora*, 1; *Coleosporium*, 1; *Melampsora*, 2; *Melampsoridium*, 1; *Pucciniastrum*, 1; *Milesina*, 1; *Aecidium*, 11; *Uredo*, 14.

ADDITIONAL HOSTS.

These hosts have come to hand since the publication of the two previous papers.

Gramineae.

Puccinia graminis Pers. (*Trans. N.Z. Inst.*, vol. 54, p. 644, 1923).

Agropyron scabrum (Lab.) Beauv. On culms. Herb. No. 1273. III. Queenstown (Otago), 500 m., *W. D. Reid!* 5 June, 1923.

Poa aquatica L. On leaves. Herb. No. 740. II, III. Araraki (Hawke's Bay), 35 m., *G. H. C.* 22 Feb., 1922.

The former host is indigenous and widespread, and occurs also in Australia (Cheeseman, 1906, p. 923). The latter host is an introduced species.

Cyperaceae.

Puccinia Caricis Schroet. (*l.c.*, p. 649).

Carex appressa R. Br. On leaves. Herb. No. 367. III. Bluff (Southland), sea-level, *W. D. Reid!* 26 May, 1922.

The host is endemic, and confined to the South, Stewart, and several of the outlying islands (Cheeseman, 1906, p. 814).

Puccinia Unciniarum Diet. et. Neg. (*l.c.*, p. 650).

Uncinia australis Pers. On leaves. Herb. No. 597. II, III. Pencarrow (Wellington), sea-coast, *E. H. Atkinson!* 21 Jan., 1923.

The host is indigenous, and not uncommon throughout the lowland areas; it is said to occur in the Sandwich Islands (Cheeseman, 1906, p. 802).

Polygonaceae.

Puccinia tiritea G. H. Cunn. (*l.c.*, p. 654).

Muehlenbeckia axillaris (Hook. f.) Walp. On leaves. Herb. No. 1274. II, III. Ettrick (Otago), 300 m., *G. H. C.* 24 March, 1923.

The host is indigenous and widespread; it occurs also in Tasmania and Australia (Cheeseman, 1906, p. 593).

ONAGRACEAE.

Puccinia pulverulenta Grev. (*l.c.*, p. 665).

Epilobium junceum Sol. On leaves. Herb. No. 593. II, III. Shore of Lake Taupo (Auckland), 400 m., *E. H. Atkinson!* 9 March, 1922.

Epilobium pictum Petrie. On leaves. Herb. No. 508. II, III. Cass (Canterbury), 800 m., *W. D. Reid! N. R. Foy!* 19 Jan., 1922.

Epilobium pubens A. Rich. Herb. No. 1275. II, III. Wakatipu (Otago), 400 m., *W. D. Reid!* 5 June, 1923.

E. junceum is indigenous and abundant throughout both Islands, and occurs also in Australia; *E. pictum* is endemic and confined to the mountain regions of the South Island; *E. pubens* is indigenous and abundant throughout, and occurs also in Australia (Cheeseman, 1906, pp. 174–76).

COMPOSITAE.

Puccinia fodiens G. H. Cunn. (*l.c.*, p. 682).

Celmisia spectabilis Hook. f. Herb. No. 750. II. Mount Waiopehu (Wellington), 1,700 m., *G. H. C.* 26 Oct., 1919. Sugarloaf, Cass (Canterbury), 1,000 m., *W. D. Reid! N. R. Foy!* 20 Jan., 1922. Waiouru–Tokaanu Road, Taupo, 1,000 m., *E. H. Atkinson!* 13 March, 1922.

Puccinia novae-zelandiae G. H. Cunn. (*l.c.*, p. 686).

Olearia arborescens (Forst. f.) Cockayne and Laing (= *Olearia nitida* Hook. f.). On leaves. Herb. No. 790. I. Mount Egmont (Taranaki), 1,000 m., *E. H. Atkinson!* 4 Feb., 1923.

Olearia avicenniaefolia (Raoul) Hook. f. Herb. No. 600. I, III. Franz Josef Glacier (Westland), 250 m., *W. D. Reid!* 28 June, 1922.

Both hosts are endemic, *O. avicenniaefolia* being confined to the South and Stewart Islands, *O. arborescens* being abundant throughout (Cheeseman, 1906, pp. 285, 291).

CORRECTION.

Miss E. M. Wakefield in a recent letter has pointed out that *Puccinia Hoheriae*, described as new on page 661, *Trans. N.Z. Inst.*, vol. 54, has already been published by her in the *Kew Bulletin*, the species being named from material forwarded to Kew in 1917 by A. H. Cockayne. This species should therefore be cited—

P. Hoheriae Wakef., *Kew. Bull. Misc. Inf.*, p. 312, 1917.
Syn. *P. Hoheriae* G. H. Cunn., *Trans. N.Z. Inst.*, vol. 54, p. 661, 1923.

I am indebted to Miss Wakefield for drawing my attention to this matter.

LATIN DIAGNOSES.

Uromyces Edwardsiae sp. nov. (Fig. 128.)

0. Incognitis.

III. Soris teleutosporiferis in sufflatis, rugosis siliquae sedere; ad 40 × 18 mm., brunneo-nigris, pulverulentibus, nudis. Teleutosporis late ellipticis v. obovatis, 30–40 × 22–26 mmm.; apice rotundato v. acuminato, leniter 3–4 mmm. incrassato, basi attenuato v. rotundato; episporio reticulato, 2–3 mmm. crasso, castaneo; pedicello deciduo, hyalino, ad 15 × 6 mmm.; foramine germinis apicale, conspicuo, saepe papillato.

Hab.: In siliquae *Edwardsiae tetrapterae* (J. Miller) Oliver. Tahakopa, Southland, New Zealand, 70 m. *C. M. Smith.*

Puccinia heketara sp. nov. (Fig. 128.)

0. Incognitis.

I. Aecidiis hypophyllis et caulicolisque, in magnis catervis in maculis detorsis quae desuper cerni possunt solide confertis, ad 25 mm. longis, irregularibus, luteis. Peridiis immersis v. leviter erumpentibus, cupulatis, ad 0·5 mm. diam., marginibus laciniatis, leniter incurvatis. Aecidiosporis ellipticis v. obovatis, 25–35 × 18–22 mmm.; episporio minute verrucoso, 2 mmm. crasso, hyalino.

III. Soris teleutosporiferis hypophyllis, in maculis minutis nigro-brunneis, brunneo-atris, rotundis v. irregularibus, ad 1 mm. diam., erumpentibus, pulverulentis. Teleutosporis ellipticis, ad 45–55 × 20–26 mmm.; apice rotundato v. acuminato, non v. leniter (3 mmm.) crassato, basi attenuato, ad septum constricto; episporio leve, 1·5–2 mmm. crasso, castaneo, contentu vacuolato; pedicello deciduo, hyalino, ad 25×8 mmm.; foramine germinis cellulare superioris apicale, foramine basili ad $\frac{1}{3}$–$\frac{2}{3}$ infra septum, conspicuo papillato.

X. Mesosporis raris, obovatis, ad 29–40 × 16–23 mmm.

Hab.: In foliis vivis *Oleariae Cunninghamii* Hook. f. I–III. York Bay. Wellington, New Zealand, 100 m. *E. H. Atkinson.*

Uredo Forsterae forma sp. nov. (Fig. 130.)

II. Uredosoris hypophyllis, in irregularibus maculis flavis, raris, ellipticis, ad 1–2 mm. longis, castaneis, bullatis, pulverulentis, epidermide rupta cinctis. Uredosporis globosis v. obovatis, ad 24–31 × 18–25 mmm.; episporio subtiliter echinulato, castaneo, 1·5–2 mmm. crasso, cum 2–3 foraminibis germinis in circulo aequinoctialis, indistinctis.

Hab.: In foliis vivis *Forsterae Bidwillii* Hook. f. II. Mount Egmont, Taranaki, New Zealand, 1,000 m. *E. H. Atkinson.*

LIST OF SPECIES AND HOSTS DISCUSSED HEREIN.

Species.

Puccinia Caricis *Schroet.*
Puccinia fodiens *G. H. Cunn.*
Puccinia graminis *Pers.*
Puccinia heketara *G. H. Cunn.*
Puccinia Hoheriae *Wakef.*
Puccinia Hoheriae G. H. Cunn.
Puccinia novae-zelandiae *G. H. Cunn.*
Puccinia pulverulenta *Grev.*
Puccinia tiritea *G. H. Cunn.*
Puccinia Uncinarum *Diet. et Neg.*
Uredo Forsterae *G. H. Cunn.*
Uromyces Edwardsiae *G. H. Cunn.*

Hosts.

Agropyron scabrum (*Lab.*) *Beauv.*
Carex appressa *R. Br.*
Celmisia spectabilis *Hook. f.*
Edwardsia tetraptera (*J. Miller*) *Oliver.*
Epilobium junceum *Sol.*
Epilobium pictum *Petrie.*
Epilobium pubens *A. Rich.*
Forstera Bidwillii *Hook. f.*
Muehlenbeckia axillaris (*Hook. f.*) *Walp.*
Olearia arborescens (*Forst. f.*) *Cockayne and Laing.*
Olearia avicenniaefolia (*Raoul*) *Hook. f.*
Olearia Cunninghamii *Hook. f.*
Olearia nitida Hook. f.
Poa aquatica *L.*
Sophora tetraptera J. Miller.
Uncinia australis *Pers.*

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The Ustilagineae, or "Smuts," of New Zealand.

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[*Read before the Wellington Philosophical Society, 24th October, 1923; received by Editor, 31st December, 1923; issued separately, 30th July, 1924.*]

Plates 44–47.

THIS group of fungi is characterized by the production of masses of dark-coloured spores in or on the leaves, stems, or inflorescences of Phanerogams. On account of the dark colour and usually powdery nature of the spore-masses, members of this suborder are popularly termed "smuts." Many are of considerable economic importance, for, where preventive methods are not practised, certain species cause a heavy annual loss to those engaged in the culture of cereals and grasses. On this account they have for the past half-century been the subject of considerable investigation by mycologists, with the result that in most cases their structure and life-history are well known.

The spore-mass, or sorus, consists of numerous spores which at maturity may be free and one-celled, or may be aggregated into spore-balls; in certain genera many of the spore-balls are surrounded completely or in part by sterile cells. Various names have been applied to the spores by different workers (*e.g.*, "chlamydospores," "teleutospores," "brand-spores," "pseudospores," "resting-spores"), but in this paper they will be termed simply "spores." The spore, on germination, usually produces a structure bearing lateral or terminal conidia. This body has been variously named (*e.g.*, "promycelium," "germinal tube," "hemibasidium," "probasidium," "basidium"), but in accordance with its significance in classification it should more properly be termed a "basidium." Unfortunately, its behaviour is so varied in different genera and species as to make it impracticable to apply this term (see under *Ustilago*); to avoid confusion the term "probasidium" is used in this paper, for this implies that it is the forerunner of the basidium, an opinion held by many modern taxonomists. In the majority of cases the probasidium gives rise to hyaline continuous spores (variously termed "sporidia," "sporidiola," "promycelial spores," "conidia"), to which in this paper the term "conidia" will be applied. A conidium, on germination, produces a hypha (infection hypha) which penetrates the host-tissues, where under favourable conditions it gives rise to a mycelium, from which eventually the spores develop.

All species undergo this cycle, but, as might be expected, the details vary considerably in different genera, and even in different species in the same genus. These differences, in so far as they concern New Zealand species, are dealt with under the respective species in which they occur.

Members of the Ustilagineae are usually considered to be obligate parasites. Strictly this is nor the case, for Kniep (1921) has successfully grown *Urocystis Anemones* Wint. on culture media, the full cycle being completed thereon. Many species may be grown on media, where they produce abundant mycelium, but this is the first recorded instance in which spore-formation occurred. Then, too, at one stage in the cycle every species is saprophytic, producing probasidia and conidia (when these occur in the cycle) in the soil.