札幌博物學會報

第十三卷 第三號

伊藤誠哉教授在職廿五年記念號

TRANSACTIONS

OF THE

SAPPORO NATURAL HISTORY SOCIETY

FOUNDED IN 1891

VOL. XIII, PT. 3

COMMEMORATION NUMBER
DEDICATED TO PROF. SEIYA ITO

PUBLISHED BY THE
SAPPORO NATURAL HISTORY SOCIETY
HOKKAIDO IMPERIAL UNIVERSITY, SAPPORO, JAPAN

JUNE, 1934

NOTICES

All communications should be addressed to the Corresponding Secretary of the Sapporo Natural History Society in the Faculty of Agriculture, Hokkaido Imperial University, Sapporo, Japan.

Subscription price. Four Yen per year; Foreign, $ 2.00; current single numbers 2.50 Yen or $ 1.25. The Transactions are issued twice a year.

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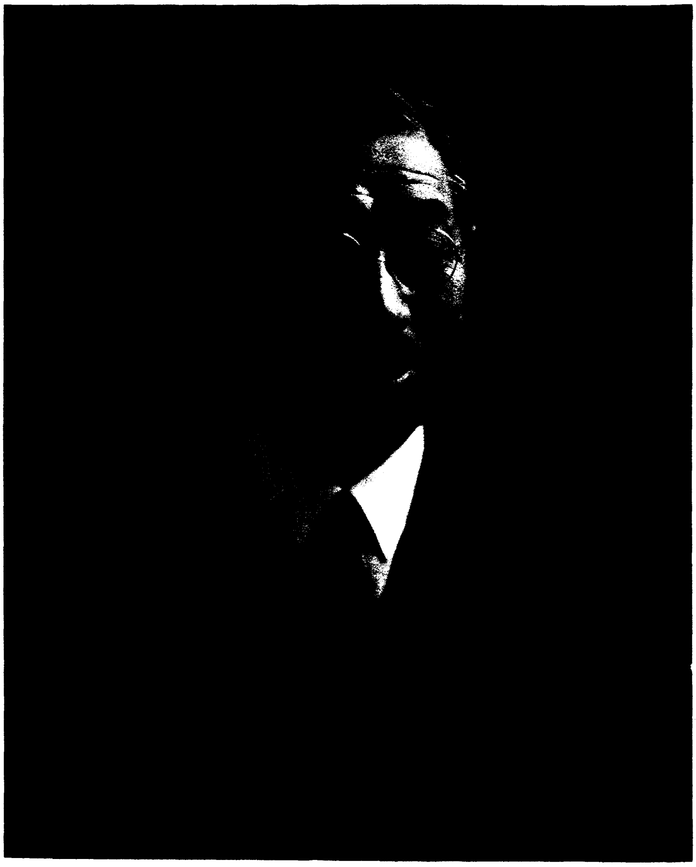
Seiya Ito



Seiya Ito

PRESENTED

TO

PROF. DR. SEIYA ITO

ON THE OCCASION OF

THE TWENTY-FIFTH ANNIVERSARY

OF

HIS ACADEMIC SERVICE

BY

HIS COLLEAGUES AND PUPILS

OCTOBER, 1933

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Foreword

This Commemoration number is dedicated to Dr. Seiya Ito, Professor of Phytopathology and Director of the Botanic Garden of the Faculty of Agriculture, Hokkaido Imperial University, by his colleagues and pupils to celebrate the twenty-fifth year of his brilliant academic career.

He graduated in 1908 from the College of Agriculture of our University with honours receiving a silver watch bestowed by the Emperor.

Soon after his graduation he was made a lecturer on botany in his alma mater, and then an assistant, and in 1909 an assistant professor and in 1918 a full professor.

In 1917 he took charge of the chair of Plant Physiology, which position he retained until 1920, when a new second chair of Phytopathology dealing with the Physiological Diseases of Plants and Mycology was offered to him, which position he holds up to the present time.

The first chair of Phytopathology concerned with the Parasitic Diseases of Plants was held by the writer until his retirement in 1927. The chair was succeeded later by Prof. Yoshihiko Tochinai.

In 1921 Prof. Ito went abroad for two years to study the type specimens of Japanese Fungi in the museums and universities in America and Europe and to attend the Phytopathological Conferences held in America and Holland.

Under his management, the Phytopathological Laboratory of our University has made a striking development, and a large number of promising young pathologists have been reared.

His connection ever since 1914 with the Agricultural Experiment Station belonging to the Hokkaido Government has given him a rare opportunity to come in actual contact with the vital problems concerned with the diseases of the principal crops and to device the most effective means for their control.

Prof. Ito's principal contributions to Mycology were on the Uredineae of Japan. His first paper was on the Uredineae parasitic on the Japanese Gramineae which was published in 1909 in which he described 21 species as new to science. In 1911 a paper on the species of Puccinia parasitic on the Japanese Ranunculaceae appeared, and in 1922 a valuable paper on the Uromyces of Japan was published.

There are a dozen more papers of interest on the taxonomy of Japanese Fungi. But his most valuable contribution to Mycology and Phytopathology is the work done with Mr. K. Kuribayashi on the ascigenous stages of six species of Helminthosporium parasitic on the important cereals, which have not been ascertained so far.

Prof. Ito's success in finding out the most effective means of control of the rice-blast disease is of great significance to the national economy, as the average annual loss to our most important staple crop due to the epidemic is calculated to be 10 to 15 million bushels.

For many years Prof. Ito has been engaged in compiling the Mycological Flora of Japan, for the completion of which it may require yet many years of assiduous labour. May he be blest of health to accomplish his long cherished desire.

KINGO MIYABE
Professor Emeritus, Hokkaido Imperial University, and
President of the Sapporo Natural History Society

March 1, 1934

ON ACONITUM ITO-SEIYANUM, SP. NOV.

BY

KINGO MIYABE AND MISAO TATEWAKI

(宮部金吾・舘脇操)

(With 1 text-figure)

Aconitum Ito-Seiyanum MIYABE ET TATEWAKI, sp. nov.

Caulis elatus, 2–3 pedalis, teres, superne flexuosus et pilis crispulis hirsutus. Folia late orbicularia, basi cordata, truncata vel cuneata, infra ad nervos pilosiuscula, inferiora longe superiora breviter petiolata; inferiora pedato-5-secta, superiora trisecta, segmentis lateralibus bipartitis; segmenta partitionesque rhombeocuneata, basin versus integerrima, centralia stipitata, superne pinnatifida laciniis lineari-lanceolatis divergentibus acutis integris vel parce et obsolete inciso-dentatis. Inflorescentia racemosa vel sub paniculata, racemis terminalibus et axillaribus. Pedunculi erecto-patentes vel erecti, pube alba tomentoso-hirsuti; bracteae foliiformes, majusculae pedunculo longiores; bracteolae suboppositae, subulatae. Flores ca. 4 cm. longi, violacei, extus pilosi; galea hemisphaerico-conica, vel conico-cylindrica, 1.6–2 cm. longa, rostro plus minusve producto; sepala media ampla, ca. 1.2 cm. longa ac lata, intus longe pilosula; sepala inferiora oblonga vel elliptica, obtusa vel acutiuscula, ca. 1.1 cm. longa, 4–5 mm. lata; nectaria cum ungui gracili, apice subtruncato vel subrotundato glabro, ca. 1.3 cm. longa, calcare arcuato, labio dilatato emarginato. Filamenta supra medium bidentata, exinde subfiliformia, pilosa. Carpella 3, matura apice divergentia, pilosa, ca. 2 mm. longa.

NOM. JAP. *Seiya-bushi.*

HAB. *Yezo*: Along the R. Nupuromappro, Toikambetsu, Prov. Teshio, growing always in the serpentine region. (M. TATEWAKI, IX. 18, 1933—type, in Herb. Fac. Agr. Hokkaido Imp. Univ.; Y. SAITO, IX. 1927).

DISTR. Endemic.

Remarks. The present species is related to *A. sachalinense* FR. SCHM. and *A. yuparense* TAKEDA. But it is distinguished from the former by the larger and pilose carpels and also by the flexuous stem, and from the latter by the shape of the leaves and nectaries and by the smaller flowers and elongated inflorescence. The plant is named in honour of Prof. Dr. SEIYA ITO.

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

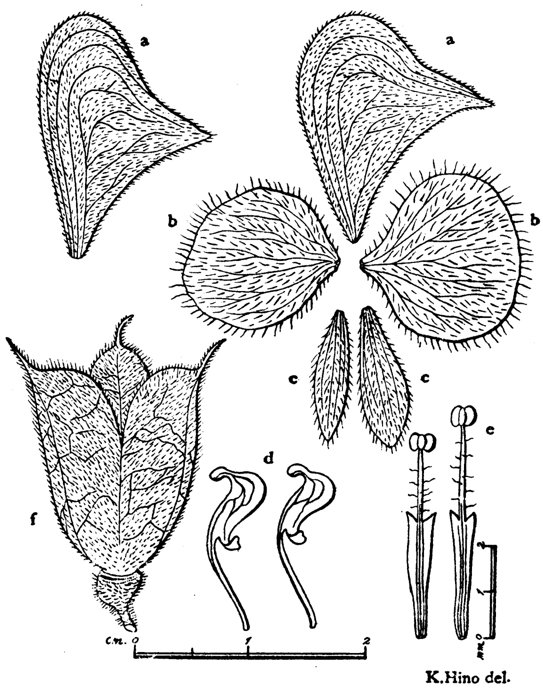

Fig. 1. *Aconitum Ito-Seiyanum* MIYABE ET TATEWAKI

a. hoods; *b.* middle sepals; *c.* inferior sepals; *d.* nectaries; *e.* stamens; and *f.* carpels.

CONTRIBUTIONS TO THE FLORA OF NORTHERN JAPAN III

BY

KINGO MIYABE AND MISAO TATEWAKI

(宮部金吾・舘脇 操)

26. ***Aconitum sachalinense*** FR. SCHM. Fl. Sachal. (1868), 107; NAKAI, in Bot. Mag. (Tokyo), XXII. (1908), 134, et *ibid.* XXXI. (1917), 227; KOIDZUMI, Pl. Sachal. (1910), 62; MIYABE & MIYAKE, Fl. Saghal. (1915), 22, *pl. I. f. 1–7;* KUDO, Rep. Veg. Nor. Saghal. (1924), 130; MAKINO & NEMOTO, Fl. Jap. ed. 2, (1931), 314.

var. ***compactum*** MIYABE ET TATEWAKI, var. nov.

Aconitum rishiriense TATEWAKI, mss.

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

Aconitum sachaliense KAWAKAMI, in Bot. Mag. (Tokyy), XIV. (1900), 109.

A type differt, minoribus ca. 30 cm. altis, inflorescentibus compactis glomeratis, lobis foliorum latioribus crassioribusque, foliis subtus nervis prominente reticulatis.

NOM. JAP. *Rishiri-bushi.*

HAB. *Yezo*: Mt. Rishiri, Isl. Rishiri (T. KAWAKAMI, VIII. 1899—type, in Herb. Fac. Agr. Hokkaido Imp. Univ.); Momoiwa, Isl. Rebun (M. TATEWAKI, IX. 11, 1933).

DISTR. *var.* Endemic.

27. *Actaea erythrocarpa* FISCH. in FISCH. et MEY. Ind. Sem. Hort. Petrop. I. (1835), 20; KOMAR. Fl. Mansh. II. (1904), 237, et Fl. Pen. Kamtschat. II. (1929), 118; HULT. Fl. Kamtchat. II. (1928), 102; NAKAI, Veg. Mt. Daisetsu, (1930), 18; MAKINO & NEMOTO, Fl. Jap. ed. 2, (1931), 315; KOMAR. & KLOB.-ALIS. Key Pl. Far East. I. (1931), 529.

Actaea spicata L. var. *erythrocarpa* TURCZ.: LEDEB. Fl. Ross. I. (1842), 71; TRAUTV. et MEY. Fl. Ochot. (1856), 12; RGL. et TIL. Fl. Ajan. (1859), 42; MAXIM. Prim. Fl. Amur. (1859), 28; FR. SCHM. Fl. Sachal. (1868), 108; KOIDZ. Pl. Sachal. (1910), 61; MIYABE & MIYAKE, Fl. Saghal. (1915), 22; KUDO, Rep. Veg. Nor. Saghal. (1924), 128.

var. ***leucocarpa*** MIYABE ET TATEWAKI, var. nov.

? Actaea spicata L. var. *leucocarpa* LEDEB. Fl. Ross. I. (1842), 72.

A typo differt, fructibus baccatis albis.

NOM. JAP. *Shiromi-no-ruiyôshôma.*

HAB. Yezo: Kamioboro, Prov. Kushiro (M. TATEWAKI, VIII. 25, 1933).

28. *Ranunculus hyperboreus* ROTTB. Skrift. Kjöb. Selsk. X. (1770), 458; TORR. & GRAY, Fl. Nor. Am. I. (1838-40), 20; LEDEB. Fl. Ross. I. (1842), 35; F. KURTZ, in ENGL. Bot. Jahrb. XIX. (1895), 451; YABE & YENDO, Pl. Isl. Shumushu, (1904), (181); KOMAR. Fl. Mansh. II. (1904), 293, et Fl. Pen. Kamtschat. II. (1929), 138; MATSUM. Ind. Pl. Jap. II.-2. (1912), 120; BRITT. & BR. Ill. Fl. ed. 2, II. (1913), 105, f. *1897*; KUDO, Fl. Isl. Paramushir, (1922), 107; HULT. Fl. Kamtchat. II. (1928), 126; MAKINO & NEMOTO, Fl. Jap. ed. 2, (1931), 335.

NOM. JAP. *Hai-hikinokasa.*

HAB. *S. Saghalien*: Lake Natarupa, Shikka (Y. HOSHINO, VII. 16, 1933).

Remarks. New to the flora of Saghalien.

29. *Thalictrum sparciflorum* TURCZ. in FISCH. et MEY. Ind. Sem. Hort. Petrop. I. (1835), 40; LEDEB. Fl. Ross. I. (1842), 5; TRAUTV. et MEY.

Fl. Ochot. (1856), 6; RGL. et TIL. Fl. Ajan. (1859), 24; MAXIM. Prim. Fl. Amur. (1859), 12; LECOY. in Bull. Soc. Bot. Belg. XXV. (1885), 156; FR. SCHM. Fl. Sachal. (1868), 101; KOMAR. Fl. Mansh. II. (1904), 305, et Fl. Pen. Kamtschat. II. (1929), 154; NAKAI, Fl. Korea. I. (1909), 16; MIYABE & MIYAKE, Fl. Saghal. (1915), 5; MORI, Enum. Pl. Corea, (1922), 163; KUDO, Rep. Veg. Nor. Saghal. (1924), 138; HULT. Fl. Kamtchat. II. (1928), 137; MAKINO & NEMOTO, Fl. Jap. ed. 2, (1931), 341; KOMAR. & KLOB.-ALIS. Key Pl. Far East. I. (1931), 554.

NOM. JAP. *Tsurifune-karamatsu*, *Karafuto-karamatsu*.

HAB. *S. Saghalien*: Aba, Shikka (H. OHTANI & Y. IMAI, VII. 31, 1930).

Remarks: New to the flora of northern Japan.

30. *Callitriche verna* L. Fl. Suec. ed. 2, II. (1755), n. 3; DC. Prodr. III. (1828), 70; FORB. et HEMSL. Fl. Ind. Sin. I. (1886–88), 293; KOMAR. Fl. Mansh. II. (1904), 696, et Fl. Pen. Kamtschat. II. (1929), 298; NAKAI, Fl. Korea. I. (1909), 234; MIYABE & MIYAKE, Fl. Saghal. (1915), 172; MORI, Enum. Pl. Corea, (1922), 235; SAMUELSSON, in Festschrift Carl Schroeter. (1925), 623, *fig. 1. e*; HULT. Fl. Kamtchat. III. (1929), 122; MAKINO & NEMOTO, Fl. Jap. ed. 2, (1931), 662.

NOM. JAP. *Chôsen-awagoke*, *Migiwa-hakobe*.

HAB. Kuriles: Ainuwan, Isl. Matsuwa (M. TATEWAKI, IX. 6, 1928).

Remarks: New to the flora of the Kuriles.

31. *Ludwigia parviflora* ROXB. Hort. Beng. (1814), 11; DC. Prodr. III. (1828), 59; FORB. et HEMSL. Ind. Fl. Sin. I. (1886–88), 309; MATSUM. & HAYATA, Enum. Pl. Formos. (1906), 154; MATSUM. Ind. Pl. Jap. II.–2. (1912), 413; MAKINO & NEMOTO, Fl. Jap. ed. 2, (1931), 813.

NOM. JAP. *Chôjitade*, *Tagobô*.

HAB. *Yezo*: Iwamizawa, Prov. Ishikari; by the puddy rice-field, introduced from Honshu (H. OHTANI, IX. 17, 1933).

Remarks: New to the flora of Hokkaido & Saghalien.

32. *Oxycoccus microcarpus* TURCZ. in sched. 1833, ex RUPR. in Beitr. Pfl. Russ. Reich. IV. (1845), 56, et Hist. Strip. Fl. Petrop. Diatribae, (1848), 59; FR. SCHM. Fl. Sachal. (1868), 157; HERD. Pl. Radd. Monopet. IV.–1. 40; KOMAR. Fl. Mansh. III. (1907), 218, et Fl. Pen. Kamtschat. III. (1930), 18; NAKAI, Fl. Korea. II. (1911), 73, et Tr. & Shr. Jap. I. ed. 3, (1927), 233, *fig. 110, C*; KUDO, Rep. Veg. Nor. Saghal. (1924), 200; HULT. Fl. Kamtchat. IV. (1930), 44; MAKINO & NEMOTO, Fl. Jap. ed. 2, (1931), 871; OHWI, Fl. Isl. Shikotan, (1932), 119; TATEWAKI, Phytogeogr. Middle Kurile, (1933), 207, 233, 255.

Oxycoccus palustris PERS. β *pusillus* DUNAL, in DC. Prodr. VII. (1838), 577, nom. nud.

Vaccinium microcarpum SCHMALH. (1871), ex BUSCH, Fl. Sib. Or. Ext. III. (1919), 102; MIYABE & MIYAKE, Fl. Saghal. (1915), 299.

Oxycoccus pusillus NAKAI, in Bot. Mag. (Tokyo), XXXI. (1917), 246, et Fl. Sylv. Korea. VIII. (1920), 52, *tab. XXI.*

NOM. JAP. *Hime-tsurukokemomo, Chôsen-kokemomo.*

HAB. *Yezo*: Attoko, Prov. Nemuro (S. ITO, VIII. 19, 1929); Kamioboro, Prov. Kushiro (M. TATEWAKI, VIII. 25, 1933); Numanohara, Prov. Ishikari (M. OKAMOTO, VIII. 1933).

Remarks. New to the flora of Yezo.

33. *Lappula deflexa* GARCKE, Fl. Nord. u. Mitt. Deutch. ed. 6, (1863), 275; GÜRKE, in ENGL. u. PR. Nat. Pfl.-fam. IV.-3.-a. (1897), 107; KOMAR. Fl. Mansh. III. (1907), 318, et Fl. Pen. Kamtschat. III. (1930), 44; NAKAI, Fl. Korea. II. (1911), 103; MORI, Enum. Pl. Corea, (1922), 297; HEGI, III. Fl. Mittel-Europ. V.-3. 2140, *f. 3100, a-c-d*; HULT. Fl. Kamtchat. IV. (1930), 75.

Myosotis deflexa WAHLB. in Vet. Acad. Handl. Stockh. XXXI. (1810), 113.

Echinospermum deflexum LEHM. Asperifl. (1818), 120; DC. Prodr. X. (1846), 135; LEDEB. Fl. Ross. III. (1846-51), 154; MAXIM. Prim. Fl. Amur. (1859), 204, et in Mél. Biol. VIII. (1872), 552; REGEL et MAACK, Fl. Ussuri. (1862), 117.

NOM. JAP. *Oka-murasaki, Karafuto-iwamurasaki.*

HAB. *S. Saghalien*: Miho (S. SUGAWARA, VII. 15, 1931).

Yezo: Mt. Kamui near Jôzankei, Prov. Ishikari (Y. IMAI, VII. 26, 1931).

Remarks: New to the flora of northern Japan.

34. *Pedicularis capitata* ADAMS, in Mem. Soc. Nat. Mosc. V. (1817), 100; LEDEB. Fl. Ross. III. (1846-51), 301; MAXIM. in Mél. Biol. (1877), 127, et *ibid.* XII. (1888), 912, *t. VI. fig. 163*; A. GRAY, Syn. Fl. Nor. Am. II.-1. (1878), 309; MACOUN, Cat. Canad. Pl. II. (1884), 371; KURTZ, in ENGL. Bot. Jahrb. XIX. (1895), 401; BRITT. & BR. Ill. Fl. III. (1898), 187; OSTENFELD, Vas. Pl. Arc. Nor. Am. (1910), 24, 65; KOIDZUMI, in Bot. Mag. (Tokyo), XXV. (1911), 218; HULT. Fl. Kamtchat. IV. (1930), 108; KOMAR. Fl. Pen. Kamtschat. III. (1930), 86.

NOM. JAP. *Paramushiro-shiogama.*

HAB. *Kuriles*: Mitoyama, Kakumabetsu, Isl. Paramushir (M. NAGAI, VII. 26, 1932).

Remarks. New to the flora of Japan.

35. *Veronica Schmidtiana* RGL. Ind. Sem. Hort. Petrop. (1864), 22; FR. SCHM. Fl. Sachal. (1868), 162; MAXIM. in Mél. Biol. XII. (1888), 501; MATSUM. Ind. Pl. Jap. II.-2. (1912), 573; FURUMI, in Bot. Mag. (Tokyo), XXX. (1916), 124; MIYABE & MIYAKE, Fl. Saghal. (1915), 348; KUDO, Rep. Veg. Nor. Saghal. (1924), 212; MAKINO & NEMOTO, Fl. Jap. ed 2, (1931), 1078.

var. ***leariloba*** MIYABE ET TATEWAKI, var. nov.

Veronica kitamiana TATEWAKI, mss.

Planta pubescens, foliis pinnatisectis, lobis foliorum anguste linearibus.

NOM. JAP. *Hosoba-no-kikubakuwagata.*

HAB. *Yezo*: Mt. Raushi, Prov. Nemuro (C. HARA, VII. 28, 1928).

Distr. *var.* Endemic.

36. *Sasa (Sect. Crassinopodi) Arikai* MIYABE ET TATEWAKI, sp. nov.

Rhizoma repens ramosum sympodiale pleuranthum. Culmus erectus vel ascendens 40–60 cm. altus 2–3 mm. latus simplex vel semel ramosus viridis. Nodi incrassati subglobulares glabri. Inter nodia dense retroso-ciliata sedum glabrentia sub nodos farinosa. Vagina foliorum primo intra venas longitudine dense retroso-ciliolata demum partim glabrescens. Setae orales paucae patentes facie setulosae. Folia in apice culmi 4–6 lanceolata vel oblongo-lanceolata inferiora ovato-lanceolata minora ca. 18–22 cm. longa ca. 3–5 cm. lata, basi acuta subcuneata vel rotundata in petiolem 2–4 mm. longum alato-mucronata, apice longe attenuato-acuminata, margine aciculato-ciliata, subtus glaucina glabra scaberula, supra glabra. Flores nostris ignoti.

NOM. JAP. *Yukawa-zasa.*

HAB. *Yezo*: Along the R. Yukawa near Kawayu, Prov. Kushiro (M. TATEWAKI, n. 20088, VIII. 14, 1933—type, in Herb. Fac. Agr. Hokkaido Imp. Univ.).

Distr. Endemic.

Remarks. The present species is related to *Sasa nikkoensis* MAKINO, but it differs from the latter by the glabrous and narrower leaves and having fewer oral setae. The specimen of this plant was sent to Prof. T. NAKAI, asking for his opinion on the validity of the species. He approved our opinion and most kindly made a few additions to the specific description, for which we wish to express our hearty thanks. The plant is named after Dr. ARIKA KIMURA, who has made the most valuable contributions to our knowledge of the species of *Salix* of Northern Japan.

37. *Sasa rivularis* NAKAI, in MIYABE & KUDO, Fl. Hok. & Saghal. II. (1931), 191.

var. ***hispidula*** TATEWAKI, var. nov.

Nodus hirsuto-hispidulus.

NOM. JAP. *Fushige-sôunzasa.*

HAB. *Yezo*: Kamiotoineppu, Prov. Teshio (A. UCHIDA, VIII. 1933).

Remarks. var. Endemic.

38. *Symplocarpus nipponicus* MAKINO, in Journ. Jap. Bot. V.-6. (1928), 24; MAKINO & NEMOTO, Fl. Jap. ed. 2, (1931), 1507.

Spathyema nipponica MAKINO, in Journ. Jap. Bot. VI.-12. (1929), 33.

NOM. JAP. *Hime-zazensô.*

HAB. *Yezo*: Sapporo, Prov. Ishikari (C. SUDÔ, VII. 25, 1933).

Remarks. New to the flora of Hokkaido & Saghalien.

39. *Hosta atropurpurea* NAKAI, in Bot. Mag. (Tokyo), XLIV. (1930), 26, 58, et Veg. Daisetsu Mts. (1930), 60, 74; MAKINO & NEMOTO, Fl. Jap. ed. 2, (1931), 1549; MIYABE & KUDO, Fl. Hok. & Saghal. III. (1932), 315; TATEWAKI, in Bull. Res. Exp. For. Fac. Agr. Hokkaido Imp. Univ. VII. (1932), 205.

form. ***albiflora*** TATEWAKI, form. nov.

Flores albi.

NOM. JAP. *Shirobana-yachi-gibôshu.*

HAB. *Yezo*: Mt. Soranuma, Prov. Ishikari (S. ASAJI, IX. 6, 1931).

DISTR. *form.* Endemic.

40. *Hosta rectifolia* NAKAI, in Bot. Mag. (Tokyo), XLIV. (1930), 26, 58, et Veg. Mt. Apoi, (1930), 15, 77; MAKINO & NEMOTO, Fl. Jap. ed. 2, (1931), 1550; MIYABE & KUDO, Fl. Hok. & Saghal. III. (1932), 315.

form. ***albiflora*** TATEWAKI, form. nov.

Flores albi.

NOM. JAP. *Shirobana-tachi-gibôshu.*

HAB. *Yezo*: Abashiri, Prov. Kitami (H. IWAMOTO, VIII. 8, 1931).

Remarks. The present form occurs sparsely throughout Yezo.

DISTR. *form.* Endemic (?).

NOTE ON A NEW FORM OF LAMINARIA JAPONICA ARESCH.

BY

KINGO MIYABE AND MASAJI NAGAI

(宮 部 金 吾 • 永 井 政 次)

(With two text-figures)

When the junior author made a trip in the summer of 1933 for the collection of marine algae along the coasts of the northeastern district of Honshu, he had an opportunity to visit the museum at Sendai which has been newly erected under the management of the Saito Hô-on-kai (Saito Gratitude Foundation). There had already been placed in the museum at that time a great number of natural specimens including land and marine plants. By the courtesy of Mr. M. TAKAMATSU, a member of the museum staff, the junior author was able to examine the specimens of marine algae collected mostly in this district. Amongst them, he saw two sheets of specimens of Laminaria which have large, membranaceous fronds but lack their holdfasts and the lower portions of the stipe. Inasmuch as a species of Laminaria having such a membranaceous frond was not familiar to the junior author in this district, he had an interest in studying the present alga more closely.

This alga was said to grow in the Bay of Onagawa which invades deeply into the land at the basal portion of the northern side of the Ojika peninsula, not far from Sendai. Upon a visit

Fig. 1. *Laminaria japonica* ARESCH., f. *membranacea* MIYABE et NAGAI, f. nov. Entire view of the plant. ×ca $\frac{1}{8}$

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

to Onagawa in the latter part of August a large number of specimens of this kelp were obtained growing in abundance in the muddy sea bottom covered with small gravel and shells. They were then found abundantly encrusted with Bryozoa and Hydrozoa epiphytic on the frond.

When examining the materials collected in this tour afterwards in the laboratory, the authors became aware that the specimens of Laminaria from the Bay of Miyako in the Prefecture of Iwate, where it is known by the local name, "Doteme", were nothing but another kelp belonging to one and the same species. After careful examinations, the authors came to the conclusion that these specimens from the two localities should be treated as a new form of *Laminaria japonica* ARESCH. which is one of the largest among the Japanese species of *Laminaria*. *Laminaria japonica* ARESCH. is the kelp that grows abundantly on the southern coast of Hokkaido from the Strait of Tsugaru to the Pacific coast as far as Mororan and is harvested in these localities for sale as a first rate kelp for food on the market under the name of "Makombu". This kelp is biennial and characteristic in having a broad-(mostly in two year old fronds) to linear-lanceolate (in one year old one), thick frond with rounded base (in the case of the juvenile narrowly cuneate, and in the one grown in the open sea often broadly cuneate), flattened stipe, and branched hapteres which are arranged in vertical rows.

In the alga in question, the hapteres are thin, and finely branched, and arranged in two vertical rows oppositely on the very base of the stipe. The stipe is thin, and much flattened, and measures 4.5-7 cm. in length, 3-5 mm. in width and 0.6-1 mm. in thickness. The mucilage lacunae in the stipe of the typical form are, in cross section, rather large, ovate or obovate in vigorously grown individuals but in younger ones more or less narrower, and closely arranged in a row just beneath the peripheral tissue. The lacunae of the present specimens, however, are not so large and rounded, but rather narrow to slightly wide and closely arranged in a row in the cortical layer as in the latter case of the typical form. The frond of this form resembles closely that of the typical one, especially of its one year old form, in general shape. However the alga in question is remarkably different from the typical form in the thin and membranaceous texture of its frond. The thickness of the frond in the typical form measures 0.35-1mm., mostly 0.4-0.9 mm. near the base and 0.05-0.15 mm. on the margin of the upper part, while in the present speciemens merely 0.2-0.3 mm. near the base and 0.05-0.1 mm. on the margins. The lacunae in the frond are observed, in a cross section, to be more or less small and rounded and arranged in a row in the subcortical layer as in the case of the one year old frond of the typical form. The sori are not found on the present specimens.

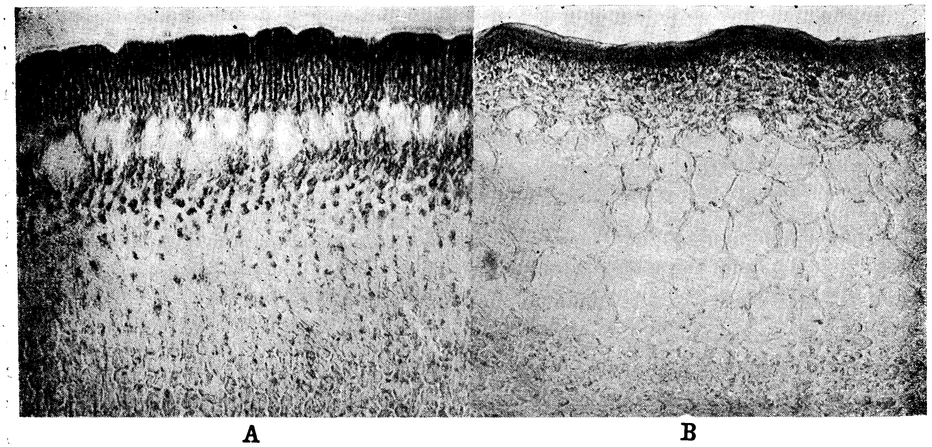

Fig. 2. *Laminaria japonica* ARESCH., f. *membranacea* MIYABE ET NAGAI, f. nov. ×90

A. Cross section of the stipe.

B. Cross section of the frond at the median portion near the base.

The diagnosis of the present form is given as follows.

Laminaria japonica ARESCH., f. ***membranacea*** MIYABE ET NAGAI, f. nov.

Radice fibrosa, ramis cylindraceis vel sensim complanatis et multis dichotome ramosis, in infima parte basilari stipitis opposite in verticales ordines dispositis; stipite complanato, 4.5-7 cm. longo, 3-5 mm. lato, 0.6-1 mm. crasso, lacunis muciferis numerosis, in orbem regularem subcorticalem dense dispositis; lamina membranacea, lineari-lanceolata, ad fasciam mediam plana et ad marginem leviter undulata, basi late cuneata vel prope rotunda, 113-365 cm. longa, 15-19 cm. lata, ad fasciam mediam 0.2-0.3 mm. et ad marginem 0.05-0.1 mm. crassa, lacunis muciferis rotundatis, minutiusculis, inter medullam prope superficiem seriatim dispositis; soris ignotis.

NOM. JAP. Doteme.

HAB. Prov. Rikuzen: Onagawa (Aug. 23, 1933). Prov. Rikuchu: Kanegasaki prope Miyako (Aug. 15, 1933).

The present form may probably be found growing and distributing more widely in other bays in the northeastern district of Honshu.

SOME REMARKS ON THE TAXONOMY OF THE FUNGUS HYPOCHNUS SASAKII SHIRAI*

BY

TAKASHI MATSUMOTO

(松　本　巍)

(With 2 text-figures)

As has already been stated by ENDO[6] as well as by the present author[14], some species designated as *Rhizoctonia Solani* KÜHN in Philippines and India are quite identical with the fungi which are generally referred to as *Hypochnus Sasakii* SHIRAI. Nevertheless, obviously much still remains to be done regarding the taxonomic relationship of these two species. In the present paper I am unable to discuss fully about the matter on account of a limited number of pages, but will permit myself only to make a brief review of the taxonomy of the fungi under consideration.

In my previous papers it has been confirmed that our fungi can be distinctly separated from the causal fungus of "Pockenkrankheit" of potato tuber in cultural characters, hyphal fusion, and temperature relation. The latter fungus was isolated from the superficial sclerotial mass of potato black speck (or black scurf) fungus collected by the author in Dahlem-Berlin.

The first question naturally arises whether or not this potato organism, i. e. No. 19 according to our numeration, can be unmistakably referred to the type species *Rhizoctonia Solani* described by KÜHN[12], inasmuch as the binomial *Rhizoctonia Solani* has been used for all the fungi morphologically more or less resembling the KÜHN's potato pathogen. According to DUGGAR[5] who conferred with Prof. KÜHN, the nomenclator of *Rhizoctonia Solani*, regarding this disease in the winter of 1899-1900, it was noted that when KÜHN first described the disease of potato in Germany he laid emphasis upon a scab ("Schorf oder Grind," later termed "Pockenkrankheit") of potato which is now widely distributed throughout the world. In view of the fact, therefore, it seems likely that our potato organism may be identical with the species described by KÜHN. In this connection, it is also to note that our potato organism is very closely related to the culture designated as P_4 in my previous paper[13] published while I was in St. Louis, U. S. A., the latter being isolated from sclerotia of black speck of potato tuber secured on the market of St. Louis, 1918.

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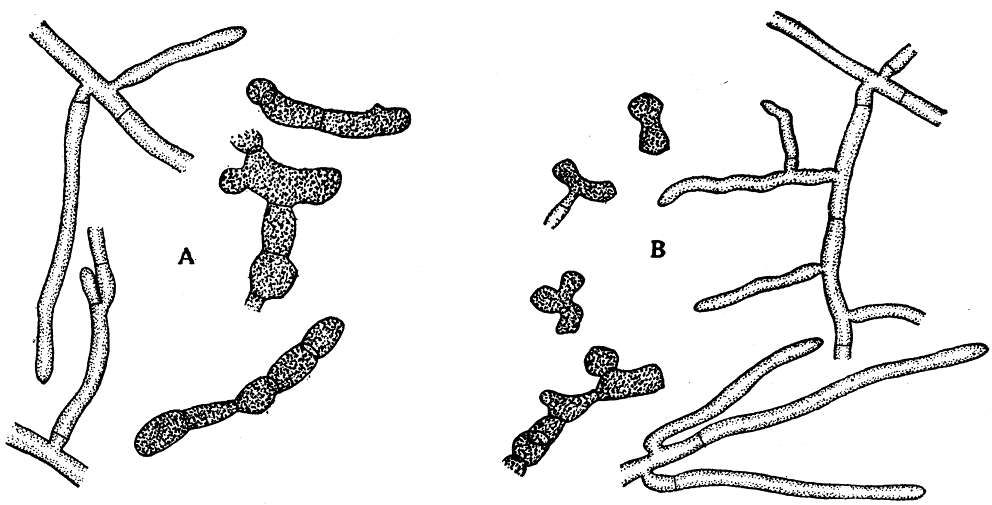

Fig. 1. A, *Rhizoctonia Solani*, hyphae and sclerotial cells; B, our fungus, hyphae and sclerotial cells. (Reduced to $\frac{2}{3}$ from camera lucida drawings, Apoch. Zeiss. 7×40.)

The vegetative characters of the fungus *Hypochnus Sasakii* are almost similar to those of Rhizoctonias in many respects. The mycelium of the former is characterized by a constriction where branching occurs, and a septum near the constriction, becoming deeply colored and branching approximately at right angles to the main hypha when mature, while in the younger stage it is colorless and inclined in the direction of growth (fig. 1). The sclerotia are generally more or less flattened, irregular, brown, and fairly homogeneous and paraplectenchymatous in structure, composing of the cells concolorous with the surface.

Although many similarities exist in the vegetative stage, the fungus *Hypochnus Sasakii* is distinctly different from *Rhizoctonia Solani* in some morphological and physiological characters, so far as a comparison is made between our rice strain (No. 1) and the potato Rhizoctonia (No. 19). For convenience, some of the more contrasting features as usually found are shown in the following table :

Hypochnus Sasakii	**Rhizoctonia Solani**
A. Morphological characters (fig. 1)	A. Morphological characters
1. Hyphae :	*1. Hyphae :*
5–11 μ, mostly 6–8 μ.	7–13 μ, mostly 8–12 μ.
2. Sclerotial cells (near the periphery):	*2. Sclerotial cells (do.) :*
7–18 × 22–37 μ.	15–26 × 26–50 μ.

B. Physiological characters

1. On phenol red-Czapek's agar:
Most of the strains exhibit "Peach red" or "Scarlet" in 7 days, showing increased alkalinity.

2. On bromcresol purple-Duggar's agar:
After 8 days all the cultures become "Mustard yellow" on account of the shifting to acid side.

3. On aniline blue-Czapek's agar:
A moderately strong growth in all the cultures.

4. On tannic acid-potato agar:
More or less tolerant to the acid.

5. Fusion of hyphae:
Fusion takes place between any strains of *Hypochnus Sasakii.*

6. Temperature relation:
These are rapid-growing fungi, giving most luxuriant growth in 2 days at 28–31° C.

B. Physiological characters

1. On phenol red-Czapek's agar:
This culture becomes "Bitter-sweet orange", thus showing less alkaline than the former.

2. On bromcresol purple-Duggar's agar:
This culture becomes "Antimony yellow", thus showing slighly less acid than the former.

3. On aniline blue-Czapek's agar:
This fungus is very sensitive to the dye.

4. On tannic acid-Czapek's agar:
Very sensitive to the acid.

5. Fusion of hyphae:
No fusion takes place in cross tests with any of the former.

6. Temperature relation:
This is a slow-growing fungus, showing no marked difference in growth even after 2 days at temperatures 22–31°C. The optimum is lower than that of the former.

In addition to these facts, it is also to note that direct attack of leaves by *Rhizoctonia Solani* is rather infrequent with the exception of such plants as lettuce, cabbage, etc., whereas in our case leaves are more frequently attacked by the fungus.

A comparison of the two species in the perfect stage also reveals some differences, provided *Corticium vagum* B. & C. described by BURT(4) is the

Fig. 2. *Corticium vagum* (*upper*), ×800. a, from specimen on potato; c, from specimen on earth; d, from specimen on wood. (Reproduced from BURT(4)) Our fungus (lower), ×500. (S. HIRANE del.)

perfect stage of *Rhizoctonia Solani.* For instance, the number of basidiospores of *Corticium vagum* varies from 4 to 6, though in the illustration of ROLFS (reproduced by GÜSSOW[9]) the basidia are 2 to 4 sterigmated, whereas in our case the basidiospores vary from 2 to 4 on each basidium, and are slightly shorter but broader than the former (fig. 2). The characteristic features as described by several investigators are shown in the following table:

Corticium vagum	*Hypochnus Sasakii*		
	SAWADA[18]	IKATA & HITOMI[10]	The author[14]
Basidia:			
10–20 × 7.5–11 μ	10–15 × 7–9 μ	5.6–12 × 5–8 μ	10–16 × 8–9 μ
Sterigma:			
6–16 μ, 4–6 sterigmated	4.5–7 × 2–3 μ, 2–4 sterigmated	2.5–8.4 × 0.8–2.8 μ	5–8 × 2.2–2.7 μ, 2–4 sterigmated
Basidiospores:			
8–14 × 4–6 μ	8–11 × 5–6.5 μ	6.5–8.4 × 4.8–8.4 μ	6–10 × 4–7 μ

It is also to note that while I was working with *Rhizoctonia Solani* in St. Louis I found that a strain, i. e. B_3*, originated from Corticium stage on lima beans grew better at lower temperatures (ca. 24°C.). This temperature relation is apparently different from that of our fungi and rather referable to that of our No. 19 strain (*Rhizoctonia Solani*).

Although the morphological differences between these two fungi in the perfect stage are not sufficient enough to warrant a classification of our fungus as a distinct species, in judging from the vegetative characters of our fungus this can not be included in the species *Corticium vagum*, and should be separated from the latter as a distinct species rather than as a biologic form.

In this connection it may be necessary to make a brief review regarding the species *Hypochnus Solani* (*Corticium Solani*), since this binomial has been used for *Rhizoctonia Solani* by several investigators, particularly by European workers[7, 11]. The species concerned was first described by PRILLIEUX and DELACROIX in 1891, about two decades after *Corticium vagum* had been reported, as a causal fungus on potato stem, although no connection was suspected with *Rhizoctonia Solani,* already known to occur in Europe. The diagnosis of the fungus was so imperfectly described, that a comparison could hardly be made satisfactorily except that the basidiospores appear to agree more closely with those of ours, as far as can be judged from the measurement of the spores[17].

* This material was examined by Dr. BURT and determined to be identical with *Corticium vagum.* (cf. the paper[13].)

As a matter of fact, however, it is to note that the species *Corticium Solani* (*Hypochnus Solani*) described by BROOKS[2] has basidiospores measuring 8-14 × 4-6 μ which perfectly agrees with that of the BURT's *Corticium vagum*. More recently, in regard to the nomenclature of the perfect form of the potato Rhizoctonia BRAUN[1] notices that it is not yet quite certain whether the fungus should be regarded as a Hypochnus or a Corticium, or whether the specific name should be vagum or Solani. However that may be, in view of the opinions given by many investigators up to the present time, it seems likely that *Hypochnus Solani* is considered to be identical with *Corticium vagum*.

Then the next attention is directed to the question whether or not there are any other species bearing a closer resemblance to the present fungus. In view of the literature available at present it would seem that our fungus is very closely related to *Corticium Stevensii* BURT[4, 19] (or *Corticium koleroga* (COOKE) v. HÖHN. according to WOLF and BACH[20]), a causal fungus of hypochnose of pomaceous plants, Citrus, crotons, roses, etc. The fungus *Corticium Stevensii* is characterized by having roundish or oblong sclerotia usually 3 or 4 mm in diameter and chestnut brown in color, composed of compactly woven masses of swollen irregular hyphae which are homogeneous throughout the tissues, dirty pinkish buff, membranaceous fructifications with spores measuring 10.5-11.6 × 4.7-5.8 μ (STEVENS & HALL[19]) or 8-11 × 3-4 μ (BURT[4]), and mycelial rhizomorphic structures extending lengthwise of the twigs and petioles. From the descriptions it would seem that this fungus somewhat differs from ours in having characteristic rhizomorphic structures, in producing sclerotia mostly on twigs, and in host relation. However, both are very closely related to each other in Rhizoctonia-like hyphal nature, sclerotial structure, fructification, mode of penetration, and in relation to temperature and humidity. As regards the matter studies are still in progress, so that further observations will be published later. In conclusion I may say that it would be better to name our fungus *Corticium Sasakii*[16] instead of *Hypochnus Sakakii* until further alteration is needed.

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SPORE-SIZE VARIABILITY IN SUBSEQUENT SPORE PRINTS OF SOME HYMENOMYCETOUS FUNGI

BY

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(富樫浩吾・小田耕次郎)

Spore size constitutes an important criterion for distinguishing the species of almost all fungi, and in turn the non-coincidence of spore measurements may often lead the investigators to divergent opinions as to classification. As to the variability owing to environment, maturity, etc., there are many data accumulating in mycological and phytopathological literature. But, as far as the writers could ascertain, no reports which demonstrate spore variability of hymenomycetous fungi caused by the repetition of spore printing with the same pileus have been published except that of ZELLER and the senior writer of this paper (ZELLER, S. M. and TOGASHI, K.: The American and Japanese Matsu-takes. Now in press). After having made biometric studies they pointed out that the spores of *Armillaria Matsutake* ITO et IMAI become somewhat smaller and rounder in the later spore prints, and also that the range of variability of spore sizes becomes narrower. It is the object of this paper to inquire whether this tendency in spore sizes may occur in the other cases of hymenomycetous fungi outside *A. Matsutake*.

For the purpose of this study fresh materials of the following hymenomycetous fungi were selected; namely *Armillaria mellea* (VAHL.) FR., *Hypholoma sublateritium* SCHAEFF., *Pholiota adiposa* FR. and *Collybia velutipes* (CURT.) FR.

As usual in getting spore prints, a fully developed pileus from which the stem had been removed was placed with the gills downward on a sheet of paper and was covered with a bell glass to keep the air from blowing the spores away. Just one day later the covering and the pileus were removed. Thus, from the same pileus four spore prints, one per day, were obtained at the regular times, and the spores from the print were used for measurements being mounted in water drops on a glass slide. In measuring the spores biometric constants were calculated by the assumed mean method. The formulae used were the same as in the case of *Armillaria Matsutake*.

The results of the measurements will be shown in the accompanying tables.

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

Table 1. Biometric data on the length and width of each 100 spores from the same pileus of *Armillaria mellea*

Length in microns										
Spore print	5	6	7	8	9	10	Total	Mean	Standard deviation	Coefficient of variability
1st		14	27	46	11	2	100	7.60±0.06	0.92±0.04	12.20±0.58
2nd	1	46	35	18			100	6.70±0.05	0.76±0.03	11.46±0.54
3rd		42	45	13			100	6.71±0.04	0.68±0.03	9.87±0.47
4th		50	37	13			100	6.63±0.04	0.70±0.03	10.59±0.50

Width in microns								
Spore print	3	4	5	6	Total	Mean	Standard deviation	Coefficient of variability
1st	1	39	59	1	100	4.60±0.03	0.52±0.02	11.33±0.53
2nd		89	11		100	4.11±0.02	0.31±0.01	7.61±0.36
3rd		97	3		100	4.03±0.01	0.17±0.01	4.23±0.20
4th		98	2		100	4.02±0.01	0.14±0.01	3.48±0.16

Table 2. Biometric data on the length and width of each 100 spores from the same pileus of *Pholiota adiposa*

Length in microns									
Spore print	6	7	8	9	10	Total	Mean	Standard deviation	Coefficient of variability
1st	12	33	50	4	1	100	7.48±0.05	0.78±0.04	10.52±0.50
2nd	54	43	3			100	6.49±0.04	0.55±0.03	8.57±0.41
3rd	55	42	3			100	6.48±0.04	0.55±0.03	8.58±0.41
4th	64	34	2			100	6.38±0.04	0.52±0.03	8.22±0.39

Width in microns							
Spore print	4	5	6	Total	Mean	Standard deviation	Coefficient of variability
1st	44	53	3	100	4.59±0.04	0.54±0.03	11.97±0.57
2nd	100			100			
3rd	100			100			
4th	100			100			

Table 3. Biometric data on the length and width of each 100 spores from the same pileus of *Hypholoma sublateritium*

Length in microns								
Spore print	3	4	5	6	Total	Mean	Standard deviation	Coefficient of variability
1st	3	13	64	20	100	5.01 ± 0.04	0.67 ± 0.03	13.38 ± 0.63
2nd	4	18	57	21	100	4.95 ± 0.04	0.73 ± 0.03	14.94 ± 0.71
3rd	4	19	64	13	100	4.86 ± 0.04	0.68 ± 0.03	14.11 ± 0.67
4th	5	20	67	8	100	4.78 ± 0.04	0.65 ± 0.03	13.74 ± 0.65

Width in microns						
Spore print	3	4	Total	Mean	Standard deviation	Coefficient of variability
1st	71	29	100	3.29 ± 0.03	0.45 ± 0.02	13.79 ± 0.65
2nd	79	21	100	3.21 ± 0.03	0.40 ± 0.02	12.68 ± 0.60
3rd	84	16	100	3.16 ± 0.02	0.37 ± 0.02	11.60 ± 0.55
4th	86	14	100	3.14 ± 0.02	0.35 ± 0.02	11.02 ± 0.52

Table 4. Biometric data on the length and width of each 100 spores from the same pileus of *Collybia velutipes*

Length in microns								
Spore print	5	6	7	8	Total	Mean	Standard deviation	Coefficient of variability
1st	15	54	28	3	100	6.19 ± 0.05	0.71 ± 0.03	11.58 ± 0.55
2nd	22	54	23	1	100	6.03 ± 0.05	0.70 ± 0.03	11.59 ± 0.55
3rd	14	63	21	2	100	6.11 ± 0.04	0.64 ± 0.03	10.58 ± 0.50
4th	9	57	27	7	100	6.32 ± 0.05	0.73 ± 0.03	11.60 ± 0.55

Width in microns						
Spore print	2	3	Total	Mean	Standard deviation	Coefficient of variability
1st	70	30	100	2.30 ± 0.03	0.45 ± 0.02	19.92 ± 0.95
2nd	79	21	100	2.21 ± 0.03	0.40 ± 0.19	18.42 ± 0.88
3rd	75	25	100	2.25 ± 0.03	0.43 ± 0.02	19.24 ± 0.92
4th	83	17	100	2.17 ± 0.03	0.37 ± 0.03	17.31 ± 0.83

Table. 5. Biometric data on the length and width of each 100 spores from the same pileus of *Collybia velutipes* (cultured)

Length in microns								
Spore print	5	6	7	8	Total	Mean	Standard deviation	Coefficient of variability
1st	7	59	25	9	100	6.36 ± 0.05	0.74 ± 0.04	11.66 ± 0.56
2nd	16	49	29	6	100	6.25 ± 0.05	0.79 ± 0.04	12.67 ± 0.60
3rd	16	51	28	5	100	6.22 ± 0.05	0.76 ± 0.04	12.36 ± 0.59
4th	7	55	30	8	100	6.39 ± 0.05	0.73 ± 0.03	11.47 ± 0.55
Width in microns								
Spore print	2		3		Total	Mean	Standard deviation	Coefficient of variability
1st	82		18		100	2.18 ± 0.03	0.38 ± 0.02	17.62 ± 0.84
2nd	72		28		100	2.28 ± 0.03	0.44 ± 0.02	19.69 ± 0.94
3rd	82		18		100	2.18 ± 0.03	0.38 ± 0.02	17.62 ± 0.84
4th	85		15		100	2.15 ± 0.02	0.35 ± 0.02	16.60 ± 0.79

As already mentioned in the case of *Armillaria Matsutake* the spore dimensions, especially the length, of the four fungi used become smaller and consequently the spores become rounder in shape with the repetitions of spore printing with the same pileus. In *Collybia velutipes*, however, this tendency was not so conspicuous and even in some instances the spores were slightly greater in length or in width (Tables 4 and 5). The most striking decrease in spore dimensions was observed in *Pholiota adiposa* showing an extreme difference between the means calculated on the spores from the first and fourth prints of 1.10 μ in length and 0.58 μ in width (Table 2). In the cases of *Armillaria mellea* and *Hypholoma sublateritium* the extreme differences of length and width were 0.97 μ and 0.58 μ (Table 1), and 0.23 μ and 0.15 μ (Table 3), respectively. It is of interest and also noteworthy that in the two cases, of *Pholiota adiposa* and *Armillaria mellea*, the spores from the second print showed an abrupt decrease in dimensions compared with those from the first print and after that a gradual decrease took place. One more interesting fact is that in the subsequent spore prints of the four fungi the variability of spore dimensions, both in length and width, became considerably narrower and the mode of spore classes removed to the lower side, with the one exception of *Collybia velutipes.*

In conclusion the writers can infer with certainty that in hymenomycetous fungi, at least in those that produce ellipsoidal or similar shaped spores, the spores are apt to show somewhat smaller and rounder in size and shape when they are examined one or more days after the fungi are collected, since the fungi may dischage the spores continuously and freely as long as the pilei do not dry out or rot. Investigators should bear in mind these facts if they try to identify a fungus of this group.

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STUDIES ON THE DOWNY MILDEWS OF CRUCIFEROUS VEGETABLES IN JAPAN I

BY

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Many kinds of cruciferous vegetables useful to the daily life of the Japanese are widely cultivated throughout the territory of Japan. Most of them belong to the genus *Brassica* or *Raphanus*, and are commonly subject to the attack of a *Peronospora* fungus known formerly as *Peronospora parasitica* (PERS.) FR., but lately often designated as *Peronospora brassicae* GM.

It seems to be inferable from the recent investigation of GÄUMANN(3) that the fungus parasitic on these cruciferous vegetables might comprise various strains different in pathogenicity. To ascertain this assumption, some inoculation experiments have been carried out, and the results so far obtained are tentatively presented in this paper.

Materials and Methods

Affected leaves of various cruciferous vegetables found in the neighbourhood of Gifu Agricultural College were collected, as a rule, towards evening, washed in running water, and each kept in a moist satchel in the laboratory. In this way, an abundance of fresh conidia were easily available on the following morning. The seeds used in these experiments were all gotten at a seed store in Gifu. They were sown and grown in ordinary porcelain pots.

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

Spore suspension was inoculated by means of an atomizer, and the plants inoculated were kept in moist chambers for 30–48 hours.

Experimental Results

(a) Experiments with the Downy Mildew of *Raphanus sativus*, L. var. *raphanistroides*, MAK.

Experiment I

On April 13, 1928, the downy mildew of Sima-Daikon, a cultural form of *Raphanus sativus*, var. *raphanistroides* collected at Rokken, was inoculated on 30-day-old* plants of various cultural forms of *Brassica* and *Raphanus*. The reactions of the plants to the fungus are briefly tabulated in Table I.

Table I. Reaction of various cultural forms of *Raphanus* and *Brassica* to the downy mildew of Sima-Daikon.

Plants inoculated		Formation of conidia
Species	Cultural forms	
Raphanus sativus, L. var. *raphanistroides*, MK.	Sima-Daikon	+++
Raphanus sativus, L.	White Icicle	+++
Brassica pekinensis, RUPR.	Aburana	++
	Tirimen-Sirona	+
Brassica chinensis, L.	Sina-Sirokuki-Taina	+
Brassica juncea, COSS.	Ôba-Takana	+
Brassica Rapa, L.	Syôgoin-Kabu	+
	Komatuna	++
Brassica oleracea, L. var. *capitata*, L.	Succession	−
Brassica oleracea, L. var. *botrytis*, L.	Late Giant	−
Brassica oleracea, L. var. *gemmifera*, ZENKER.	Exhibition	−
Brassica oleracea, L. var. *bullata*, DC.	Drumhead Savoy	−

"+" means positive in conidial formation, while "−" negative.

* This means 30 days after sowing.

Experiment 2

On October 23, 1933, the downy mildew of Miyasige-Daikon, a cultural form of *Raphanus sativus*, var. *raphanistroides* collected at Naka, was inoculated on ten-day-old seedlings of the same host and of Taina, a cultural form of *Brassica chinensis*. Conidia were abundantly produced on the former, but none on the latter.

Experiment 3

On November 18, 1933, the downy mildew of Miyasige-Daikon collected at Sinkanô, was inoculated on 30–day-old plants of the same host and Taina. The results were exactly the same as in Experiment 2.

Experiment 4

On December 4, 1933, the downy mildew of Miyasige-Daikon collected at Sinkanô, was inoculated on various cultural forms of *Raphanus* and *Brassica*. The plants inoculated were 25 days old. The reactions are shown in Table 2.

Table 2. Reaction of various cultural forms of *Raphanus* and *Brassica* to the downy mildew of Miyasige-Daikon.

Plants inoculated		Formation of conidia
Species	Cultural forms	
Raphanus sativus, L. var. *raphanistroides*, MK.	Miyasige-Daikon	+++
	Sirimaru-Daikon	+++
	Minowase-Daikon	+++
	Sirokubi-Hôryô-Daikon	+++
Raphanus sativus, L.	Hatuka-Daikon	++
Brassica Rapa, L.	Komatuna	+++
	Tennoji-Kabu	−
Brassica pekinensis, RUPR.	Tirimen-Sirona	++
	Sirokuki-Santôna	−
Brassica chinensis, L.	Hirosimana	−
	Yukisiro-Taina	−
Brassica oleracea, L. var. *capitata*, L.	Tamana	−

As seen from the results tabulated above, the downy mildew of *Raphanus sativus*, var. *raphanistroides*, so far as the present investigation is concerned, is very pathogenic to all cultural forms of *Raphanus* as well as to certain cultural forms of *Brassica pekinensis*, and *B. Rapa*; not or slightly pathogenic to most of the cultural forms of *Brassica pekinensis*, *B. chinensis*, *B. Rapa*, and *B. juncea*, and not pathogenic to the varieties of *Brassica oleracea*.

(b) Experiments with the Downy Mildew of *Brassica pekinensis* L.

Experiment 5

On May 5, 1928, the downy mildew of Aburana, a cultural form of *Brassica pekinensis* collected at Inuyama, was inoculated on 10-day-old seedlings of Sima-Daikon and Aburana. Conidia were produced on both kinds of plants. But, the amount of the conidia was found to be less on the former than on the latter.

Experiment 6

On November 16, 1933, the downy mildew of Sirona, a cultural form of *Brassica pekinensis* collected in the experimental farm of our college, was inoculated on the seedlings of Miyasige-Daikon and Taina, both being 11 day old. No conidia were produced on Miyasige-Daikon, but they were produced on Taina.

Experiments 7–8

On December 1, 1933, the downy mildew of Santôna, a cultural form of *Brassica pekinensis* collected in the experimental farm of our college, was inoculated on various cultural forms of *Raphanus* and *Brassica*. The plants were 22 days old, when inoculated (Exp. 7).

On the next day, the downy mildew of Sirona collected in the experimental farm of our college, was also inoculated on another series of the same cultural forms as used in Experiment 7. The plants were 23 days old in this case (Exp. 8). The reactions of the plants to the fungus in both experiments are shown together in Table 3.

Table 3. Reaction of various cultural forms of *Raphanus* and *Brassica* to the downy mildews of Santôna and of Sirona

Plants inoculated		Formation of conidia	
Species	Cultural forms	Exp. 7	Exp. 8
Raphanus sativus, L. var. *raphanistroides*, MK.	Miyasige-Daikon	—	—
	Sirimaru-Daikon	—	—
	Minowase-Daikon	—	—
	Sirokubi-Hôryô-Daikon	—	—
Raphanus sativus, L.	Hatuka-Daikon	—	—
Brassica Rapa, L.	Komatuna	+++	+++
	Tennoji-Kabu	+++	+++
Brassica pekinensis, RUPR.	Tirimen-Sirona	+++	+++
	Sirokubi-Santôna	+++	+
Brassica chinensis, L.	Hirosimana	+++	+
	Yukisiro-Taina	+++	+
Brassica oleracea. L. var. *capitata*, L.	Tamana	—	—

The results of Experiments 5–8 indicate clearly that the downy mildew of *Brassica pekinensis*, with the exception of Aburana, cannot attack the cultural forms of *Raphanus* tested, showing that the fungus on *Brassica pekinensis* is quite different in pathogenicity from that on *Raphanus*. The results are also somewhat suggestive to indicate that the fungus on Aburana, Sirona, and Santôna, respectively, might be different pathogenically. However, further study is necessary for a determination of this point.

(c) Experiments with the Downy Mildew of *Brassica chinensis*, L.

Experiment 9

On November 16, 1933, the downy mildew of Taina, a cultural form of *Brassica chinensis*, L. collected from the experimental farm of our college, was inoculated on the seedlings of Miyasige-Daikon and Taina, when both were 11 days old. Abundant conidia were produced on Taina, but none on Miyasige-Daikon.

Experiment 10

On December 6, 1933, the downy mildew of Taina collected from the experimental garden of the Phytopathological Division, was inoculated on various cultural forms of *Raphanus* and *Brassica*, when the plants were 27 days of age. The reactions are shown in Table 4.

Table 4. Reaction of various cultural forms of *Raphanus* and *Brassica* to the downy mildew of Taina

Plants inoculated: Species	Plants inoculated: Cultural forms	Formation of conidia
Raphanus sativus, var. *raphanistroides*, MK.	Miyasige-Daikon	—
	Sirimaru-Daikon	—
	Minowase-Daikon	—
	Sirokubi-Hôryô-Daikon	—
Raphanus sativus, L.	Hatuka-Daikon	—
Brassica Rapa, L.	Komatuna	+++
Brassica pekinensis, L.	Tirimen-Sirona	+++
	Sirokubi-Santôna	+++
Brassica chinensis, RUPR.	Hirosimana	++
	Yukisiro-Taina	+++
Brassica oleracea, L. var. *capitata*, L.	Tamana	—

The results of Experiments 9-10 indicate that the fungus on Taina (*Brassica chinensis*) is distinguishable in pathogenicity from that on *Raphanus*, but seems to be closely related to that on Santôna (See Expt. 7).

(d) Experiments with the Downy Mildew of *Brassica Rapa*, L.

Experiment 11

On November 22, 1933, the downy mildew of Kurona, possibly a cultural form of *Brassica Rapa*, L. collected in Saraki-Mura, was inoculated on

(1) 17-day-old plants of Sirona,
(2) 13-day-old plants of Tennoji-Kabu, and
(3) 40-day-old plants of Miyasige-Daikon and Taina.

Abundant conida were formed on Sirona and Tennoji-Kabu, but none on Miyasige-Daikon and Taina.

Experiment 12

On December 1, 1933, the downy mildew of Kurona collected in the experimental farm of our college, was inoculated on various cultural forms of

Raphanus and *Brassica*. The plants were 22 days old, when inoculated. Table 5 represents the reactions of the plants to the fungus.

Table 5. Reaction of various cultural forms of *Raphanus* and *Brassica* to the downy mildew of Kurona

Plants inoculated		Formation of conidia
Species	Cultural forms	
Raphanus sativus, L. var. *raphanistroides*, MK.	Minowase-Daikon	−
	Sirimaru-Daikon	−
	Miyasige-Daikon	−
	Sirokubi-Hôryô-Daikon	−
Raphanus sativus, L.	Hatuka-Daikon	−
Brassica Rapa, L.	Komatuna	+++
	Tennoji-Kabu	+
Brassica pekinensis, RUPR.	Tirimen-Sirona	+
	Sirokuki-Santôna	+
Brassica chinensis, L.	Hirosimana	+
	Yukisiro Taina	+
Brassica oleracea, L. var. *capitata*, L.	Tamana	−

The results of these experiments also indicate that the fungus on *Brassica Rapa* is evidently different from that on *Raphanus*.

It is noticeable that the downy mildew of *Brassica pekinensis*, *B. chinensis*, and *B. Rapa*, respectively, is closely related, since it has a similar range of susceptible hosts. However, there are some differences in the grade of production of conidia, and it remains to be determined, whether these differences are significant from the standpoint of physiological specialization, or are merely explained by the influence of environmental factors.

Considerations

In 1926, GÄUMANN[3] reported that *Peronospora brassicae* GM. is sub-divided into three biologic forms, namely:

(1) f. sp. *brassicae*, the principal hosts of which are *Brassica oleracea*, L., *Br. Napus*, L., *Br. Rapa*, L., *Br. nigra* (L.) KOCH, *Br. juncea* (L.) COSS., *Br. Tournefortii*, GOUAN and *Br. fruticulosa*, CHR. It is able to produce sub-infections

on *Sinapis arvensis*, L., *Sin. alba*, L., *Raphanus Raphanistrum*, L., *R. sativus*, L., and *Eruca sativa*, L.

(2) f. sp. *sinapidis*, the principal hosts of which are *Sinapis arvensis*, L., and *S. alba*. It is able to produce sub-infections on all the above-mentioned species of *Brassica*, with the exception of *Br. Rapa* and *Br. juncea*, and both species of *Raphanus*, with occasional conidiophore formation on *Br. oleracea*.

(3) f. sp. *raphani*, the principal hosts of which are *Raphanus Raphanistrum*, L. and *R. sativus*, L. It is able to produce sub-infections on all the above-mentioned species of *Brassica* (except *Br. fruticulosa*), as well as on both species of *Sinapis*, with occasional conidiophore formation on *Br. oleracea* and *Br. Napus*.

In 1933, SAWADA[4] described the *Peronospora* on *Brassica chinensis* under the name of *Peronospora Brassicae*, GM., also the *Peronospora* on *Raphanus sativus*, L. as *Peronospora Brassicae*, GM. f. sp. *Raphani*, SAW., without mentioning GÄUMANN's publication stated above.

According to SAWADA, H. KUROSAWA formerly proved by inoculation experiments that (1) the fungus on Taina, a cultural form of *Brassica chinensis*, L., is capable of infecting Sirona-group (*Brassica pekinensis*), Tamana-group (*Br. oleracea*), Kabu-group (*Br. Rapa*), and Karasina-group (*Br. juncea*), but is unable to infect Daikon-group (*Raphanus sativus*); (2) on the other hand the fungus on *Raphanus* infects readily many cultural forms of *Raphanus*, but very rarely many forms of *Brassica*, with the exception of *Br. oleracea* which is rather susceptible; (3) the fungus on *Br. oleracea* is unable to infect *Raphanus*, although it is capable of infecting all the cultural forms of *Brassica*.

If GÄUMANN's results in inoculation experiments with the fungus from *Brassica oleracea* are compared with those reported by SAWADA, it is perceived that there is a general coincidence between the two. The same is also the case with the results of the experiments on the fungus from *Raphanus sativus*, suggesting that f. sp. *Raphani* SAW. is a synonym of f. sp. *raphani* GM.

As has been already stated, the results of the present investigation are sufficient to show that the fungus on *Raphanus sativus* is distinguishable pathogenically from that on *Brassica*. However, it seems quite questionable, whether or not the fungus on *Raphanus* or *Brassica* is uniform pathogenically. The fungus on *Raphanus* studied by the present writers has appeared to be more pathogenic on species of *Brassica* than that studied by GÄUMANN. The behaviour of the fungus on *Brassica Rapa* has been also found to be somewhat different from that reported by the latter. Still more, the results of the present experiments with the downy mildew from various cultural forms of *Brassica* have suggested that the fungus on *Brassica* might not be uniform, since there have been found some differences in the reactions of the same plants to each strain of the fungus. If proper differential hosts are chosen, and inoculations are made under controlled conditions, the problem under consideration may be proved to be more complex than hitherto considered.

Biometrical studies have shown that the conidia of the fungus on *Raphanus sativus* are considerably smaller than those on *Brassica*. This is mainly in accordance with the descriptions given by SAWADA. Further study is now in progress.

Literature cited

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(2) ———: Beiträge zu einer Monographie der Gattung *Peronospora* CORDA. Beitr. Krypt. flora d. Schweiz, Bd. 5, Heft 4: 1–360, 1923.

(3) ———: Über die Spezialisierung des falschen Mehltaus (*Peronospora brassicae* GM.) auf dem Kohl und seinen Verwandten. Landwirts. Jahrbuch d. Schweiz, 40: 463–468, 1926.

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ON SOME NEW SPECIES OF PHRAGMIDIUM

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I. ***Phragmidium Itoanum*** HIRATSUKA, f. nov. spec.

Aecidiis amphigenis, plerumque hypophyllis vel petiolicolis, sparsis vel aggregatis, minutis, rotundatis, ellipsoideis vel irregularibus, 0.3–1.5 mm diam., praecipue ad petiolos et nervos foliorum evolutis et tunc elongatis, usque 6 mm longis, pulvinatis, aurantiacis; paraphysibus clavatis, $45-62 \times 10-16\ \mu$; aecidiosporis globosis, subglobosis, ellipsoideis vel ovatis, $20-31 \times 18-21\ \mu$; episporio $1.8-2.5\ \mu$ crasso, densiuscule verruculoso.

Soris teleutosporiferis amphigenis vel caulicolis, sparsis vel solitariis, rotundatis vel oblongis, 0.3–1.2 mm diam., vel elongatis 1–6 mm vel ultra longis, pulvinatis, mox nudis, epidermide rupta cinctis, atris; teleutosporis cylindraceis, 1–4-septatis (plerumque 2–3), $45-87 \times 18-27\ \mu$, ad septa non constrictis, apice et basi rotundatis olivaceo- vel cloveo-brunneis, levibus; episporio $2.5-3.5\ \mu$ crasso, quaque cellula poris germinationis 2–3; pedicello persistenti, hyalino, $60-145\ \mu$ longo.

Hab. In foliis caulibusque *Potentillae Matsumurae* in Hokkaidô (Ishikari, Iburi), Honshû (Shinano) et Kuriles in Japonia.

Aecidia amphigenous, mostly hypophyllous, petiolicolous or often on stems, scattered or gregarious, minute, round, oblong or irregular in shape, 0.3–1.5 mm across, often elongated on the nerves or petioles, up to 6 mm long, at first covered by the epidermis, then naked, pulvinate, ruptured epidermis conspicuous, orange in colour; paraphyses not abundant nor consicuous, surrounding each sorus, clavate, erect, $45-62\ \mu$ long, $10-16\ \mu$ wide, walls uniformly thin, $1\ \mu$ or less, smooth, colourless; aecidiospores globose, subglobose, ellipsoidal or ovate, $20-31 \times 18-21\ \mu$; epispore moderately thin, $1.8-2.5\ \mu$ thick, minutely verrucose; contents orange-yellow in colour.

Teleutosori amphigenous or on petioles, peduncles, stems, even on bracts, scattered or solitary, small, round or oblong, 0.3–1.2 mm across, or elongated up to 1–6 mm long, pulvinate, finally powdery, ruptured epidermis conspicuous, black; teleutospores cylindrical, 1–4-septate (generally 2 or 3), $45-87 \times 18-27\ \mu$; rounded at both ends, not constricted at the septa; epispore olive-brown to clove-brown in colour, smooth, moderately thick, $2.5-3.5\ \mu$ thick, thickened at the apex (up to $10\ \mu$), 2 or 3 germ pores in each cell; pedicels persistent, $60-145\ \mu$ long, colourless, somewhat rugose especially in the lower part, non-hygroscopic.

Hab. On *Potentilla Matsumurae* WOLF. (*Miyama-kimbai*).

Hokkaidô:—Prov. Iburi: Mt. Makkari-nupuri (Aug. 8, 1907, S. ITO). Prov. Ishikari: Mt. Hokkaidake (Sept. 11, 1926, HIRATSUKA, f.); Kumonotaira (Daisetsu-zan) (Aug. 19, 1925, K. MIYABE & HIRA-

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

TSUKA, f.; Sept. 11, 1926, HIRATSUKA, f.); Mt. Hakuun-dake (Aug. 5, 1925, HIRATSUKA, f.); Hokkai-sawa (Daisetsu-zan) (Aug. 14, 1927, S. ITO, HIRATSUKA, f. & S. IWADARE, *type* !); Mt. Tomuraushi (Aug. 1927, H. KATAOKA).

Kuriles:—Shikotan: Shakotan (Aug. 22, 1927, M. TATEWAKI).

Honshû:—Prov. Shinano: Mt. Yatsugatake (July 21, 1930, HIRATSUKA, f.); Mt. Tsubakura (July 29 & Aug. 2, 1930, HIRATSUKA, f.); Mt. Komagatake (Kiso) (Aug. 10 & 11, 1931; Aug. 23, 1932, HIRATSUKA, f.).

This is an alpine species; it has been found only in the alpine regions in Japan up to the present.

The present fungus closely resembles the American species, *Phragmidium biloculare* DIET. et HOLW. on *Potentilla gelida* C. A. MEY., in its life-cycle and the host relation as well as in some morphological characters. This fungus is, however, distinguishable from the American species by the septation of the teleutospores and the teleutospore-walls. The teleutospores of the Japanese fungus are generally 2 or 3-septate and their epispore is entirely smooth, while those of the American fungus are mostly 1-septate (very rarely 3-septate) and their epispore is closely verrucose especially at the apex.

Moreover, this species can easily be distinguished from the related species, *Phragmidium Potentillae* (PERS.) KARST. by the smaller number of teleutospore-cells as well as by its life-history, lacking the uredo-generation.

The first reference to this species was made by M. KASAI[1] under the name *Phragmidium Potentillae* (PERS.) KARST. basing upon a collection on *Potentilla Matsumurae* WOLF. (KASAI erroneously recorded it as *Potentilla gelida* C. A. MEY.) which was made by Prof. ITO on Mt. Makkari-nupuri in the province of Iburi in August 1907. I have had the privilege of examining Dr. ITO's collection preserved in the Herbarium of the Botanical Institute, Faculty of Agriculture, Hokkaido Imperial University, and found that it is really this fungus.

This species is dedicated to Prof. ITO in honor of the twenty-fifth anniversary of his appointment to a post in the Botanical Institute of the Hokkaido Imperial University.

2. ***Phragmidium brevipedicellatum*** HIRATSUKA, f. nov. spec.

Syn. *Phragmidium Potentillae* (not KARSTEN nor WINTER) (DIETEL in Engl. Bot. Jahrb. XXXVII, p. 104, 1905, p.p.; Ann. Myc. VI, p. 227, 1908; HENNINGS in Engl. Bot. Jahrb. XXXII, p. 36, 1902; KASAI in Trans. Sapporo Nat. Hist. Soc. III, p. 29, 1910, p.p.; NAMBU in Bot. Mag. Tokyo, XXIII, p. (309), fig. 3, 1909; YOSHINAGA in Bot. Mag. Tokyo, XV, p. (96), 1901; YOSHINAGA & HIRATSUKA, f. in Bot. Mag. Tokyo, XLIV, p. 649, 1930).

Aecidiis amphigenis, plerumque hypophyllis vel petiolicolis, sparsis vel aggregatis, minutis, rotundatis vel ellipsoideis, 0.4–1 mm diam., mox nudis, pulverulentis, aurantiacis, aparaphysatis; aecidiosporis globosis, subglobosis, ob-

(1) Trans. Sapporo Nat. Hist. Soc. III, p. 29, 1910.

ovatis vel ellipsoideis, 17.5–30 × 15–25 μ; episporio 1.2–2 μ crasso, densiuscule verruculoso.

Soris uredosporiferis plerumque hypophyllis, petiolicolis vel caulicolis, sparsis vel laxe aggregatis, minutis, rotundatis vel oblongis, 0.2–1 mm diam., rarius elongatis usque 1 cm longis, mox nudis, pulvinatis, aurantiacis; paraphysibus numerosis, clavatis vel plus minus capitatis, 35–75 × 9–18 μ, levibus, hyalinis; uredosporis globosis, subglobosis vel obovatis, 15–25 × 15–22.5 μ; episporio minutissime echinulato, 1.2–1.8 μ crasso, pallide flavidio vel subhyalino.

Soris teleutosporiferis hypophyllis vel petiolicolis, sparsis vel aggregatis, minutis, rotundatis vel oblongis, 0.3–1 mm diam., pulvinatis, mox nudis, atris; teleutosporis cylindraceis, 1–5-septatis (plerumque 3–4), 42–93 × 21–30 μ, levibus olivaceo-brunneis; episporio 2–3 μ crasso, quaque cellula poris germinationis 2–3; pedicello persistenti, 18–70 μ longo, hyalino vel superne leniter colorato.

Hab. In foliis caulibusque *Potentillae Kleinianae* in Honshû (Inaba, Hôki, Iwami), Shikoku (Iyo, Tosa), Kiushû (Higo, Bungo) in Japonia.

Aecidia amphigenous, mostly hypophyllous or petiolicolous, scattered or gregarious, small, round or ellipsoidal, 0.4–1 mm across, soon naked, pulvinate, orange chrome in colour; paraphyses wanting; aecidiospores globose, subglobose, obovate or ellipsoidal, 17.5–30 × 15–25 μ; epispore rather thin, 1.2–2 μ thick, nearly colourless, densely verrucose; contents orange-yellow in colour.

Uredosori mostly hypophyllous or on petioles, peduncles or stems, scattered or loosely grouped, minute, round or oblong, 0.2–1 mm across, elongated on petioles, peduncles or stems, up to 1 cm long, soon naked, pulvinate, finally pulverulent, orange to cadmium orange in colour; paraphyses numerous, clavate or more or less capitate, erect or somewhat incurved, 35–75 × 9–18 μ, walls smooth, colourless, uniformly thin, 1 μ or less; uredospores globose, subglobose or obovate, 15–25 × 15–22.5 μ; epispore minutely echinulate, thin, 1.2–1.8 μ thick, pale yellow or nearly colourless; contents orange-yellow in colour.

Teleutosori hypophyllous, or rarely on petioles, scattered or gregarious, minute, round or oblong, 0.3–1 mm across, pulvinate, early naked, black; teleutospores cylindrical, 1–5-septate (generally 3 or 4), 42–93 × 21–30 μ, rounded at both ends, not constricted at the septa; epispore rather thick, 2–3 μ, smooth, olive-brown in colour, germ pores 2 or 3 in each cell; pedicels persistent, non-hygroscopic, 18–70 μ long, hyaline and slightly coloured toward the upper part.

Hab. On *Potentilla Kleiniana* WIGHT et ARN. (*O-hebi-ichigo*).

Honshû:—Prov. Inaba: Tottori (May 31 & June 5, 1933; Nov. 27, 1930, HIRATSUKA, f. *type*!); Omokage-mura (June 8, 1933; Oct. 24, 1929, HIRATSUKA, f.); Ubeno-mura (May 18, 1930, HIRATSUKA, f.). Prov. Hôki: Daisen-mura (Nov. 11, 1929, HIRATSUKA, f.); Tokoroko-mura (Nov. 11, 1929, HIRATSUKA, f.). Prov. Iwami: Yoshida-mura (May 22, 1921, T. NAITÔ).

Shikoku:—Prov. Iyo: Ebara-mura (May 22, 1899, M. OKUDAIRA). Prov. Tosa: Kamoda-mura (May, 1903, T. YOSHINAGA); Asakura-mura (Nov., 1907, T. YOSHINAGA); Nyûgauchi, Higashigawa-mura (May, 1904, T. YOSHINAGA).

Kiushû:—Prov. Higo: Idzumi-mura (Jan. 3, 1907, K. YOSHINO; April 18, 1910, K. MURAKAMI); Jinnai-mura (May 11, 1907, K. YOSHINO). Prov. Bungo: Takeda-machi (June 21, 1905, K. YOSHINO).

The first record of this fungus was made by P. HENNINGS[1] in 1902

(1) Engl. Bot. Jahrb. XXXII, p. 36, 1902.

under the name *Phragmidium Potentillae* (PERS.) KARST. based upon a specimen which was collected by T. YOSHINAGA (T. INOUYE) at Sakawa-machi, the province of Tosa (Shikoku). Since then, this fungus was reported by DIETEL, KASAI, YOSHINAGA and the writer under the same name from Honshû and Shikoku.

Although the present fungus is closely related to *Phragmidium Potentillae* (PERS.) KARST., it is well distinguished from the latter species by its much shorter pedicels of the teleutospores, measuring 18–70 μ, instead of 60–240 μ in length.

This species is indigenous to Japan, and is commonly found in the southern districts of our country; viz. in southern Honshû, Shikoku and Kiushû. The specific name of this species was suggested by the very short pedicels of the teleutospores.

3. ***Phragmidium arisanense*** HIRATSUKA, f. et HASHIOKA, nov. spec.

Soris uredosporiferis hypophyllis, sparsis vel aggregatis, minutis, rotundatis, 0.2–0.8 mm diam., mox nudis, pulverulentis, aurantiacis; paraphysibus numerosis, cylindraceis vel clavatis, 50–80 μ longis, 12–20 μ latis; uredosporis globosis, subglobosis, obovatis vel ellipsoideis, 17–25 × 16.5–22 μ; episporio 1.5–2 μ crasso, echinulato.

Soris teleutosporiferis hypophyllis, sparsis vel hinc inde aggregatis, mox nudis, pulverulentis, atris; teleutosporis cylindraceis, 4–7-septatis (plerumque 5 vel 4), 60–114 × 25.5–39 μ; apice rotundatis, epapillatis, ad septa non constrictis, verrucis minutis dense obsitis, castaneo-brunneis; episporio 3–4.5 μ crasso, quaque cellula poris germinationis 3 instructa; pedicello persistenti, hyalino, superne leniter flavidulo, 30–90 μ longo, basi incrassato, hygroscopiceo.

Hab. In foliis *Rubi rarissimi* in Formosa, Japonia.

Uredosori hypophyllous, scattered or in small groups, round, minute, 0.2–0.8 mm across, early naked, somewhat pulverulent, orange-yellow in colour; paraphyses numerous, cylindrical or clavate, 50–80 μ long, 12–20 μ wide, somewhat incurved, walls smooth, thin, colourless; uredospores globose, subglobose, obovate or ellipsoidal, 17–25 × 16.5–22 μ; epispore 1.5–2 μ thick, coarsely echinulate, colourless; contents orange-yellow in colour.

Teleutosori hypophyllous, scattered or gregarious, minute, round, 0.2–0.4 mm across, early naked, pulverulent, black; teleutospores cylindrical, 4–7-septate (generally 5 or 4), 60–114 × 25.5–39 μ, apical papilla wanting, rounded at both ends, not constricted at the septa; epispore verrucose with hyaline or subhyaline warts, 2.5–4 μ thick, chestnut-brown in colour, 3 germ pores in each cell; pedicels persistent, hyaline, smooth, 30–90 μ long, up to 20 μ at broadest diameter, hygroscopic.

Hab. On *Rubus rarissimus* HAYATA (*Arisan-miyama-urajiro-ichigo*).

Formosa:—Prov. Tainan: Mt. Arisan (July 12, 1933 & Nov. 6, 1932, Y. HASHIOKA, *type* !).

In the general character of the teleutostage, the present fungus resembles *Phragmidium Nambuanum* DIET., from which it differs, however, in the septation of teleutospores and the length of their pedicels.

This species is known only from the above two collections by Mr. Yoshio HASHIOKA in Mt. Arisan, Formosa. The specific name of this fungus is derived from the locality where it was discovered.

4. ***Phragmidium Rubi-Oldhami*** TOGASHI et MAKI, nov. spec.

Soris uredosporiferis hypophyllis, sparsis vel aggregatis, minutis, rotundatis, 0.1–0.4 mm diam., flavidis; paraphysibus numerosis, clavatis, 35–70 × 10–18 μ; uredosporis globosis, subglobosis, ovatis vel ellipsoideis, densiuscule breviterque echinulatis vel echinulato-verruculosis, 14–24 × 12–20 μ; episporio 1.5–2 μ crasso, hyalino.

Soris teleutosporiferis hypophyllis, sparsis vel aggregatis, medioribus, rotundatis, 0.2–1.5 mm diam., subinde confluentibus, pulverulentis, atris; teleutosporis plerumque cylindraceis vel fusoideo-cylindraceis, 1–7-septatis, plerumque 4–6-septatis, ad septa non constrictis, apice papilla hyalina, subhyalina vel dilutiore (1–12.5 μ) longa auctis, verrucis numerosis minutis obsitis, castaneo-brunneis, 32.5–107.5 × 24–32.5 μ; episporio 2–4 μ crasso, quaque cellula poris germinationis 2–3 instructa; pedicello persistenti, 42–144 μ longo, superne 6–12 μ crasso, deorsam (10–20 μ) incrassato, hygroscopiceo.

Hab. In foliis *Rubi Oldhami* in Honshû (Rikuchû), Japonia.

Uredosori hypophyllous, scattered or gregarious, round, small, 0.1–0.4 mm across, early naked, somewhat pulverulent, yellow in colour; paraphyses numerous, clavate, 35–70 × 10–18 μ, incurved, walls thin, 1 μ or less, occasionally slightly thickened at apex, smooth; uredospores globose, subglobose, ovate or ellipsoidal, 14–24 × 12–20 μ; epispore 1.5–2 μ thick, densely and strongly echinulate, colourless; contents yellow in colour.

Teleutosori hypophyllous, scattered or grouped, round, minute, 0.2–1.5 mm across, sometimes confluent, early naked, powdery, black; teleutospores mostly cylindrical or fusoid-cylindrical, 1–7-septate (generally 4 to 6), 32.5–107.5 × 24–32.5 μ, not constricted at the septa, rounded at both ends, apical papilla 1–12.5 μ long, hyaline or subhyaline; epispore 2–4 μ thick, densely verrucose with hyaline or subhyaline tubercles, 2 or 3 germ pores in each cell, chestnut-brown in colour; pedicels persistent, 42–144 μ long, 6–12 μ wide at the upper part, wider at the base (10–20 μ), somewhat rugose at the lower part, hygroscopic.

Hab. On *Rubus Oldhami* MIQ. (*Rubus pungens* CAMB. var. *Oldhami* MAXIM.) (*Sanagi-ichigo*).

Honshû:—Prov. Rikuchû: Morioka (Nov. 7 & 14, 1931, Y. MAKI, *type* !).

The present fungus seems to be closely related to the European species, *Phragmidium Rubi-saxatilis* LIRO. But it is distinctly distinguished from the latter species by the smaller number of septa, shorter papilla and longer pedicels of the teleutospores.

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CERCOSPORA FROM FORMOSA I

BY

WATARO YAMAMOTO

(山 本 和 太 郎)

(With three text figures)

1. ***Cercospora Bischofiae*** sp. nov. (Fig. 1, Nos. 1 & 2)

Maculis amphigenis, laxe irregulariterque sparsis, plerumque orbicularibus vel suborbicularibus, raro angularibus, plus minusve indefinitis, 2–10 mm diam., rufo-fuscis vel sordide purpureo-brunneis; caespitulis hypophyllis, raro epiphyllis, laxe dispersis, inconspicuis; conidiophoris plerumque binis vel compluribus e stomatibus oriundis, simplicibus, raro ramulis 1–2 brevibus instructis, rectis vel parum curvatis, leniter geniculatis, 1–9-septatis, pallide olivaceis, 16–72 μ longis, 3–4.5 μ latis; conidiis obclavato-acicularibus vel anguste cylindraceis, rectis vel plus minusve curvatis, 1–9-septatis, dilutissime olivaceis, 23–81 μ longis, 2.3–3.6 μ latis.

Hab. in foliis vivis *Bischofiae javanicae* BLUME; Taihoku, Formosa, 11. XI, 1933, leg. W. YAMAMOTO.

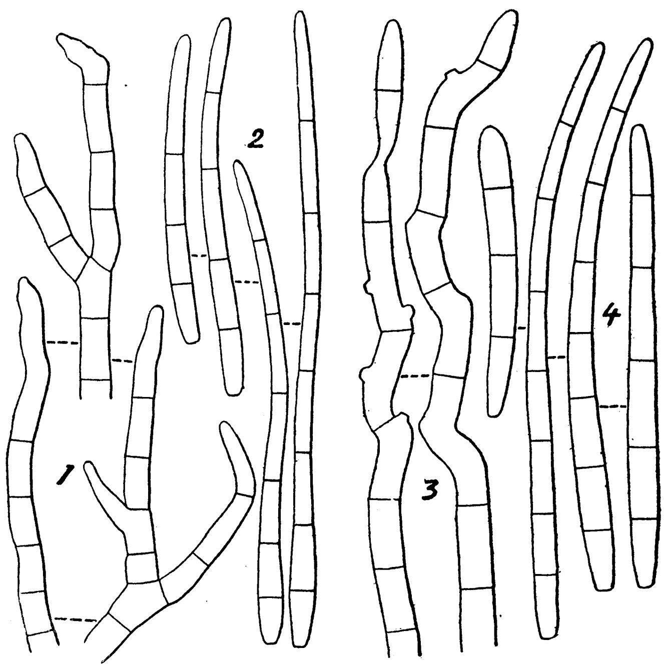
2. ***Cercospora Catappae*** HENN. in ENGL. Bot. Jahrb. XXXIV, p. 56, 1905; SACC. Syll. Fung. XVIII, p. 598, 1906; BUTLER & BISBY, The Fungi of India p. 142, 1931.

Hab. in foliis vivis *Terminaliae Catappae* L.; Taihoku, Formosa, 6. XII. 1933, leg. W. YAMAMOTO.

3. ***Cercospora ebulicola*** sp. nov. (Fig. 1, Nos. 3 & 4)

Caespitulis semper hypophyllis, sine maculis, in epiphyllo tantum decolorationibus suborbicularibus, flavo-viridulas vel flavo-brunneolas indistinctas efficientibus, irregulariter lateque dispersis, ambitu irregularibus, plus minusve angularibus, indistincte limitatis, saepe confluentibus et majoribus, interdum magnam folii partem obtegentibus, laxis vel subdensis, velutinis, fuscis vel atro-olivaceis; conidiophoris plerumque e stomatibus oriundis, fasciculatis, simplicibus vel ramulis 1–2 instructis, varie curvatis et geniculatis, 4–15-septatis, pallide olivaceo-brunneolis, 75–137 μ, raro ad 208 μ longis, 3.5–5 μ latis; conidiis vermiformibus vel acicularibus, raro clavato-cylindraceis, rectis vel parum curvatis, ad basim

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]



saepe attenuato-truncatis, apicem versus sensim attenuatis, 3–9-septatis, non constrictis, dilutissime olivaceis, 36–98 μ longis, 3.5–4.5 μ latis.

Hab. in foliis vivis *Ebuli formosanae* NAKAI; Sozan, Formosa, 3. XII. 1933, leg. W. YAMAMOTO.

Fig. 1.

Nos. 1 & 2. Conidiophores and conidia of *Cercospora Bischofiae* sp. nov. Nos. 3 & 4. Conidiophores and conidia of *Cercospora ebulicola* sp. nov. (×ca. 667)

4. ***Cercospora Fagarae*** sp. nov. (Fig. 2, Nos. 1 & 2)

Maculis laxe vel densiuscule irregulariterque sparsis, angularibus vel irregularibus, raro fere orbicularibus, saepe nervuli foliorum plus minusve limitatis, 1–5 mm. diam., saepe confluentibus et majoribus, purpureo-brunneis vel atrobrunneolis, postea in centro saepe expallescentibus; caespitulis amphigenis, sed autem saepe hypophyllis, in epiphyllo laxe dispersis, minutissime punctiformibus, in hypophyllo dense dispersis, tenuissime velutinis, atro-olivaceis; conidiophoris in hypostromatibus densiuscule gregariis, innato-erumpentibus, irregulariter rotundatis vel breviter cylindraceis, 30–85 μ latis, e cellulis, pallide olivaceis vel brunneolis, anguloso-rotundatis, 3.6–7.2 μ diam. metientibus compositis ortis, simplicibus vel ramulosis, rectis vel parum curvatis, subgeniculatis, dilute olivaceo-brunneolis, apicem versus pallidioris, 1–7-septatis, 26–72 μ longis, 3–4.5 μ latis; conidiis obclavato-acicularibus vel cylindraceis, rectis vel parum curvatis, ad basim attenuato-truncatis, apicem versus sensim attenuatis, dilutissime olivaceis, granulosis, indistincte 3–11-septatis, 28–104 μ longis, 3–4.5 μ latis.

Hab. in foliis vivis *Fagarae ailanthoidis* ENGL.; Tansui, Formosa, 26. XI. 1933, leg. W. YAMAMOTO.

Remarks. This species differs from *Cercospora Xanthoxyli* COOKE, occurring on *Xanthoxylum carolinensis*, in having mostly hypophyllous, longer, branched, somewhat geniculate conidiophores and longer, more septate, olivaceous conidia.

5. ***Cercospora malayensis*** STEV. et SOLH. in Myc. XXIII, p. 394, 1931.
Hab. in foliis vivis *Hibisci esculenti* L.; Taihoku, Formosa, 6. XII. 1933, leg. W. YAMAMOTO.

6. ***Cercospora Mucunae-ferrugineae*** sp. nov. (Fig. 2, Nos. 3 & 4)

Caespitulis hypophyllis, in epiphyllo decolorationes indeterminatas irregulares, primitus flavo-brunneas dein sordide atro-brunneolas efficientibus, late effusis, 0.3–9 mm diam., interdum confluendo multo majores et saepe magnam folii partem obtegentibus, fusco-brunneis vel brunneo-griseolis; hyphis mycelii e stomatibus erumpentibus, ad folii superficem repentibus, dilute olivaceis, 2–3 μ latis; conidiophoris plus minusve stipatis, plerumque bina vel complura e stomatibus oriundis, sed saepe singularia in hyphis mycelii ortis, simplicibus vel ramulosis, rectis vel curvatis, apicem versus saepe breviter denticulatis et subgeniculatis,

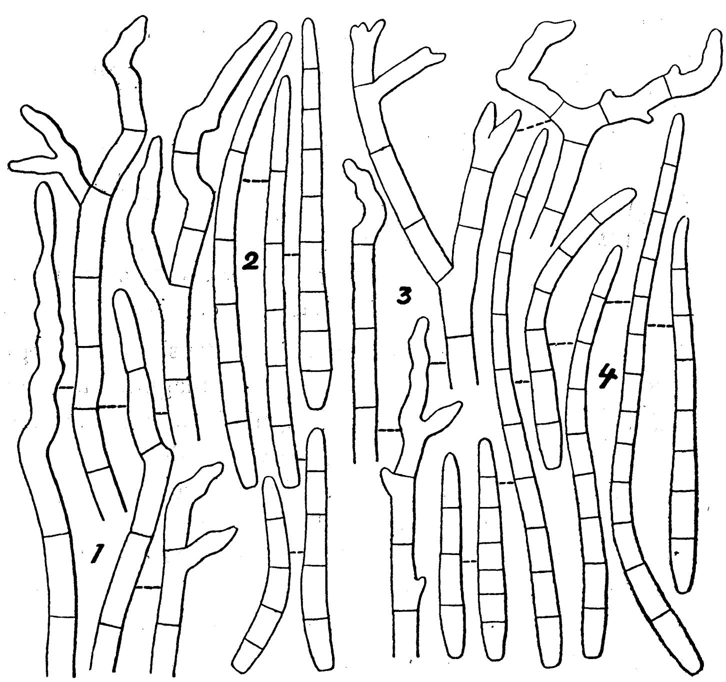


Fig. 2.

Nos. 1 & 2. Conidiophores and conidia of *Cercospora Fagarae* sp. nov.
Nos. 3 & 4. Conidiophores and conidia of *Cercospora Mucunae-ferrugineae* sp. nov. (×ca. 667)

continuis vel 1–7-septatis, dilute olivaceo-brunneolis, 13–62 μ longis, 3–4 μ latis; conidiis cylindraceis vel obclavato-acicularibus, rectis vel parum curvatis, utrinque rotundatis vel obtusiusculis, apicem versus parum attenuatis, indistincte 1–12-septatis, ad septa non vel raro parum constrictis, dilute olivaceis, granulosis, 23–130 μ longis, 3–4.5 μ latis.

Hab. in foliis vivis *Mucunae ferrugineae* MATS.; Taihoku, Formosa, 3. XII. 1933, leg. W. YAMAMOTO.

Remarks. This species differs from *Cercospora Mucunae* SYD. on *Mucuna* sp. in having shorter, branched, denticulate, and somewhat geniculate conidiophores and longer, more septate, slender conidia.

7. *Cercospora neovignae* nom. nov.

Cercospora Vignae RAC. (non ELL. et Ev.) in Zeitschr. für Pflanzenkr. VIII, p. 66, 1898; SACC. Syll. Fung. XVI, p. 1068, 1902; STEVENS, The Fungi Which Cause Plant Disease p. 630, 1919; BUTLER, Fungi and Disease in Plants p. 261, 1918; WELLES, Amer, Journ. Bot. XII, p. 211, 1925; SYD. Ann. Myc. XXVII, p. 434, 1929; WOLLENWEBER, Hyphomycetes (SORAUER, Handb. der Pflanzenkr. 5te Aufl. III, Teil ii) p. 685, 1932.

Cercospora Raciborskii (RAC.) MATS. et NAG. (non SACC. et Syd.) in Journ. of Plant Prot. XVIII, p. 721, 1931.

Hab. in foliis vivis *Vignae sinensis* (L.) ENDL. var. *Catiang* NAKAI; Taihoku, Formosa, 20. XII. 1933, leg. W. YAMAMOTO.

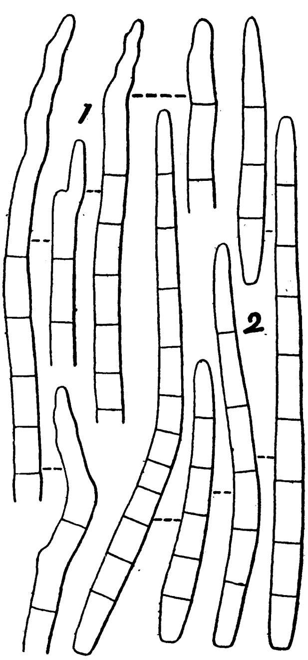


Fig. 3.

Nos. 1 & 2. Conidiophores and conidia of *Cercospora puerаricola* sp. nov. (×ca. 667)

8. *Cercospora pueraricola* sp. nov.
(Fig. 3, Nos. 1 & 2)

Maculis laxe vel densiuscule irregulariterque sparsis, quoad formam et magnitudinem variis, plerumque omnino irregularibus, raro angularibus vel orbicularibus, ca. 2–10 mm diam., primitus brunneis vel atro-brunneis, linea marginali vix vel parum elevatis; caespitulis plerumque epiphyllis, densiuscule dispersis, minutissimis, punctiformibus; conidiophoris dense stipatis, saepe in hypostromate innato-erumpenti ortis, simplicibus vel raro ramulosis, cylindraceis, olivaceo-brunneolis, apicem versus pallidioris et saepe attenuatis, continuis vel 1–5-septatis, ad septa non constrictis, 23-68 μ longis, 3.5–4.5 μ latis; conidiis obclavato-acicularibus vel cylindraceis, rectis vel parum curvatis, ad basim truncatis vel rotundatis, apicem versus sensim attenuatis, 1–11-septatis, plerumque 3-7-septatis, non constrictis, dilutissime olivaceis, 26–133 μ, plerumque 33-85 μ longis, 3-4.5 μ latis.

Hab. in foliis vivis *Puerariae Thunbergianae* (SIEB. et ZUCC.) BENTH.; Taihoku, Formosa, 10. XII. 1933, leg. W. YAMAMOTO.

Remarks. This species differs from *Cercospora Puerariae* SYD. on *Pueraria phaseoloides* (ROXB.) BENTH. in being epiphyllous, and in having shorter, narrower, non constricted conidiophores and more slender conidia.

9. ***Cercospora Ternateae*** PETCH in Ann. R. Bot. Gard. Peradeniya IV, Pt. V, p. 306, 1909; SACC. Syll. Fung. XXII, p. 1419, 1913; BUTLER & BISBY, The Fungi of India p. 143, 1931.

Hab. in follis vivis *Clitoriae Ternateae* L.; Taihoku, Formosa, 11. XII. 1933, leg. W. YAMAMOTO.

Remarks. This species is very closely related to *Cercospora pantholeuca* SYD., occurring on the same host, but it differs in having longer, thicker, more septate conidiophores and longer, more septate conidia.

The writer wishes to express here his heartiest thanks to Prof. Dr. T. MATSUMOTO, under whose direction this study was undertaken, for his many helpful suggestions.

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NOTE ON SOME NEW SPECIES OF FUNGI COLLECTED IN MT. TAISETSU

BY

YOSHIHIKO TOCHINAI AND SUEWO YAMAGIWA

(栃内吉彦・山極末男)

(With 4 text-figures)

Since 1931, the authors have engaged in studies of fungus-flora of Mt. Taisetsu and vicinity. As a part of these studies it is proposed to describe some ascomycetous fungi new to science in the present paper.

Mt. Taisetsu consists of an enormous group of active and extinct volcanos and is situated in the central part of Hokkaido Island. Nearly surrounding a vast central crater-basin which has an average altitude of about 1,800 m. above the sea-level, several peaks over 2,000 m. altitude stand prominently. On the mountain-sides magnificient primeval forests luxuriate and the peaks and crater-basin are covered with well developed associations of alpine plants. The plants are particular and rich in kinds, accordingly the fungi parasitic on them are interesting. The altitude of Mt. Taisetsu is only a little higher than 2,000 m., even the highest point of Peak of Asahi being only 2,290 m., but the climatic conditions are alpine owing to the comparatively high latitude of the locality. It influences the living of plants as well as their parasites resulting in peculiarity of their flora.

The authors have the pleasure to express their cordial gratitude to Professor SEIYA ITO for his valuable suggestions given in the identification of the fungi, and it is their great delight to publish the present paper in this Commemoration Number in honour of his quarter century's service in the Hokkaido Imperial University.

Meliola Vaccinii sp. nov.

Coloniis hypophyllis, atris, circularibus vel irregularibus, diffusis, 0.5–2 mm. diam.; mycelio dense contexto, ramis utplurimum oppositis, repentibus, septatis, fuscis, 6-8 μ crassis; hyphopodiis plerumque alternantibus, forma varia (rhomboideis, angulatis, etc.), stipitatis, 17.5–22.5 × 12.5–15; setis simplicibus, rigidis, rectis, ad apicem attenuatis, septatis, atris, 492–518 μ longis, basi 10 μ crassis;

peritheciis superficialibus, globosis, verruculosis, atris; ascis ellipticis, evanescentibus, 4-sporis, 63.6–120 × 32.4–45.6 μ; sporidiis cylindraceis, 3-septatis, parum constrictis, fuligineis, 45.6–77.5 × 15.6–19.2 μ; paraphysibus filiformibus, hyalinis, 60–110 × 4.4–4.8 μ.

Hab. in foliis *Vaccinii Vitis-Idaei* L. (Koke-momo). Peak Chûbetsu, Mt. Taisetsu vicinity, Prov. of Ishikari, Aug. 20, 1931, Y. IMAI & S. YAMAGIWA.

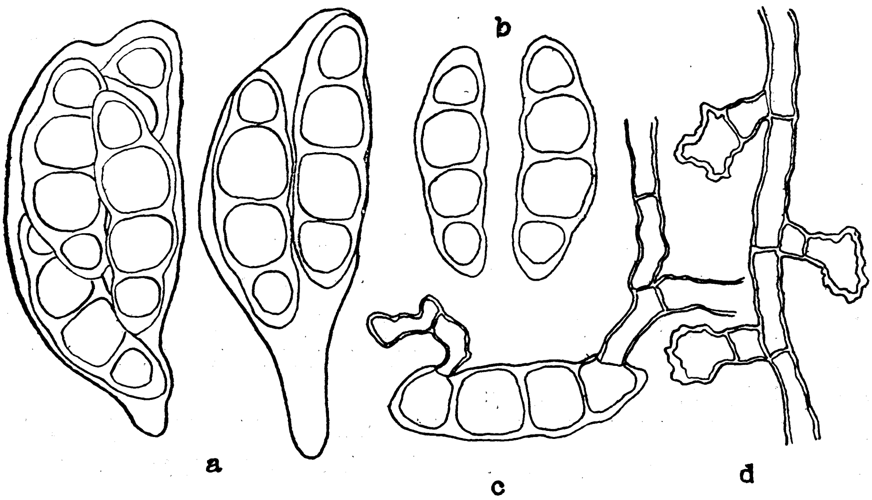


Fig. 1. *Meliola Vaccinii*

a. Asci b. Ascospores c. Germinated ascospore d. Hyphopodia

Remarks: There are three species of *Meliola* parasitic on *Vaccinium Vitis-Idae* and somewhat resembling the present fungus. They are *M. nidulans*, *M. Niessleana*, and *M. pulchella*. The present fungus differs from *M. nidulans* in smaller ascospores and longer mycelial setae, from *M. pulchella* in larger perithecia and ascospores, and in longer mycelial setae, and from *M. Niessleana* in the presence of mycelial setae. It is an unusual fact that the presence of paraphyses is noticed in this fungus. The presence of paraphyses has not hitherto been described in the fungi belonging to the genus Meliola, but the authors should like to consider the present fungus as a new species of this genus, because all the other characters of it are nothing other than those of Meliola.

Didymosphaeria atropunctata sp. nov.

Peritheciis phyllogenis, epiphyllis, punctiformibus, globosis, atris, subcutaneo-erumpentibus, 198–264 μ diam.; ascis tereti-clavatis, brevissime stipitatis, apice

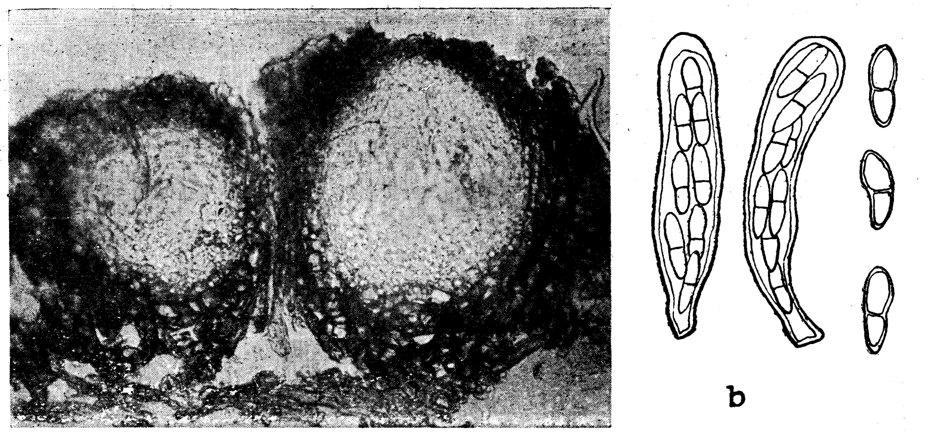


Fig. 2. *Didymosphaeria atropunctata*

a. Perithecia b. Asci c. Ascospores

rotundatis, 27.5-62.5 × 8-12.5 μ, octosporis; paraphysibus filiformibus; sporidiis distichis vel oblique monostichis, oblongo-biconicoideis, olivaceis, 1-septatis, ad septis constrictis, 16.8-18 × 2.6-4.8 μ

Hab. in foliis etiolatis *Arctoi japonici* NAKAI (Urashima-Tsutsuji). Takane-ga-hara, Mt. Taisetsu vicinity, Prov. of Ishikari, Aug. 18, 1931, Y. IMAI & S. YAMAGIWA.

Remarks: The present fungus which may be a weak parasite is found commonly on dying leaves of *Arctous japonicus*, but the perfectly matured specimen is rather rarely met.

Gnomonia polyasca sp. nov.

Peritheciis primo subepidermicis, sparsis, depresso-globosis, membranaceis, atris, 0.3-0.4 mm. lat.; rostro cylindraceo, versus apicem leniter attenuato, rigido, 100-160 μ long.; ascis clavatis, in stipites brevissime attenuatis, 8-sporis, 27.5-45 × 7 5-10 μ; sporidiis bistichis, oblongo-cylindraceis, utrinque rotundatis, infra medium 1-septatis, non constrictis, hyalinis, 4-guttulatis, 10-12.5 × 2.5-5 μ.

Hab. in caule putri *Polygoni polymorphi* LEDEB. var. *ajanensis* REGEL et TIL. forma *pilosi* TAKEDA (Hosoba-ontade). Takene-ga-hara, Mt. Taisetsu vicinity, Prov. of Ishikari, July 18, 1931, S. YAMAGIWA.

Remarks: Young peritheria are formed embedded in the tissue of stem, and on maturity the characteristic beaks project breaking the epidermis. The perithecia are usually formed on dead stems, but they are found very rarely on the nerves of leaf. A perithecium contains extremely numerous asci occupying the whole cavity, and the species name of this fungus is derived from this character. The tip of the clavate ascus thickens a little and two pores are present at the apex which is stained deeply by taking iodine potassium iodide. Ascospore has two cells, the upper cell being larger than the lower one, and containing some guttae.

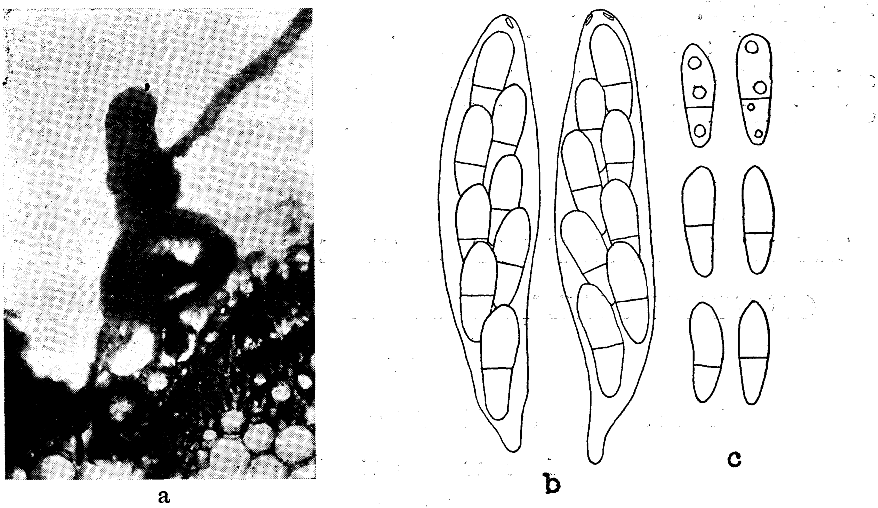


Fig. 3. *Gnomonia polyasca*

a. Perithecium b. Asci Ascospores

Bagnisiopsis coptidis sp. nov.

Epiphylla. Stromate nigro, rotundato vel irregulari, usque 0.4-0.8 mm. diam., 0.16-0.18 mm. alt., depresse pulvinato vel noduloso, epidermide rupta cincto, superficie muriculata, loculis numerosis, 90-180 μ diam., 78-158 μ alt.;

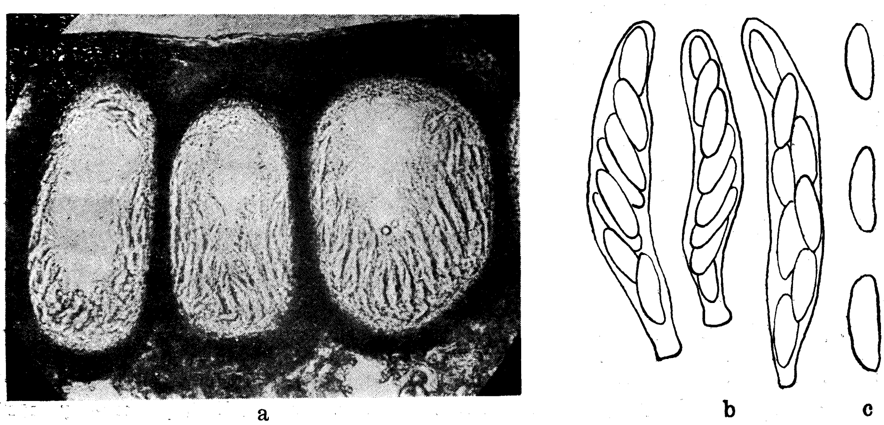


Fig. 4. *Bagnisiopsis coptidis*

a. Perithecia b. Asci c. Ascospores

ascis cylindraceis, apice rotundatis, 50–75 × 10–13 μ, octosporis, brevissime stipitatis, filiformiter paraphysatis; sporidiis distichis, ellipsoideis, continuis, hyalinis.

Hab. in foliis *Coptidis trifolii* SALISB. (Mitsuba-wôren). Peak Kuro-dake, Aug. 11, 1928, G. HAYASHI, Aug. 1931, H. ÔTANI & KIKUCHI; Peak Chûbetsu, Aug. 1931, Y. TOCHINAI.

Remarks: The present fungus attacks the old living leaves of *Coptis trifolia*, and kills them. The pitch-black stromata are formed in the middle of a discolored lesion. Each affected leaf has comparatively few stromata scatteredly.

THE AFTER EFFECT OF THE FUNGUS FILTRATE OF GIBBERELLA FUJIKUROI ON RICE PLANTS

BY

YOSHIHIKO TOCHINAI AND KIICHI ISHIZUKA

(栃内吉彥・石塚喜一)

(With 1 text figure)

Since E. KUROSAWA[1] found, in 1926, that the abnormal elongation of rice seedlings which is the characteristic symptom of the "*Bakanae*"-disease is entirely due to the toxic action of the growth promoting substance excreted by the causal fungus (*Gibberella Fujikuroi*), several investigations of the problem from various standpoints have been reported by many authors. But, in general, the studies hitherto published in connection with the toxic substance in question, have been limited to the early stage of the growth of the affected seedlings.

The present studies have been carried out to learn preliminarily the after effects of the toxin produced by the fungus. The rice seedlings were cultivated under the influence of the fungus filtrate, and the affected seedlings were transplanted at certain intervals in the nutrient solution which contains no fungus excretion. In continuing the sand culture with normal nutrient solution it is examined whether or not the influence of the toxin which worked at the early stage of the development of seedlings affects their further growth.

No. 36 and No. 42, two of the forty seven strains of the "*Bakanae*"-fungus

1) E. KUROSAWA :—Experimental studies on the filtrate of the causal fungus of the "*Bakanae*" of the rice-plants (preliminary report). Trans. Nat. Hist. Soc. Formosa, XVI, pp. 213–227, 1926. (*In Japanese*).

isolated from the affected plants by the authors in 1932, were used for the purpose of obtaining the fungus filtrate.

Fifty c.c. of Knop's solution containing 0.5 % grape sugar were placed in an Erlenmeyer flask of 200 c.c. capacity. After sterilization in a Koch's steam sterilizer, the medium was inoculated with the fungus and incubated in a thermostat at 25° C. for a month. At the end of the culture period, the cultured solution was filtered through a sheet of filter paper to remove the vigorously developed fungus. Thirty c.c. of the fungus filtrate were diluted by the addition of the original Knop's solution up to 120 c.c. in a flask. It was sterilized for one hour in a Koch's sterilizer. The whole amount of the solution was poured into a Petri-dish, 11.5 cm. in diameter and 3.5 cm. in depth, containing 350 grams of sifted sand which had been sterilized previously. The control nutrient solution for the sand culture of rice seedlings was prepared with the fungus free Knop's solution containg 0.5 % grape sugar diluted by the addition of the original solution to maintain the same proportion of dilution as in the case of the fungus filtrate. The rice grains (*Bôzu No. 5*) were beforehand placed in a thermostat at 25°–28° C. to germinate aseptically, and when they attained a length of about 0.5 cm., ten of them were transplanted to each of the sand-culture beds prepared as above mentioned. They were kept in a greenhouse. Sterilized distilled water was added occasionally to avoid the drying up of the culture bed in Petri-dishes. After 10 (in Experiment 1) or 20 days (in Experiment 2), the seedlings were removed to another culture bed after their length was measured. The preparation of the new culture bed will be explained later in each experiment. The newly started cultivation was continued without adding any nutrient except tap water to keep the soil moistened. After the transplantation the development of the rice plants was observed every day until the harvest time when they were cut off at the base of the culms, and compared with the control plants as to the length of leaves and internodes and as to other characters.

Experiment 1.

The fungus filtrate used in the experiment was obtained from the culture of *Gibberella Fujikuroi* strain No. 36. The rice seedlings were first cultured under the influence of the fungus filtrate from Aug. 19 to 28, 1933. On the 28th, the length of the seedlings was measured. They were then transplanted to another culture bed prepared in a pot, 25 cm. in diameter and 15 cm. in depth and full of farm soil. The conditions of the seedlings grown under influence of the fungus filtrate before transplantation were as follows:

Table 1. Effects of the fungus filtrate on rice seedlings before transplantation.

Solution used	Number of plants tested	Length of shoots (in cm.)			Remarks
		Aver.	Maxim.	Minim.	
Fungus filtrate	5	27.71	32.9	19.3	slender, light green
Control	5	13.27	14.1	12.7	normal, green

On Dec. 14, 1933, the rice plants were harvested. The results of measuring the length are shown in the following table.

Table 2. Conditions of rice plants at harvest time.

Culture solution used before transpl.	plants tested	Whole length (cm.)	Length of internodes (cm.)					Length of leaves (cm.)	Length of ears (cm.)	Number of tillers
			I	II	III	IV	V			
Fungus filtrate	1	96.0	35.0	17.8	11.5	14.0	4.5	32.7	13.5	3
	2	93.0	32.7	17.0	11.0	15.3	4.7	33.0	12.3	2
	3	93.0	31.3	17.2	11.0	15.2	4.8	28.8	13.5	3
	4	89.0	34.0	24.0	16.8	—	—	39.2	13.2	2
	5	89.0	34.0	17.0	11.5	13.0	—	32.0	14.2	2
	Aver.	92.1	33.4	18.6	12.3	11.5	2.8	35.1	13.3	—
Control solution	1	86.0	35.0	18.5	11.5	6.7	—	39.3	14.5	2
	2	79.0	32.0	15.5	10.0	8.0	1.0	31.0	12.5	3
	3	78.0	31.0	18.5	9.0	6.5	—	36.5	13.0	2
	4	76.0	28.5	16.5	9.5	8.0	—	32.5	14.0	2
	5	74.0	31.0	19.6	10.5	—	—	42.4	13.0	2
	Aver.	78.6	31.5	17.7	10.1	5.8	0.2	36.3	13.5	—

In the table, the signs I, II,........., V indicate the order of internodes form the upper to the lower, and the length of leaves means that of the last one.

Experiment 2.

The rice seedlings were cultured with the fungus filtrate obtained from the culture of *Gibberella Fujikuroi* strain No. 42 during the period Oct. 1–20, 1933.

Table 3. Effects of the fungus filtrate on rice seedlings before transplantation.

Solution used	Number of plants tested	Length of shoots (in cm.)			Remarks
		Aver.	Maxim.	Minim.	
Fungus filtrate	4	17.7	18.7	16.4	slender, light green
Control	4	10.5	10.9	10.2	normal, green

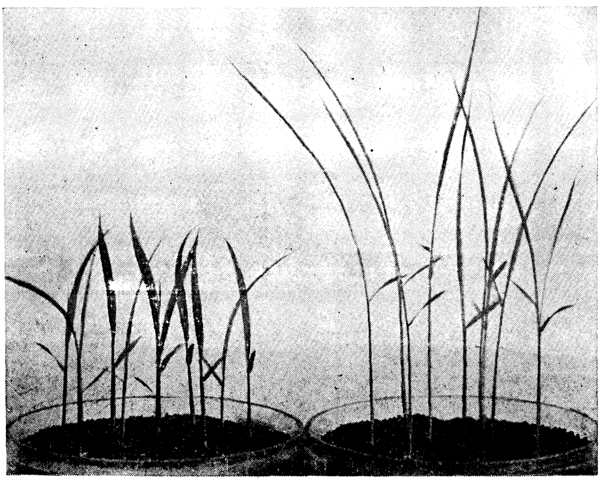
On Oct. 20, 1933, these seedlings were transplanted to a porcelain pot, 13 cm. in diameter and depth, each, and full of farm soil. The rice plants were harvested on Jan. 4, 1934. The results are shown in the following table and the text figure.

Table 4. Conditions of rice plants at harvest time.

Culture sotution used before transpl.	Plants tested	Whole length (cm.)	Length of internodes (cm.)				Length of leaves (cm.)	Length of ears (cm.)	Number of tillers
			I	II	III	IV			
Fungus filtrate	1	57.0	22.5	12.2	7.0	4.7	36.1	10.6	2
	2	55.5	22.2	12.5	7.2	3.0	48.3	10.6	2
	3	55.0	21.7	12.2	6.7	4.7	40.4	9.7	2
	4	54.5	21.8	12.0	8.0	3.0	41.0	9.7	2
	Aver.	55.5	22.1	12.2	7.2	3.9	41.5	10.2	—
Control solution	1	57.0	22.7	12.4	8.0	1.6	42.0	12.3	3
	2	53.0	23.0	11.8	7.0	2.5	34.7	8.7	2
	3	50.0	21.0	11.3	9.0	—	50.7	8.8	3
	4	44.5	16.0	11.7	8.5	0.5	46.7	7.8	2
	Aver.	51.1	20.7	11.8	8.1	1.2	43.5	9.4	—

As shown in Tables 1 and 3, the rice seedlings grown under the toxic influence of the fungus filtrate in both expriments presented remarkable elongation, slender appearance, and lighter color, corresponding with the typical "*Bakanae*"-symptoms. With in a few days after transplantation into normal culture bed, however, they began to put forth newly developed leaves which were hardly distinguished in morphological appearance from those of the control plants, and in respect to other features of growth produced by them in successive days there was no distinct difference from the control plants. Though they were apparently taller in whole length than the control plants in the first experiment, comparing the corresponding plant-parts, they were almost equal in respect to

A



B

Fig. 1. Results of Experiment 2.

A. Seedlings grown in the fungus filtrate on right; control on left.

B. Rice plants transplanted from A, photographed at harvest time. The position of the plants corresponds to that in A.

length of the last leaves, ears, upper internodes of the culms, and number of tillers, but rather conspicuously longer in the lower internodes. This latter point was also clearly recognized in the second experiment. Therefore, the difference in the whole length between affected plants and the control ones seems to be attributable chiefly to the elongation of the lower internodes which occurred before transplantation as a result of the toxic influence of the fungus filtrate.

Considering the results obtained in the above experiments, the following conclusions may be induced:

1). The reactions of the rice seedlings to the fungus filtrate of the "*Bakanae*"-fungus, *Gibberella Fujikuroi*, are limited only to the period during which they are cultured with the nutrient solution containing the growth promoting substance excreted by the fungus.

2). When the rice-seedlings abnormally elongated under the toxic influence of the fungus filtrate of the "*Bakanae*"-fungus are transplanted in an early stage of growth to the toxin-free culture bed, they soon recover from the "*Bakanae*"-symptoms and continue normal or healthy growing and bear as large a harvest of grains as the control plants.

Finally the authors wish to express their heartiest thanks to Prof. S. ITO for his valuable suggestions given in the course of the present investigation.

IDENTIFICATION OF A PERIDERMIAL STAGE ON THE SEEDLINGS OF ABIES MAYRIANA AND THE INJURY CAUSED THEREBY

BY

SENJI KAMEI

(亀 井 専 次)

(With 3 Text-figures)

Up to the present time it has already been learned that about 22 species of white-spored rusts out of 50 have their peridermial stages on the needles of Abies. If in any certain locality Abies is attacked by various kinds of such peridermia, the distinction between them is of great interest from the etiological as well as from the taxonomical point of view.

After a comparative study of the spermogonia of various species of rusts on *Abies balsamea* (L.) MILL., HUNTER (4) claimed that the morphology of spermogonia accompanying peridermia shows the most distinctive criteria. Moreover, FAULL (2), under whose direction HUNTER's work was done, thus commented upon this fact: "in general there is a characteristic type of each genus, and these types are similar for genera that on other grounds might be considered more closely related. In some cases the forms within a type are distinctive for individual species".

The writer also has had the opportunity to compare the peridermial stages of various species of rusts on *Abies Mayriana* MIYABE et KUDO and other related species and is likewise able to admit that they can be classified into some similar groups by the morphology of spermogonia, and these groups may be subdivided by other criteria such as the characters of peridial cells and aecidiospores.

In this paper, the writer intends to report on a case in which he could identify a white peridermial stage on the needles of the seedlings of *Abies Mayriana* raised in the college nursery at Tomakomai to be of *Uredinopsis hirosakiensis* KAMEI et HIRATSUKA f. and how the host-plants suffered injury from the parasite.

Symptoms of the affected needles and seedlings. In the first part of July of last year, the writer happened to visit the Tomakomai Experimental Forest of our University, where in one plot (No. 4) of the nursery he saw many white

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

peridermia attacking a considerable number of the young seedlings of *Abies Mayriana*. The affected parts were restricted to the new leaves made conspicuous by the maculae of pale discoloration or of a reddish colour and deformed to a certain extent. Careful observation of each affected needle showed that this discoloration occupied a half or more of the entire length but was sometimes restricted to a small portion in the middle of each leaf. The discoloured area was light yellow and more or less sharply delimited from the healthy deep green portions. The boundary between the affected and healthy areas was at times very abrupt or at times rather transient. Often on such a faded portion a more or less rosy to dark reddish coloration appeared which was extended to the entire discoloured area or often was limited to a narrow region at the leaf

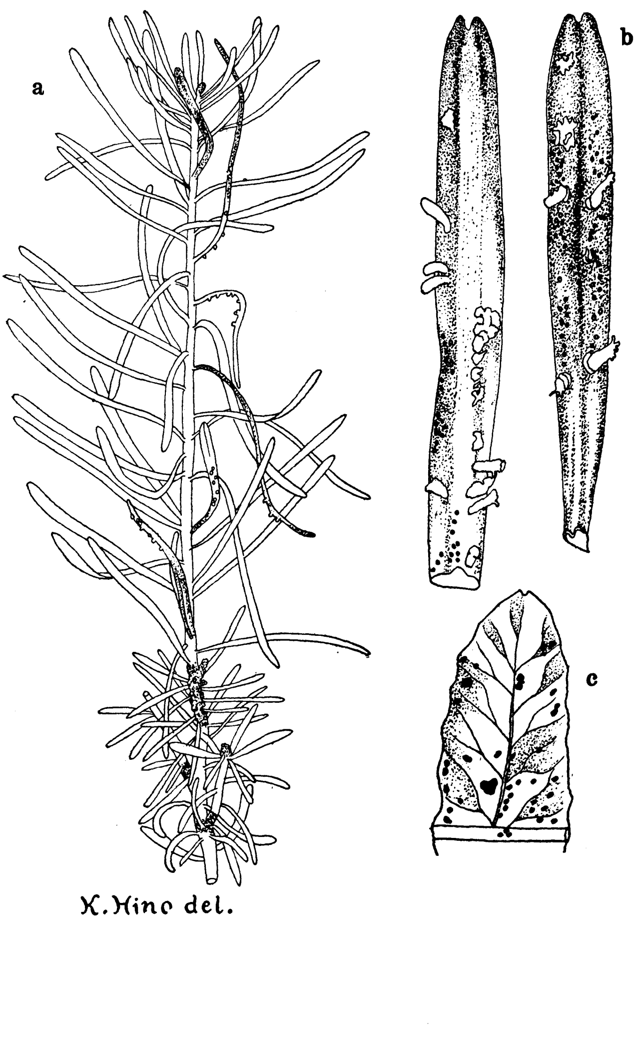


Fig. 1.

a. A three-year old seedling of *Abies Mayriana* in the Tomakomai college nursery affected by *Uredinopsis hirosakiensis* collected in July 10 1933. ×3/4.

b. Two affected needles of the same, on the undersurface distributed by several peridermia and many spermogonia, discoloured and slightly deformed. ×4.

c. A pinna of *Dryopteris Thelypteris* affected by uredo- and teleuto-stages, on the undersurface distributed by uredo-pustules and discoloured. Enlarged.

margin. Such a coloration was more conspicuous on the upper surface. The deformation of leaves was sometimes slightly hypertrophic or sometimes showed a considerable shrinkage which was especially distinct where the peridermia were formed close together. Sometimes this shrinkage was seen to occur very suddenly from the middle portion or sometimes on the basal portion of an affected leaf. The affected leaves were mostly curved flexuously and seemed to be slightly more elongated than the healthy leaves. The diseased needles were seen not only amongst those of well grown seedlings but also appeared in the poorly developed ones. One of these affected seedlings and two diseased leaves are shown in Figure 1.

Identification of the peridermial stage in question. It is reasonable to think that there may be a difference in the time of the appearance of peridermia in the field according to the species. Considering from the writer's own experience, the most abundant appearance of the white peridermia on the leaves of *Abies Mayriana* grown in the field of our locality occurs in the later part of the year, namely from September to November. However, FRASER (3) when he performed his experiments to determine the generic relations of the five species of Uredinopsis to *Peridermium balsameum* PECK in Nova Scotia, must have collected the fresh inocula from the field in the later part of June, as his experiments were recorded to have been carried out from June 27 to July 3. Also in the writer's experiments the aecidiospores of the white peridermial stage on the needles of *Abies Mayriana* used in the inoculation to obtain the characteristic uredospores of *Uredinopsis ossaeiformis* KAMEI were collected in Chitose and Nopporo on July 4 and July 9 respectively. So the writer at first thought that this peridermium in Tomakomai may also belong to the species mentioned above before he saw them under the microscope. Quite contrary to his expectation, however, the aecidiospores are much smaller and more roundish. Measurements of 100 fresh aecidiospores range from 14 to 25 μ in length, 11–23 μ in width, and the biometric mean is 18.90 ± 0.12 in length, and 17.55 ± 0.14 μ in width. Moreover the inner wall of the peridial cell is finely striated or alveolated. These special markings of peridial cells are very characteristic as shown in Fig. 2, c. Besides, the spermogonia accompanying the peridermia are colourless, subcuticular, smaller and slightly raised from the surface, more or less depressing the epidermal cells or even the subepidermal tissue, and subconoidal to lenticular in shape. Twenty spermogonia in the longitudinal sections measured 80–140 μ in length and 50–80 μ in width, and the average 105.9 μ in length and 64.2 μ in width. None of these characters of the aecidial phase agree with those of *Uredinopsis ossaeiformis* in which the aecidiospores are more oblong, more thin-walled, the peridial cells have more distinct verruculose markings and the spermogonia are subepidermal, larger sized, deeply immersed into the mesophyll and more or less globose. On the other hand, considering from the results of the writer's comparative study of the morphology of various white peridermial forms, such characters of the spermogonia as in the case of the Tomakomai specimens agree with the type of Uredinopsis, especially represented by such species as *Uredinopsis filicina* MAGN., *U. Pteridis* DIET. et HOLW., *U. Struthiopteridis* STOERMER, *U. Adianti* KOMAROV, *U. Woodsiae* KAMEI, *U. Athyrii* KAMEI and *U. hirosakiensis* KAMEI et HIRATSUKA f.

The characters of peridial cells and aecidiospores in the fungus in question reminded the writer at once of those of *Uredinopsis hirosakiensis*, with which he was familiar from having studied several specimens obtained from cultures. A comparison of materials obtained both from the field and from cultures is shown in the following table.

Table 1. Comparison of the size of the spermogonia and aecidiospores of *Uredinopsis hirosakiensis* obtained from the field and from cultures.

		Spermogonia			Aecidiospores		
		Number	from the field (Tomakomai)	from cultures (*Abies Mayriana* X2)	Number	from the field (Tomakomai)	from cultures (*Abies Mayriana* VIII5
Length	Range (μ)	20	80—140	74—137	100	14—25	13—21
	Average (μ)	20	105.9	109.3	100	18.90±0.12	17.86±0.10
Width	Range (μ)	20	50—80	37—93	100	11—23	12—20
	Average (μ)	20	64 2	64.9	100	17.55±0.14	16.48±0.10

The inoculation experiments with the aecidiospores in question on *Dryopteris Thelypteris* A. GRAY by the usual methods were successful showing the resulting uredospores to be identical with those of *Uredinopsis hirosakiensis*. The results of the experiments are shown in the following table.

Table 2. Results of inoculation experiments with the aecidiospores of *Uredinopsis hirosakiensis* collected from Tomakomai on *Dryopteris Thelypteris*.

Experiment No.	Plants inoculated	Date of inoculation	Date of first appearance of uredosori	Remarks
I	*Dryopteris Thelypteris*	July 12 1933	July 22 1933	Potted plants were used for inoculation. After the inoculation covered by bell-jar for two to three days. Then the pot was laid in cooler place.
II	,,	July 16 ,,	July 21 ,,	Pinnae of host plant were used for inoculation. They were laid on moistened paper lined inside of a glass-dish. Then the dish was laid on the laboratory desk.
III	,,	July 22 ,,	July 29 ,,	Same as No. I

Considering from these results of the artificial inoculation experiments with the aecidiospores it is believed that the aecidial stage in question may safely be admitted to be the antithetic phase of *Uredinopsis hirosakiensis* which is parasitic on *Dryopteris Thelypteris*.

Actually when the writer visited Tomakomai on Oct. 31 last year, though somewhat late in the season, he was able to see many fronds of *Dryopteris Thelypteris* near the nursery beds as well as in the immediate neighbourhood attacked by this rust presenting the characteristic discoloration and many uredosori. An affected pinna in such condition is illustrated in Fig. 1. c.

Remarks on the taxonomy and life-cycle of Uredinopsis hirosakiensis. As has already been mentioned by the writer (6), the uredo- and teleutostages of *Uredinopsis hirosakiensis* were first discovered by Dr. NAOHARU HIRATSUKA early in 1897 at Hirosaki in Prov. Mutsu. In Hokkaido it has also been collected by several botanists such as N. HIRATSUKA, T. MIYAKE, T. FUKUSHI, K. TOGASHI and N. HIRATSUKA f. from the Provinces of Ishikari, Iburi, Kushiro and Tokachi. Moreover it was also collected by Miss. Y. HOMMA from Prov. Echigo in Honshu. The writer himself also collected many specimens from the vicinity of Sapporo and other localities and studied the taxonomy and life-cycle of this rust for many years.

The uredospores are colourless and usually pushed out as powdery masses from the sori which are formed on the undersurface of the frond as well as on

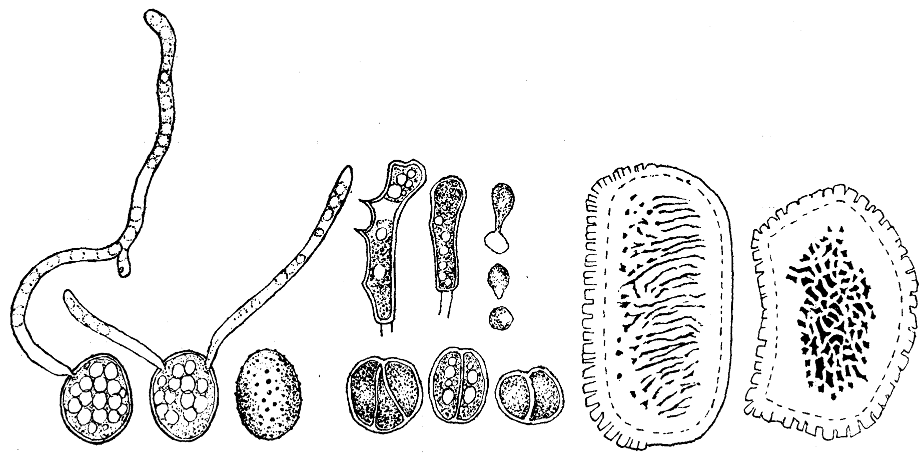


Fig. 2. a. Three uredospores of *Uredinopsis hirosakiensis* showing germination and markings of epispore. ×376. b. Three teleutospores, two promycelia and three sporidia. ×376. c. Peridial cells of a peridermium, the right shows the face view of the inner wall and the other the side view. ×1280.

the stipe. They are more or less globose, mostly ovoid, but often elliptic in shape and the epispore is evenly and sparsely covered with fine verrucose projections. They germinate usually by a slender germ-tube but often two tubes appear simultaneously from two germ-pores laid on both sides near the apex or on points near both ends of either side of the spores (Fig. 2 a). But the total number of pores could not be definitely determined, so that it can not be stated here whether these features do agree with those in the cases of *Uredinopsis mirabilis* MAGN. (3) and *Uredinopsis Phegopteridis* ARTH. (1) or of *Pucciniastrum Potentillae* KOMAROV and *Pucciniastrum arcticum* TRANZSCH. (8). On the other hand, these uredospores are adorned by neither beak nor ridges with which they are usually equipped in the case of the typical species of Uredinopsis, for instance, *Uredinopsis Atkinsonii* MAGN., by which rust one and the same species of the host plant is attacked in North America has a long beak and two longitudinal ridges quite distinct from the species now in question. So the morphology of the uredospores of this species is not quite similar to those typical species of Uredinopsis but apparently like to those of the species of Pucciniastrum, except that they are devoid of a coloured pigment even in fresh condition. Besides, the subepidermal and colourless teleutospores which are often compactly aggregated just under the epidermis are surely like those of *Uredinopsis Osmundae* MAGN. and *Uredinospsis Phegopteridis* ARTH. regarding which a b c

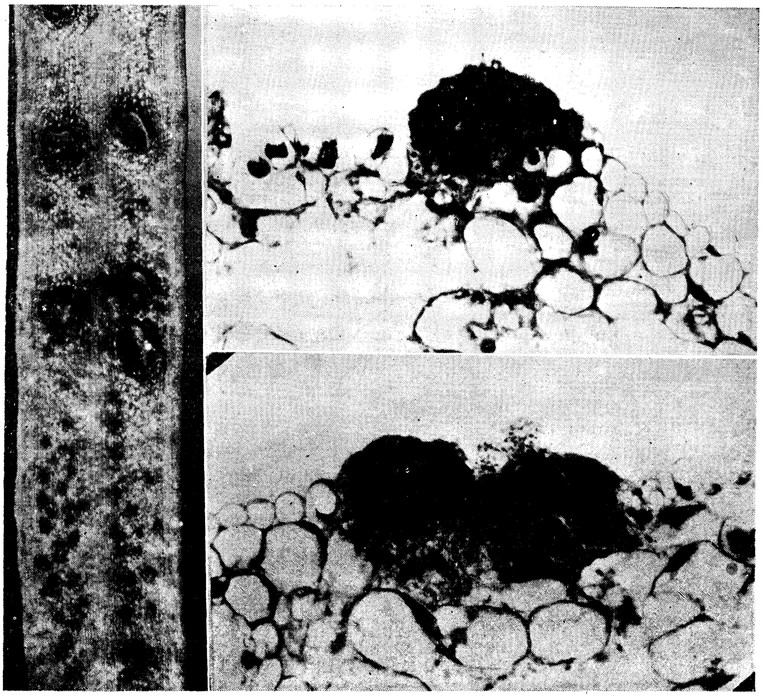


Fig. 3. a. An affected needle of *Abies Mayriana* VI_6, on the undersurface distributed by several peridermia and many spermogonia. ×17. b, c. Three spermogonia seen in the transversal section of the needle of *Abies Mayriana* III_3. ×330.

MAGNUS (7) and BELL (1) respectively have already reported. Each teleutospore is commonly two-celled but sometimes three- to more celled (Fig. 2 b). It germinates after hibernation issuing a promycelium from each cell. Sporidia produced on the promycelium infect the young needles of *Abies Mayriana* in the early summer to produce spermogonia after about two weeks and peridermia after about three to four weeks. The writer successfully obtained such a peridermial stage on the needles of seven seedlings (X_2, III_3, $VIII_5$, VI_6, II_8, II_{10} and X_{10}) out of eight inoculated ones. These spermogonia and peridermia were invariably colourless and unlike those of *Pucciniastrum Tiliae* MIYABE, *P. Styracinum* HIRATSUKA and *P. Epilobii* OTTH. Magnified photographs of an affected needle and spermogonia obtained from the cultures are shown in Fig. 3. Moreover in this species the amphispores which in other species of Uredinopsis usually accompany the ordinary uredospores are not found so far as the writer is aware.

After a careful perusal on every stage of life-cycle in this rust it seems to preferable to consider the fungus in question to be a species of Uredinopsis in spite of the peculiar characters furnished in its uredospores. So, the writer has already published its technical description based on this idea.

Damage to the seedlings. When the writer first saw this peridermium on the needles of the seedlings of *Abies Mayriana* at the nursery bed (Plot No. 4) at Tomakomai, he attempted to count number of the affected seedlings taking three different standard areas (1 square meter) and obtained from each area 58.7, 56.4 and 41.1 percent as the number of diseased seedlings respectively. Mr. SHIGEJI ITO of whom was requested further surveying of these injuries over the entire area of the nursery beds, reported with several packets of specimens and the accompanying table (Table 3). A considerable number of the affected needles selected from each specimen were soon inspected and were determined to be the same fungus as those from plot No. 4 above mentioned. So, if these seedlings counted by Mr. ITO were invariably attacked by this rust in question, the total number of diseased young seedlings of 2 to 10-years old, attained to 20368, varying 6 to 51 percent according to the plot. Moreover the writer saw the same peridermium also on the needles of numbers of seedlings (11-years old) grown in the plantation plot at XXI division of this college forest.

Secondly, to estimate the amount of the diseased leaves per seedling, careful inspection was made of each of 50 seedlings taken from plot No. 4. It was ascertained that 1 to 11 leaves were attacked per seedling. As the total number of the needles of a new shoot count 20 to 239, the percentage of attacked needles remains only 19 percent at most. However, in the case of such small seedlings as those of only 4 cm. height even such a grade of injury may surely offer a considerable damage to their vigour.

Table 3. General features of damage of seedlings of *Abies Mayriana* attacked by *Uredinopsis hirosakiensis* in the plots of the college nursery at Tomakomai.

Plot No.	Area (tsubo)*	Year of sowing	Total number of seedlings	Age of seedlings (years)	Average height (cm.)	Average diam. (mm.)	Total number of diseased seedlings	Percentage of diseased seedlings
4 a	20.0	1931	23203	3	9.1	2.9	6278	27
4 b	30.0	1931	6240	3	4.7	1.4	1260	20
II	7.5	1924	207	10	55.0	9.0	69	33
IV. A	23.0	1931	28244	3	6.0	1.5	3389	12
IV. B	6.0	1924	200	10	35.0	7.5	76	38
V. A	5.5	1924	111	10	50.0	9.5	57	51

Plot No.	Area (tsubo)*	Year of sowing	Total number of seedlings	Age of seedlings (years)	Average height (cm.)	Average diam. (mm.)	Total number of diseased seedlings	Percentage of diseased seedlings
V. B	14.5	1931	11928	3	5.5	1.3	3198	27
V. C	30.0	1931	15000	3	7.6	1.2	3900	26
VIII	5.5	1932	35080	2	4.0	1.0	2141	6
Total	182.0	—	120210	—	—	—	20368	17

* A tsubo corresponds to 3.3 square meters.

In conclusion, the writer wishes to express his heartiest thanks for the kind direction of Professor SEIYA ITO.

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PLANTS SUSCEPTIBLE TO DWARF DISEASE OF RICE PLANT

BY

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(福 士 貞 吉)

The symptoms of dwarf disease of rice plant closely resemble those of corn stripe disease in Cuba and likewise those of streak disease of maize and sugar cane in South Africa. The latter diseases are transmitted by the agency of the leafhoppers, *Peregrinus maidis* ASHM. (STAHL 1927) and *Cicadulina mbila* NAUDE (STOREY 1925), respectively. According to STOREY (1925) various species of cultivated and wild grasses are subject to the attack of streak disease of maize. The writer, accordingly, attempted to transmit dwarf disease of rice plant to corn and several other grasses by the agency of the leafhopper, *Nephotettix apicalis* MOSTCH. var. *cincticeps* UHL.

All the inoculated plants were raised in 5-inch pots in insect proof cages and young plants 2 to 10 days after germination were exposed to the infestation of leafhoppers in cages or glass tubes. The cages employed were 30 cm. square and 60 cm. high. The potted young plants were placed in the cages and a definite number of leafhoppers were introduced therein. When the plants were unfavorite food plants for the leafhopper, certain individual insects would not migrate to the plants to feed upon them but remained on the wall of their cages eventually to be starved to death. In the later experiments, therefore, glass tubes were used instead of cages, allowing 3 or 4 plants to be grown in a glass tube and a definite number of infective leafhoppers were transferred on to these plants. The glass tubes were about 30-40 cm. long by 3 cm. in diameter, closed at the upper end with a thin cotton cloth and put on plants to be inoculated. The leafhoppers were allowed to remain there until they all died or the symptom of the disease began to appear.

The results of these experiments are shown in the following table.

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

Table I Results of attempted transmission of dwarf disease of rice plant to cultivated and wild grasses.

Series I Cage Experiment

date	name of plant	No. of insect per plant	length of feeding period	No. of plants	
				inoculated	affected
	Zea mais L.				
July 9 '28	unnamed variety	2	5–12 days	28	0
June 20 '30	Longfellow & Sapporo Hachigyô	3	7–14	10	0
	Setaria italica BEAUV.				
June 30 '30	Yûshi	3	7–14	5	0
	Echinochloa Crus-galli BEAUV. subsp. *colona* var. *edulis* HONDA				
June 30 '30	Shiro Sangoku & Shiratama	3	20	10	5
July 31 "	Shiro Sangoku	2	21	10	9
	Panicum miliaceum L.				
June 30 '30	Wase	3	20	5	5
July 31 "	"	2	20	10	7
Jan. 23 '33	"	1	20	10	6
	Hordeum sativum JESS. var. *vulgare* HACK. subv. *coeleste* HACK.				
Feb. 2 '33	Marumi	1	5	10	0
Oct. 3 '33	*Poa pratensis* L.	2	30	20	6

Series 2 Glass Tube Experiment

date	name of plant	No. of insect per plant	length of feeding period	No. of plants	
				inoculated	affected
	Zea mais L.				
Mar. 1 '33	Sapporo Hachigyô	1	7–10 days	5	0
"	Longfellow	1	7–10	6	0
Mar. 3 "	"	1	7–10	5	0
Mar. 20 "	Sapporo Hachigyô	3	5–7	10	0
Mar. 21 "	"	10	5–7	5	0
	Hordeum sativum JESS. var. *vulgare* HACK. subv. *coeleste* HACK.				
June 14 '33	Marumi	2	7–13	10	0
	Hordeum sativum JESS. var. *hexastichon* HACK.				
Mar. 11 '33	Chevalier	1	7–10	10	0
June 14 "	"	2	7–15	5	0
Mar. 11 "	Golden Melon	1	7–10	10	0
June 14 "	"	2	7–15	10	0
	Avena sativa L.				
Feb. 28 '33	White Belgium	1	7–10	10	0
May 14 "	"	1	7–15	10	1
Mar. 13 "	Race Horse	1	7–15	10	1
May 14 "	"	1	5–7	10	2
	Secale cereale L.				
Mar. 16 '33	unnamed variety	1	7–10	10	3
May 14 "	"	1	5–8	10	0
Nov. 20 "	"	3	4–16	10 (-6*)	1
	Triticum vulgare VILL.				
Mar. 16 '33	Sapporo Harukomugi	1	7–10	10	2
May 25 "	"	3	7–20	3	0
June 7 "	"	2	7–20	10	0
Nov. 20 "	"	3	4–16	10 (-5*)	2
Mar. 17 "	Martin's Amber	1	7–10	7	0
May 25 "	"	3	7–20	5	0
June 7 "	"	2	7–20	10	0
	Setaria italica BEAUV.				
Mar. 16 '33	Yûshi	1	5–10	10	0
Mar. 17 "	Hôten 20–gô	1	5–15	10	0

date	name of plant	No. of insect per plant	length of feeding period	No. of plants	
				inoculated	affected
	Andropogon Sorghum BROT. var. *vulgaris* HACK. subv. *japonicus* HACK.				
Mar. 14 '33	Jagan	1	7–10	10	0
May 15 "	"	1	5–7	20	0
	Andropogon Sorghum BROT. var. *obovatus* HACK.				
Apr. 5 '33	Kuromi Baraho	1	7–10	5	0
	Panicum miliaceum L.				
Mar. 11 '33	Wase	1	10	7	7
Mar. 16 "	Manshû Shiro	1	10	10 (–8*)	2
Apr. 5 "	"	1	12	10 (–6*)	4
	Echinochloa Crus-galli BEAUV. subsp. *colona* var. *edulis* HONDA.				
Apr. 5 '33	Shiro Sangoku	1	12	10	10
Apr. 25 '33	*Alopecurus fulvus* L.	1	10–15	10	7
May 9 "	"	1	10–15	5	1

* No. of plants prematurely died

In the experiments performed in 1928 and 1930, it was not definitely known whether the leafhoppers used were all viruliferous, although they all had been reared on dwarf diseased rice plants. Consequently the results may be regarded as inconclusive when negative. All the leafhoppers used in the experiments conducted in 1933 were progeny from infective female leafhoppers, which had been bred on diseased plants and so it is highly probable that almost all of them were viruliferous.**

As shown in table 1, it has been conclusively proved that *Panicum miliaceum* L., *Echinochloa Crus-galli* BEAUV. subsp. *colona* HONDA var. *edulis* HONDA, *Alopecurus fulvus* L. and *Poa pratensis* L. are subject to attack by the virus causing dwarf disease of rice plant. The symptoms on these plants closely resemble those on rice plant, being characterized by streak and spotting on leaves and stunting of the whole plant. These plants proved to be favorite plants for the leafhopper under consideration. Rye, wheat and oats are slightly susceptible to the disease, infection having been produced in only a small portion of the inoculated plants. This may be partly due to the fact that these plants

** cf. FUKUSHI, T., On the relation between *Nephotettix apicalis* var. *cincticeps* and dwarf disease of rice plant. Agric. & Hortic. 9 : 669–676, 879–890. (in Japanese) 1934.

are uncongenial food plants for the leafhoppers which could not survive on them for longer than two or three weeks at most. The manifestations of the disease on these plants are generally less conspicuous but the severely affected plants are much stunted and the yellowish white spots and streaks on the leaves are striking when viewed by transmitted light.

The plants which gave negative results are corn, Italian millet, barley and sorghum, although some of them may in the future prove to be more or less susceptible, if the work is carried out on a large scale. These plants were apparently unfavorable as food plants for the leafhoppers. They could survive on these plants for less than 15 days and perished sooner or later.

In "Results of experiments with insect pests. Report 8" published by the Shiga Agricultural Experiment Station in 1908, it is briefly mentioned that dwarf disease of rice plant was successfully transferred to *Echinochloa Crus-galli* BEAUV. subsp. *colona* HONDA var. *edulis* HONDA but all the attempts to transmit it to *Panicum miliaceum* L. and *Setaria italica* BEAUV. failed. It appears that similar experiments were repeatedly conducted with invariably the same results during a period from 1904 to 1912 as briefly stated in that Experiment Station's Special Bulletin No. 2 and likewise in Annual Reports for the years 1908 to 1912.

It is worthy of note that *Alopecurus fulvus* L. is susceptible to dwarf disease of rice plant. Since this is a biennial wild grass abundantly growing on the rice fields throughout Japan, it is possible that the virus causing dwarf disease of rice plant may be carried over the winter in this wild grass. However, there are no records to indicate the occurrence of symptoms similar to those of dwarf disease of rice plant on wild grasses and the writer has never met with even one suspected case.

The writer gratefully acknowledges here his indebtedness to Prof. SEIYA ITO for his valuable suggestions.

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ON THE REST PERIOD AND ITS SHORTENING IN SMUT SPORES

(PRELIMINARY REPORT)

BY

SUZUO ENOMOTO

(榎 本 鈴 雄)

It is generally recognized that spores of certain smut fungi such as *Ustilago nuda* (PERS.) KELL. et SW., *U. Tritici* (PERS.) JENS., *U. Hordei* (PERS.) KELL. et SW., *U. grandis* FR., *U. Avenae* (PERS.) JENS., and *Sorosporium Panici-miliacei* (PERS.) TAKAHASHI, germinate with ease, immediately after they have been produced, requiring no period of after-ripening.

So far as the writer's germination experiments are concerned, however, only small percentage of fresh spores of the above mentioned smut fungi germinated in most cases very sparsely, whereas the spores which had been kept at room temperature for several days germinated very readily showing a high percentage of germination. Consequently, it seems that the spores of these fungi may require a rest period before they are ready to germinate.

Aiming to ascertain the rest period and to find a method which will shorten the dormant period and accelerate germination of fresh spores, a series of germination experiments were carried out.

The present paper is a preliminary report of the results of these experiments with special reference to the effect of etherization upon the germination of smut spores.

The writer wishes to express his hearty thanks to Prof. S. ITO for his kind advices.

Rest Period of Smut Spores

Certain investigators of smut fungi such as BREFELD, (2), PARAVICINI (8), KNIEP (6), STAKMAN (10), DAVIS (3), and some others recognized a rest period of spores in certain smut fungi, e. q., *Urocystis Anemones* (PERS.) WINT. (2, 6, 8) *Tilletia laevis* KÜHN (10), *Cintractia Caricis* (PERS.) MAGN. (2), and *Ustilago striaeformis* (WESTEND.) NIESS. (3).

In general, however, spores of smuts, particularly in *Ustilago nuda*, *U.*

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

Tritici, *U. Avenae*, *U. Hordei*, and *U. grandis* are regarded as germinating readily either in water or nutrient solution.

As to *Ustilago Zeae*, KÜHN (7) and BREFELD (1) stated that fresh spores could not germinate in water, but did so readily when they had passed through a period of after-ripening.

On the other hand HITCHCOCK and NORTON (4), experienced no difficulty in making fresh spores germinate in water.

For the purpose of finding whether or not the spores of these fungi require a rest peridd, a series of germination experiments was performed with fresh spores of the smuts at intervals of 1 to 131 days. The germination tests were made by hanging drop cultures with 2 % sugar solution which were incubated at 25°C.

For the germination of the spores of *U. Hordei* distilled water was used incubating the cultures at 20°C. All the hanging drop cultures were examined on the next morning. The results of these experiments are shown in Table 1.

Table 1. Results of germination tests of smut spores

(Number of examined spores is 300 in each test)

Name of Smut	*Ustilago Tritici*	*U. Avenae*	*U. nuda*	*U. grandis*		*U. Zeae*	*U. Hordei*	*Sorosporium Panici-miliacei*
Date of collection	July 6 1933	July 4 1933	June 25 1933	Oct. 12 1932	Oct. 19 1933	Aug. 16 1933	Aug. 31 1931	July 31 1933
Date of test	July 11 1933	July 11 1933	June 27 1933	Oct. 19 1932	Oct. 22 1933	Aug. 23 1933	Sept. 23 1931	Aug. 2 1933
Number of germinated spores	21	13	58	13	8	39	few	64
Percent. of germination	7.0	4.3	19.3	4.3	2.7	13 0		21.3
Date of test	July 14 1933	July 26 1933	July 4 1933	Oct. 20 1932	Oct. 25 1933	Aug. 30 1933	Jan. 23 1932	Aug. 4 1933
Number of germ. spores	43	29	94	47	14	44	168	52
Percent. of germ.	14.3	9 7	31.3	15 7	4.7	14.7	62.3	17.3
Date of test	July 18 1933	Aug. 4 1933	July 11 1933	Oct. 21 1932	Nov. 1 1933	Sept. 19 1933	June 3 1932	Aug. 15 1933
Number of germ. spores	53	47	100	66	28	42	218	25
Percent. of germ.	17 7	15.7	33.3	22.0	9,0	14.0	72.2	8.3

Date of test	July 26 1933	Aug. 15 1933	July 14 1933	Nov. 18 1932	Nov. 16 1933	Oct. 10 1933	July 5 1932	Aug. 30 1933
Number of germ. sposes	56	69	114	111	48	32	169	19
Percent. of germ.	18.7	23.0	38.0	37.0	16 0	10.7	56.3	6.3
Date of test	Aug. 4 1933	Aug. 30 1933	July 20 1933	Dec. 17 1932	Dec. 7 1933	Nov. 16 1933	Sept. 7 1932	Sept. 15 1933
Number of germ. spores	67	41	122	67	91	23	143	22
Percent. of germ.	22.3	13.7	40.7	22.3	30.3	7.7	47.7	7.3
Date of test	Aug. 15 1933	Sept. 19 1933	July 26 1933	Jan. 25 1933	Jan. 14 1934	Dec. 7 1933	Oct. 19 1932	Oct. 10 1933
Number of germ. spores	44	20	197	61	78	31	146	13
Percent. of germ.	14.7	6.7	35.7	20.3	26.0	10.3	48.7	4.3
Date of test	Aug. 30 1933	Oct. 10 1933	Aug. 4 1933	Feb. 23 1933		Jan. 14 1934	Nov. 18 1932	Nov. 16 1933
Number of germ. spores	23	13	49	53		17	144	27
Percent. of germ.	7.7	4.3	16.3	14.3		5.7	48.0	9.0
Date of test	Sept. 19 1933	Nov. 16 1933	Aug. 15 1933	Mch. 15 1933			Dec. 7 1932	Dec. 6 1933
Number of germ. spores	0	23	13	58			102	19
Percent. of germ.	0	7.7	4.3	19.3			34.0	6.3
Date of test	Oct. 10 1933	Dec. 6 1933	Aug. 30 1933	April 20 1933			Jan. 21 1933	Jan. 17 1933
Number of germ. spores	3	18	16	50			101	14
Percent. of germ.	1.0	6.0	5.3	16.7			33.7	4.6
Date of test	Nov. 16 1933	Jan. 13 1934	Sept. 19 1933	May 27 1933			Feb. 23 1933	
Number of germ. spores	0	11	0	44			90	
Percent. of germ.	0	3.3	0	14.7			30.0	

As shown in the above table, fresh spores of the smuts germinated very sparsely except these of *Ustilago Zeae*, *Sorosporium Panici-miliacei*, but with the lapse of days, the percentage of germination gradually increased to attain the maximum and then decreased again eventually diminishing to zero, showing that these spores may require some rest period before their germination.

It seems that the length of rest period of each spore is different to some extent because the germination of the spores did not take place simultaneously.

As regards *Ustilago Zeae*, in the writer's previous experiments, it was found that the fresh spores of this fungus sometimes germinated scarcely at all as pointed out by KÜHN and BREFELD, while in other cases they germinated pretty well as HITCHCOCK and NORTON reported working with the same smut. This may be partly due to the fact that some of the fresh spores require a longer rest period, while the others have passed through the dormant period and are ready to germinate. The spores of *Ustilago Zeae* as well as those of *Sorosporium Panici-miliacei* did not germinate abundantly in most cases, but they retained their germinating power during a period longer than a year.

Effects of Etherization upon Smut Spores

Certain investigators have succeeded in shortening the dormant period of fungous spores. According to THIEL and WEISS (11), citric acid solution was effective to accelerate the germination of teleutospores of *Puccinia graminis tritici*.

Carbon dioxide was used by PLATZ (9) to shorten the rest period of the spores of *U. Zeae* and likewise chloroform vapor and citric acid solution were used by DAVIS (3), for the spores of *Ustilago striaeformis*.

Among various methods tested by the writer the ether-forcing method originally devised by JOHANNSEN (5) for the purpose of forcing lilac flowers was found most effective in causing prompt germination of the fresh spores of the smut fungi under consideration. The procedure employed was as follows. In a tight glass jar the spores were etherized, using from 0.3 to 0.5 cc. of ether per 1 liter of space. After 20 hours' etherization, the spores were taken out and their germinating power was tested by the hanging drop cultures with 2 % sugar solution, incubating about 20 hours at 25°C. On the next morning these drop cultures were examined and the germinated spores counted. It was found, as will be shown in the following table, that etherized spores germinated more readily than the untreated ones. The results of the experiments are shown in Table II.

Table II. Effect of ether-vapors upon the germination of Smut spores.

Name of Smut	Date of collection	Date of test	Amount of ether per liter (in cc.)	Number of spores examined	Number of germinated spores	Percentege of germinated spores	Number of germinated spores untreated	Percentage of germinated spores untreated
Ustilago Tritici	July, 6 1933	July 14 1933	0.5	300	148	49.3	43	14.3
"	"	July 20 1933	0.3	300	74	24.0	42	14.0
"	"	Aug. 5 1933	0.4	300	121	40.3	110	36.7
U. Avenae	July 4 1933	July 14 1933	0.5	300	78	26.0	42	14.0
"	"	July 20 1933	0.3	300	64	21 3	19	6.3
"	"	Aug. 5 1933	0.5	300	101	30.4	51	17.0
U. nuda	June 25 1933	July 14 1933	0.5	300	143	47.7	114	38.0
"	"	Aug. 5 1933	0.3	300	138	46.0	122	40.7
U. grandis	Oct. 19 1933	Nov. 1 1933	0.3	300	53	17.7	28	9.3
"	"	"	0.5	300	97	32.3	28	9.3
U. Zeae	Aug. 16 1933	Aug. 23 1933	0.4	300	191	63.7	39	13.0
"	"	Nov. 2 1933	0.5	3co	139	46.3	29	9.7
"	"	Nov. 2 1933	0.3	300	47	15.7	28	9.3
"	"	"	0.5	300	63	21.0	28	9.3
"	"	Nov. 8 1933	0.3	300	45	15 0	29	9.7
"	"	"	0.5	3co	61	20.3	29	9.7
Sorosporium Panici-miliacei	July 31 1933	Aug. 5 1933	0.4	300	57	19.0	7	2.3
"	"	Nov. 2 1933	0.3	300	38	12.7	18	6.0
"	"	"	0.5	300	34	11.3	18	6.0
"	"	Nov. 8 1933	0.3	3co	40	13.3	17	5.7
"	"	"	0.5	300	62	20.7	17	5.7

Summary

1. Fresh spores of certain smut fungi such as *Ustilago nuda*, *U. Tritici*, *U. Hordei*, *U. grandis* and some others germinated less readily than those which had been kept at room temperature for several days, indicating that these smut spores may require a period of after-ripening.

2. Ether vapor was remarkably effective in causing prompt germination of these smut spores.

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A LIFE-CYCLE OF SPHAEROTHECA FULIGINEA (SCHLECHT.) POLLACCI PARASITIC ON TARAXACUM CERATOPHORUM DC.

BY

YASU HOMMA

(本　間　ヤ　ス)

(With Plate VI)

Up to the present time, the conidial and perithecial formation of Sphaerotheca have been studied by several authors.

The ground work on the development and structure of the ascocarp of Sphaerotheca was done by A. DE BARY, in 1863 (1). The oogonium and antheridium of *Sph. Humuli* are formed at the crossing or touching point of two special hyphae. In 1895, R. A. HARPER (2) reported on the development of the perithecium of *Sph. Castagnei* on Humulus. In 1905, V. H. BLACKMAN and H. C. L. FRASER (3) reported on the ascocarp formation of *Sph. Humuli* on Humulus. In 1907, P. A. DANGEARD (4) published a paper under the title of "L'origine du périthèce chez les Ascomycètes", in which he described the perithecial formation of *Sph. Humuli* parasitic on Humulus. In 1911, Ö. WINGE (5) reported on that of *Sph. Castagnei* parasitic on Melampyrum. In 1914, N. BEZSSONOFF (6) reported on that of *Sph. Mors-Uvae* and *Sph. Humuli.*

In 1913, E. FOËX (7) reported on the development of the conidia of *Sphaerotheca Humuli* var. *Humuli* parasitic on *Erodium malacoides* and also of *Sphaerotheca Humuli* var. *fuliginea* on *Calendula arvensis.* According to him, the basal

(1) A. DE BARY: Entwicklungsgeschichte der Ascomyceten. Leipzig. 1863.

(2) R. A. HARPER: Die Entwicklung des Peritheciums bei *Sphaerotheca Castagnei.* (Ber. d. Deutsch. Bot. Gesell. XIII. 475-481, 1895).

(3) V. H. BLACKMAN and H. C. L. FRASER: Fertilization in Sphaerotheca. (Ann. Bot. XIX. 567-569, 1905).

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(7) E. FOËX: Evolution du conidiophore de *Sphaerotheca Humuli.* (Bull. Soc. Myc. France, XXIX. 251-252, 1913).

cell (conidiophore) is unceasingly divided, forming the spore-mother cells. The spore-mother cell divides into two cells, each cell developing to a normal conidium. Besides, he noted that this mode of formation belongs to the first series of the four types of the conidial formation in Erysiphaceae. In *Sphaerotheca pannosa* on Rosa, the conidial formation coincides with that of *Sph. Humuli.* In 1925 (1), the same author published again on the formation of the conidia of *Sph. pannosa* parasitic on Rosa.

In the present paper, the writer has paid her special attention on the following three points in regard to the perithecial formation which have been left undetermined up to the present time, and also on the conidial formation.

1. On the origin of the antheridial and ascogonial hyphae.
2. On the migration of the nucleus of the antheridium.
3. On the chromosome number.

The writer wishes to express her heartiest thanks to Prof. S. ITO for his valuable advices.

I. Single spore inoculation with the conidia

In the present study, *Sphaerotheca fuliginea* parasitic on *Taraxacum ceratophorum* was used for the material.

The young shoots of *Taraxacum ceratophorum* raised from the cuttings of the root and planted in pots were covered with large glass-tubes whose upper openings were closed with cotton plugs.

On Nov. 19, 1931, the seven pots were prepared, and No. 1 was left as a control; No. 2 was inoculated with numerous conidia; No. 3 was inoculated with three spores; Nos. 4, 5, 6 and 7 were inoculated with a single spore.

The single spore inoculation was made by the following method. The matured conidia were quickly transferred in as small a quantity as possible to slide-glass from the leaf of the affected host plant. A single spore was picked up by means of a fine glass needle under the microscope, and it was gently inoculated on the leaf in the glass-tube.

In No. 2, on Nov. 26, the white patches of the conidia appeared on the leaves, and on Dec. 3, the formation of the perithecia began to take palce. In No. 3, on Nov. 28, the infection spots appeared on the leaf, and on Dec. 6, the formation of the perithecia began to take place.

In No. 4, on Dec. 1, a small white spot appeared on the infected portion of the leaf, and on Dec. 12, the perithecia began to be formed. After a week normal perithecia were abundantly found on the mycelium.

(1) E. FOËX: Notes sur quelques Erysiphacées. (Bull. Soc. Myc. France, XLI. 417-438, 1925).

In Nos. 5, 6 and 7, the spots did not appear on the leaf, while in the control plant no signs of the disease were to be seen.

Besides, 3 out of the 18 pots which were inoculated with a single spore were successfully infected, and the perithecia appeared on the mycelial patches.

By the above experiments, the writer recognized that the male and female sexual hyphae originate from a single conidium in *Sphaerotheca fuliginea*, that is homothallism takes place in the fungus (1).

II. Conidial formation

The incipient conidiophore is formed as a branch from the creeping mycelium on the surface of the host plant, and it is easily distinguished from the mycelial hyphae by its larger size. The young conidiophore assumes a cylindrical shape, and when it reaches about 50 μ in length it is delimited from the mycelium by a septum. (Fig. 1) The young conidiophore is divided into two cells by a septum at its upper portion, forming a new spore-mother cell. (Fig. 2) The nucleus of the young conidiophore divides into two, one of which is included in the new cell while the other remains in the conidiophore. The spore-mother cell divides into two cells, the apical one becoming a normal conidium when matured, and the lower one divides again into two cells. Similar divisions are repeated forming a chain of conidiospores. (Fig. 3-5) In this species, the matured conidia form a chain of spores 2 or 3 in number and the immatured conidia about 2 in number are found beneath them. The spore-mother cell is always found remaining between the immatured conidium and the conidiophore.

In *Erysiphe graminis* and *Podosphaera tridactyla*, when the conidia are abundantly produced under favorable conditions, the conidiophore sometimes divides again into two cells. In this case, the apical cell becomes a new spore-mother cell. But under the normal condition, the spore-mother cell is formed only once on the conidiophore.

III. Perithecial formation

The young perithecia are formed from the center of the mycelial patch which was originated from a single spore. The ascogonium and antheridium are formed at the place where the ascogonial and antheridial hyphae cross each other and touch. The antheridial hypha is more slender than the ascogonial. Both hyphae always run side by side or coil about each other or cross each other. The ascogonium and antheridium seem to arise simultaneously;

(1) Y. HOMMA: Homothallism in *Sphaerotheca fuliginea* (SCHLECHT.) POLLACCI. (Proc. Imp. Acad. IX, 186-187, 1933).

the former is larger than the latter from the start, also, the ascogonium grows more rapidly. (Fig. 6) Sometimes both organs swell up at the base, and adhere closely to each other and become more or less spirally twisted. At first, they are single cells which are delimited from the sexual hyphae with a septum. Later they divide into two cells. The apical cell is the ascogonium or antheridium, and the under one is the stalk cell. (Fig. 7) The ascogonium soon becomes larger than its stalk cell, while the antheridium remains smaller. The ascogonium grows straight up into the subglobose body, while the antheridium clinging to the side of the ascogonium adheres at its upper part. The antheridial nucleus divides into two nuclei, one of which goes into the ascogonium. When both organs become matured, the nucleus of the antheridium seems to have migrated into the ascogonium as two or rarely three nuclei are found enclosed in the ascogonium and one of them is always more or less smaller than the other.

The primary perithecial wall cells are formed from the twisting hyphal cells springing upward from the stalk cell of the ascogonium. (Fig. 8, 9) The enclosing wall thus formed is closed at the upper part of the ascogonium. (Fig. 10) At this time, the antheridium is seen adhering at the outer side of the wall. (Fig. 11) The second perithecial wall cells develop between the ascogonium and the first wall. (Fig. 12) In this stage, the antheridium withers and gradually disappears. Thus, when about 4 to 5 layers of the wall are developed, the appendages arise at the place nearer to the base of the perithecium, and the perithecial hyphae are sent out from its basal portion. (Fig. 16–21) The outer two layers are composed of large cells, whose walls gradually turn brown in color. These layers constitute the so-called outer wall. The inner two or three layers make up the inner wall, which is always hyaline and binucleate.

As the time, when two layers of the outer perithecial wall are developed, the male and female nuclei in the ascogonium conjugate to form a more or less large nucleus. (Fig. 13) Then the ascogonium divides into two cells. (Fig. 14, 15) The upper cell divides again into two cells. (Fig. 16, 17) The same process is repeated thus forming 4 to 5 cells. The penultimate cell is always more or less larger than the rest, and its character for the staining solution differs from the others. This cell gradually grows and forms the ascus. In the young ascus a large nucleus is formed. (Fig. 18) This nucleus divides three times, and eight free ascospores are formed. (Fig. 19, 20) Eight chromosomes could be counted in the first division, but it was difficult to detect them in the second and third division.

IV. The inoculation experiment with the ascospore

The perithecia on the leaves which had been kept dry in the green house were collected in early March. Experiments on germination of the ascospores were made in the laboratory every ten days. On July 5, the ascospores were put on the leaves of *Taraxacum ceratophorum* planted in pots which had been covered with large glass-tubes. On July 16, small white patches were observed on the inoculated portions. On the check plant, the mycelial hyphae did not appear on the leaves. The mycelial patches increased in number by the secondary infection, numerous conidia were produced. On July 22, young perithecia were produced on the first mycelial patch.

Summary

1. The conidia are successively produced from a single spore-mother cell formed at the end of the conidiophore, and the mode of conidial formation noted by FOËX seems to appear under a special condition.

2. The antheridial and ascogonial hyphae are derived from a single spore.

3. The nucleus in the antheridium seems to have migrated into the ascogonium, as two or rarely three nuclei were found in the young ascogonium.

4. In the first nuclear division in the ascospore formation, eight chromosomes were counted.

Explanation of Plate

Fig. 1–5 ×550; 6–21 ×815

Fig. 1. Young conidiophore.

Fig. 2. Spore-mother cell on conidiophore.

Fig. 3–5. Chain of spores on spore-mother cell.

Fig. 6. Male and female branches.

Fig. 7. Antheridium and ascogonium.

Fig. 8, 9. Primary perithecial wall cells from stalk-cell of ascogonium.

Fig. 10. Primary wall closed at upper part of ascogonium.

Fig. 11, 12. Male and female nuclei in ascogonium.

Fig. 13. Conjugated nucleus.

Fig. 14. Two nuclei formed by division.

Fig. 15. Two cells from ascogonium.

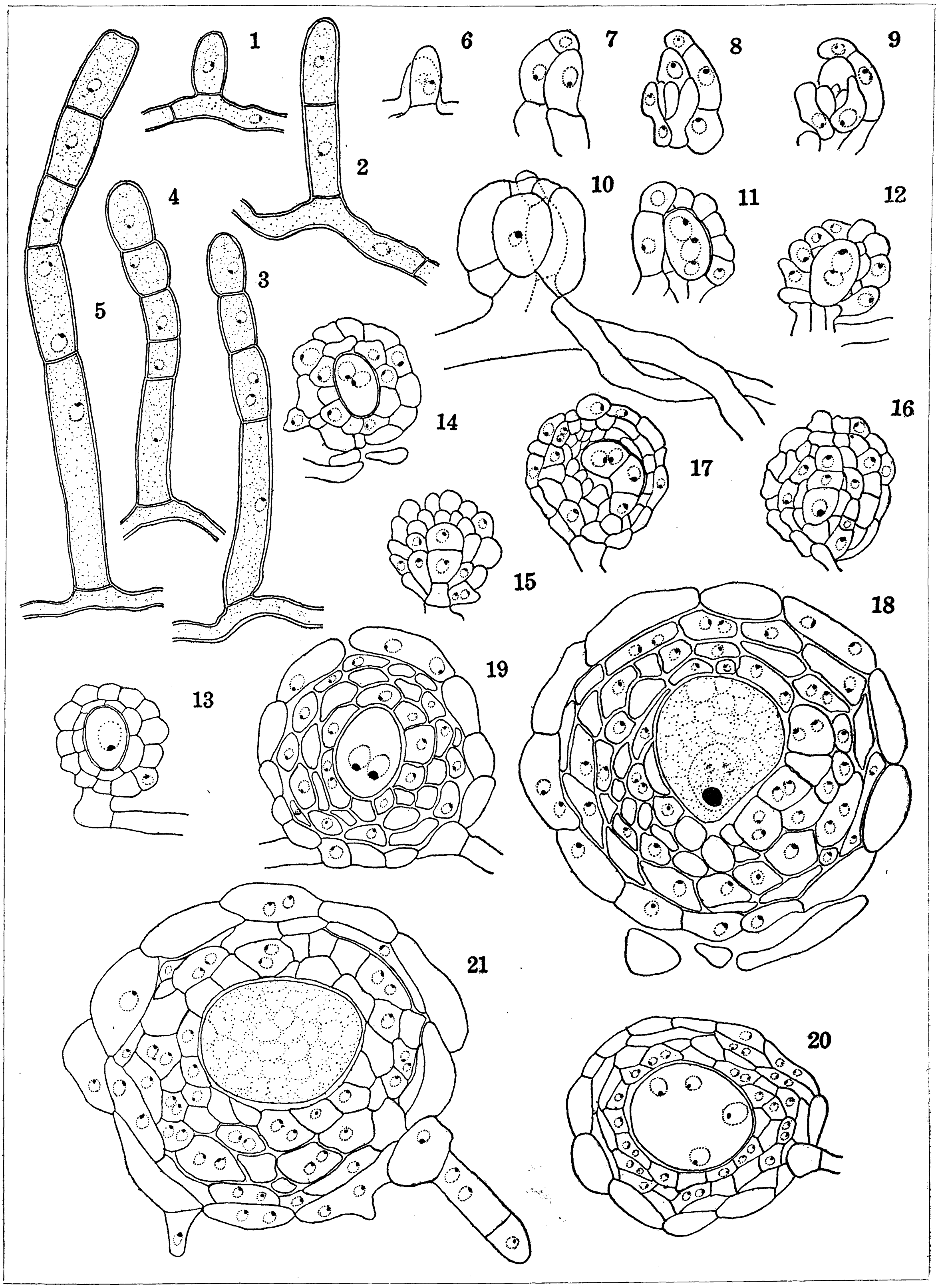
Fig. 16, 17. Three cells from ascogonium.

Fig. 18. Young ascus, including a large nucleus and binucleated perithecial wall cells.

Fig. 19. Two nuclei in ascus.

Fig. 20. Four nuclei in ascus.

Fig. 21 Outer and inner perithecial walls and young appendage.



YASU HOMMA del.

STUDIES ON THE GEOGLOSSACEAE OF JAPAN

BY

SANSHI IMAI

(今 井 三 子)

(With Plate VII)

In the course of taxonomic studies on the Japanese Geoglossaceae during past several years, the writer has obtained a large number of species, in which two genera and eight species seem to be new to science. The writer proposes to report them in the present short paper.

1. ***Ascocorynium*** S. ITO et IMAI, gen. nov.

Proceed. Jap. Assoc. Adv. Soc. VII, 145, 1932, nom. nud.

Ascomata stipitata, carnosa, recta, plerumque clavata vel subcylindracea; clavula plerumque ellipsoidea, clavata vel subcylindracea, laete colorata (vitellina), determinata; asci cylindracei vel clavato-cylindracei, inoperculati, octospori; sporidia crasso-ellipsoidea vel brevi-fusiformia, hyalina, continua; paraphyses nullae. (Pl. VII, figs. 1–2)

Typus: *Geoglossum irregulare* PK.

(Etym. *ascos* + *coryne* + *ium*)

Considering the presence or absence of the paraphyses in the hymenium as an essential criterion in the classification of the genera, the new genus, *Ascocorynium*, is proposed, separating it from *Mitrula* proper.

The type species, *Geoglossum irregulare* PK. [=*Mitrula irregulare* (PK.) DURAND] has no paraphyses, as noticed by DURAND.

It has been recorded by some authors that *Mitrula vitellina* (BRES.) SACC. has filiform paraphyses in the hymenium, but DURAND denied it after a careful examination of BRESADOLA's and American specimens. The species also belongs clearly to the genus.

The species mentioned above were collected in our country and they were given the names *Ascocorynium irregurale* (PK.) S. ITO et IMAI and *A. vitellinum* (BRES.) S. ITO et IMAI respectively.

2. ***Geoglossum subpumilum*** IMAI, sp. nov.

Proceed. Jap. Assoc. Adv. Sc. VII, 148, 1932, nom. nud.

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

Ascomatibus solitariis, clavatis, atris, 1.5-5.5 cm. altis; clavulis lanceolatis, obtusis, compressis, 0.5-1.5 cm. longis, 2-4 mm. latis; stipite gracili, tereti, sursum squamuloso, 1.0-2.0 mm. crasso; ascis clavatis vel cylindraceo-clavatis, apice contractis, poro iodo caerulescente, 8-sporis, 150-210 x 20-27.5 μ; sporidiis fasciculatis, cylindraceo-clavatis vel clavatis, primo continuis multiguttulatisque, demum 7-12-septatis (rarissimo usque ad 14-15-septatis), 62.5-117.5 x 6-7.5 μ (plurima 80-100 μ), fuligineis; paraphysibus filiformibus, pallide brunneis, sursum rectis vel curvatis, apice abrupte ellipsoideis vel globosis, 7.5-10 μ crassis. (Pl. VII, figs. 3-5)

Hab. in terra silvarum. Hokkaido: Ishikari. Oct.-Nov.

Nom. Jap.

The present fungus is allied to *Geoglossum paludosum* and *G. intermedium*, having 7 to 12-septate spores, but it is distinguished from the former species by the black ascophores and early colored spores, as well as by the darker colored longer spores, as well as by absence of epithecium.

Moreover, the fungus differs form *G. pygmaeum* by the shorter and less septate spores, and from *G. pumilum* by the form of the ascophores and spores.

3. ***Geoglossum proximum*** IMAI et MINAKATA, sp. nov.

Proceed. Jap. Assoc. Adv. Sc. VII, 148, 1932, nom. nud.

Ascomatibus solitariis, clavatis, nigris, 1.5-3 cm. altis; clavulis oblongis vel ovatis, obtusis, subcompressis, longitudinaliter canaliculatis rugosisque, nigris, 5-15 mm. longis; stipite gracili, tereti, subaequali, vix curvato, squamuloso, nigresco-brunneo vel fuliginoso-carneo; ascis cylindraceo-clavatis, apice contractis, poro iodo caerulescente, 8-sporis, 130-160 x 16-20 μ; sporidiis subdistichis vel fasciculatis, cylindraceo-clavatis, rectis vel curvatis, primo continuis demum 7-12-septatis, fuligineis, 70-115 x 4-6 μ (plurima 80-100 μ); paraphysibus filiformibus, sursum clavatis et fuligineis, apice abrupte ellipsoideis vel globosis, ca. 6 μ crassis, deorsum subhyalinis, apicibus cum ascis cohaerentibus epithecium brunneum formantibus. (Pl. VII, figs. 6-8)

Hab. ad terram. Honshu: Kii. Apr.

Nom. Jap.

The present species resembles *G. intermedium* and *G. paludosum*, but it is easily distinguished from the former by the early colored larger spores and from the latter by the early colored spores and presence of the amorphous brown epithecium. From *G. subpumilum* it differs also by the presence of epithecium.

4. ***Hemiglossum Itoanum*** IMAI, sp. nov.

Proceed. Jap. Assoc. Adv. Sc. VII, 148, 1932, nom. nud.

Ascomatibus gregariis vel solitariis, ramosis, 1.5–3.5 cm. altis; clavulis ramosis, supra incisis vel lobatis, margine revolutis, 1.5–3 mm. crassis; hymenio glabro, levi, ochraceo vel pallide aurantiaceo, unilaterale tecto; facie sterili pallidiori et furfuracei; stipite rigido, 5–15 mm. longo, 2–5 mm. crasso, sordido-brunneo vel castaneo, recto vel flexuoso; ascis clavatis, circa porum iodo caerulescentibus, inoperculatis, octosporis, 30–45 × 3–6 μ; sporidiis monostichis, longe oblongis vel ellipsoideis, hyalinis, continuis, utrinque leniter obtusis, 5.5–8.5 × 2–2.5 μ; paraphysibus filiformibus, simplicibus, hyalinis. (Pl. VII. figs. 9–12)

Hab. ad terram. Hokkaido: Iburi. Sept.

Nom. Jap. *Fukuro-sango-take*.

Hemiglossum Yunnanense PAT., from China, is probably an unique species of this genus. In comparison with this species, the present fungus quite differs from it in having the beautiful colored and more branched ascophores, while the ascophores of the Chinese fungus are tawny colored and simple or less branched. The present fungus is of interest, reminding some species of *Clavaria* in the macroscopic appearance. This is named in honour of Prof. SEIYA ITO.

5. ***Cudoniella rutilans*** IMAI et MINAKATA, sp. nov.

Ascomatibus gregariis, nonnumquam caespitosis, stipitatis, gelatinoso-ceraceis, 1–4 cm. altis; parte ascigerante pileata, convexa, irregulariter formante vel pulvinescente, uvida, minute papillosa, saepe fissa, rosea, deinde sanguinescente, margine obtusa, aliquantulum strigosa, 1–10 mm. lata; stipite subaequali vel basi attenuato, 1–3 cm. longo, 1–5 mm. crasso, uvido, subtranslucido, succineo, rufescente, crasse verrucoso; ascis cylindraceo-clavatis, apice rotundatis, iodo non caerulescentibus, 8-sporis, 100–125 × 7.5–12.5 μ; sporidiis monostichis vel bistichis, ellipsoideis vel subfusiformibus, rectis vel subventricosis, hyalinis, continuis, 15–22.5 × 5 μ; paraphysibus filiformibus, circa 2.5 μ crassis, ramosis, apice non vel vix incrassatis, curvatis vel leniter uncinatis, brunneolis. (Pl, VII, figs. 18–22)

Hab. ad terram in silvis. Honshu: Kii. Jul.-Aug.

Nom. Jap.

The fungus is easily distinguishable from other members of the genus by the color of fructification.

6. ***Cudoniella jezoensis*** IMAI, sp. nov.

Ascomatibus dense gregariis, stipitatis, gelatinoso-carnosis vel ceraceo-carnosis, albidulis, avellaneis vel brunneolis, 1–4 cm. altis; parte ascigerante pileata, convexa, albidula, avellanea vel brunneola, glabra, sulcato-rugosa, margine involuta, undulata, 3–10 mm. lata; stipite tereti vel compresso, subaequali vel apice leniter attenuato, raro flexuoso, glabro, non levi, concolori, translucido, 2–3 mm.

crasso; ascis cylindraceo-clavatis; apice leniter attenuatis rotundatisque, iodo non caerulescentibus, octosporis, 55–80 × 5–7 μ; sporidiis ellipsoideis, utrinque obtusis, continuis, hyalinis, levibus, monostichis, 5–6 × 2.5–3 μ; paraphysibus filiformibus, hyalinis, apice leniter incrassatis. (Pl. VII, figs. 13–17)

Hab. in lignis putridis in silvis. Hokkaido: Ishikari. Oct.

Nom. Jap.

The present species has small spores by which it is allied to *Cudoniella javanica* var. *microspora* PENZ. et SACC. But it is easily distinguishable from the latter by the larger fructification.

7. ***Sarcoleotia*** S. ITO et IMAI, gen. nov.

Leotia S. ITO et IMAI (non HILL nec FR.) Proceed. Jap. Assoc. Adv. Sc. VII, 147, 1932, pro min. parte.

Ascomata carnosa, stipitata, recta; pars ascigerens pileata, convexa; stipes gracilis brevisque; asci clavati, inoperculati, octospori; sporidia in cumulo rosea, hyalina, subcylindracea vel subclavato-cylindracea, longe continua, demum bicellulata; paraphyses praesentes.

Typus: *Sarcoleotia nigra* S. ITO et IMAI.

(Etym. *sarx* + *Leotia*)

The type species of the present new genus was classified as *Leotia* in our previous paper published in 1932. After careful comparison with many of the other species of *Leotia*, we are inclined to found a new genus, laying stress on the fleshy nature of the ascophores and the subcylindrical spores which are pink colored in mass, while the members of *Leotia* have gelatinous ascophores and hyaline oblong-fusiform spores.

8. ***Sarcoleotia nigra*** S. ITO et IMAI, sp. nov.

Leotia nigra S. ITO et IMAI, Proceed. Jap. Assoc. Adv. Sc. VII, 148, 1932, nom. nud.

Ascomatibus gregariis, pileatis, stipitatis, carnosis, atris, 8–20 mm. altis; parte ascigerante pileata, convexa, hemisphaerica, 6–12 mm. crassa, atra, margine valide incurvata, libera, rugosa vel nodulosa, atro-purpurea; hymenio levi vel rugoso, glabro; inferne avellaneo, furfuraceo; stipite aequali vel deorsum leniter attenuato, 6–16 mm. longo, 1–3.5 mm. crasso, umbrino vel fuligineo, basi subalbido, vix furfuraceo; ascis clavatis, apice contractis, poro iodo non caerulescente, 115–155 × 10 μ, octosporis; sporidiis bistichis, in cumulo roseis, hyalinis, subcylindraceis vel subclavato-cylindraceis, obtusis vel vix acutis, longe continuis, demum uniseptatis, 22.5–35 × 5 μ; paraphysibus filiformibus, ramosis, apice non crassis, brunneolis. (Pl. VII, figs. 23–27)

Hab. ad terram in silvis. Hokkaido: Kushiro. Sept.

Nom. Jap. *Kuro-zukin-take.*

The present fungus somewhat resembles *Leotia atra* FR. (ex WEINM.), but it is distinguished by a larger and glabrous pileus.

9. ***Cudonia constrictospora*** S. ITO et IMAI, sp. nov.

Ascomatibus gregariis vel caespitosis, 1.5–5 cm. altis, carnosis; parte ascigerante pileata, subglobosa vel hemiglobosa, usque ad 1.2 cm. lata, margine acuto, incurvato, undulato vel plano, plerumque ad stipitem adhaerente sed non cohaerente; hymenio convexo, leniter depresso, ruguloso, flavidulo, pallide isabellino vel subochroleuco; stipite 1.5–4.5 cm. alto, sursum attenuato, basi saepe admosum incrassato, apice 1.5–4 mm. crasso, basi ultra 10 mm. crasso, subconcolori; ascis clavatis, basi admosum longe attenuatis, apice contractis, iodo non caerulescentibus, 60–110 × 5–7.5 μ, octosporis; sporidiis leniter clavato-filiformibus sed medio constrictis, fasciculatis, hyalinis, 20–27.5 × 2 μ; paraphysibus filiformibus, tenuissimis, hyalinis, ramosis, apice non incrassatis, curvatis vel circinatis. (Pl. VII, figs. 28–31)

Hab. ad terram in silvis. Hokkaido: Ishikari. Honshu: Rikuzen. Sept.–Oct.

Nom. Jap. *Ô-hoteitake.*

The present species is closely allied to *Cudonia circinans* in macroscopic features. It is distinguished by the shorter spores constricted at the middle portion, as well as by the smaller and long tailed asci.

The microscopic features of this fungus somewhat resemble *Cudonia ochroleuca* (CKE. et HARKN.) DURAND, a Californian species, but the stipe of the latter quite differs from this fungus in being slender, flexuous and white in color.

10. ***Cudonia helvelloides*** S. ITO et IMAI, sp. nov.

Cudonia japonica S. ITO et IMAI (non YASUDA) Proceed. Jap. Assoc. Adv. Sc. VII, 148, 1932, pro parte.

Ascomatibus caespitosis vel gregariis, 2.5–7 cm. altis; parte ascigerante pileata, tenuissima, primo convexa, deinde helvelloidea, 1–2 cm. lata, hymenio primo pallide flavidulo, deinde pallide isabellino, leniter sulcato, centro leniter depresso, subtus ruguloso, primo albido breviterque tomentoso, deinde pallide avellaneo minusque tomentoso, margine acuto, libero; stipite tereti vel compresso, basi leniter incrassato, subconcolori, primo albo-flocculoso; ascis clavatis, apice leniter contractis, iodo non caerulescentibus, octosporis, 95–140 × 7.5–10 μ; sporidiis clavato-filiformibus, hyalinis, levibus, 48–60 × 1.5–2 μ; paraphysibus filiformibus, ramosis, apice curvatis vel circinatis. (Pl. VII, figs. 32–35)

Hab. ad terram in silvis. Hokkaido: Ishikari. Sept.–Oct.

Nom. Jap.

From the description and figures given by YASUDA, we considered the fungus in question to be identical to his *Cudonia japonica* but when the actual type specimen was examined, it became apparent that they are two distinct species, differing in respect to the more thin, delicate and lighter colored ascophores, as well as in respect to the slender and smaller asci and spores occurring in our specimen.

The present fungus seems to be related to *Cudonia orientalis* YASUDA, but the relation between them cannot be determined at the present time, because no specimen of the latter species is preserved in the YASUDA Herbarium and the description given by LLOYD is too brief and incomplete.

Botanical Institute, Faculty of Agriculture,
Hokkaido Imperial University, Sapporo, Japan

Explanation of Plate

Figs. 1–2. *Ascocorynium irregulare*: 1. Asci, × ca. 600. 2. Ascus and spores, × ca. 600.

Figs. 3–5. *Geoglossum subpumilum*: 3. Asci, × ca. 375. 4. Spores, × ca. 650. 5. Apices of paraphyses, × ca. 650.

Figs. 6–8. *Geoglossum proximum*: 6. Ascus, × ca. 375. 7. Spores, × ca. 650. 8. Apices of paraphyses, × ca. 500.

Figs. 9–12. *Hemiglossum Itoanum*: 9. Ascophores, × ca. 1. 10. Asci, × ca. 800. 11. Spores, × ca. 800. 12. Paraphysis, × ca. 800.

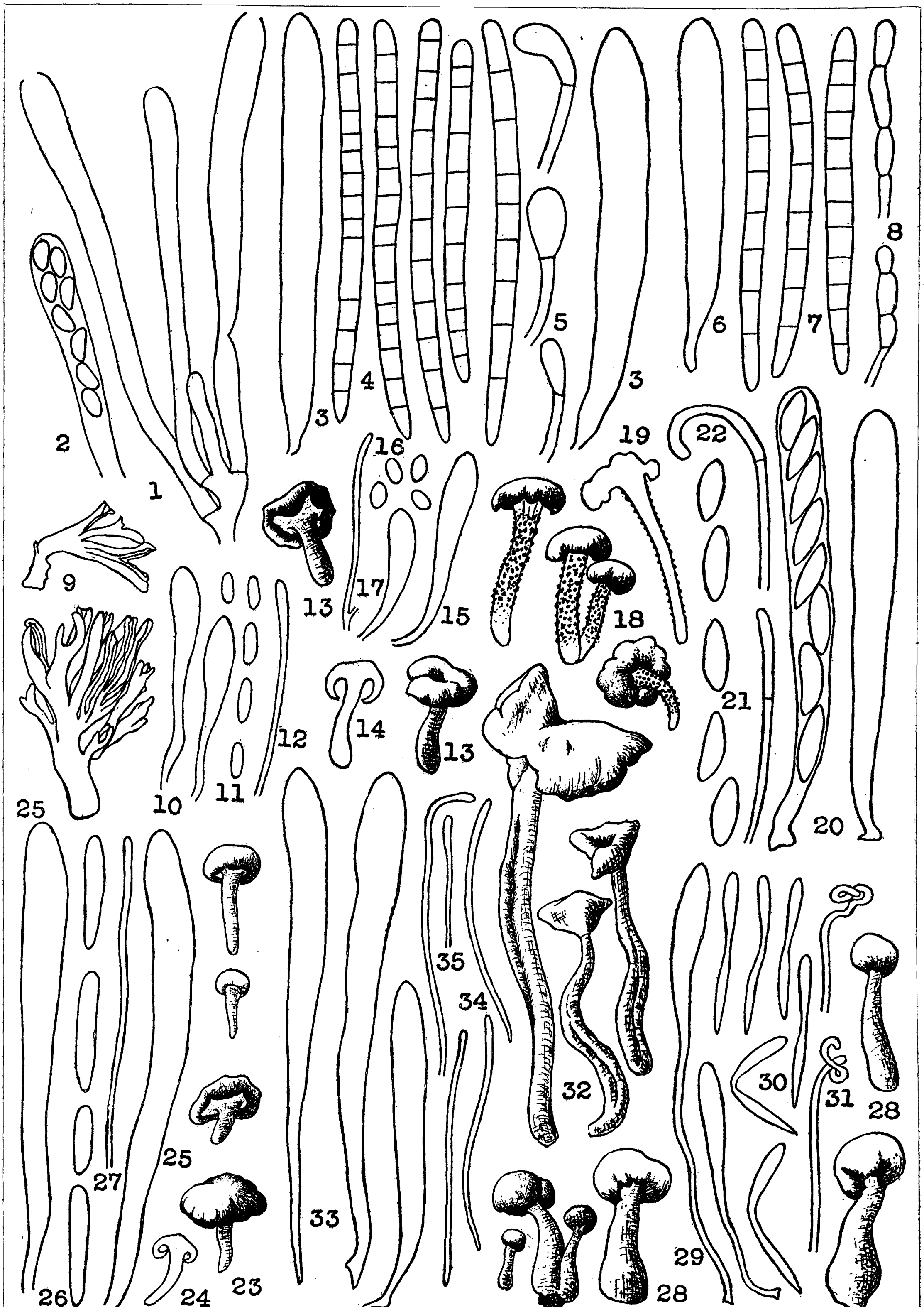
Figs. 13–17. *Cudoniella jezoensis*: 13. Ascophores, × ca. 1. 14. Section of ascophore, × ca. 1. 15. Asci, × ca. 700. 16. Spores, × ca. 700. 17. Paraphysis, × ca. 700.

Figs. 18–22. *Cudoniella rutilans*: 18. Ascophores, × ca. 1. 19. Section of ascophore, × ca. 1. 20. Asci, × ca. 600. 21. Spores, × ca. 600. 22. Paraphyses, × ca. 600.

Figs. 23–27. *Sarcoleotia nigra*: 23. Ascophores, × ca. 1. 24. Section of ascophore, × ca. 1. 25. Asci, × ca. 700. 26. Spores, × ca. 600. 27. Paraphysis, × ca. 600.

Figs. 28–31. *Cudonia constrictospora*: 28. Ascophores, × ca. 1. 29. Asci, × ca. 650. 30. Spores, × ca. 1000. 31. Paraphyses, × ca. 1000.

Figs. 32–35. *Cudonia helvelloides*: 32. Ascophores, × ca. 1. 33. Asci, × ca. 650. 34. Spores, × ca. 7co. 35. Paraphpses, × ca. 700.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S. IMAI del.

ADDITIONAL LIST OF THE FUNGI OF MANCHUKUO

(FIRST NOTE)

BY

HIDEO TAKASUGI

(高 杉 英 男)

In 1928, M. MIURA published "Flora of Manchuria and Mongolia, Part III" in Industrial Materials, No. XXVII, a publication of the South Manchuria Railway Company, enumerating about 500 species of parasitic fungi collected in Manchukuo; and in 1930 Miss Y. HOMMA published a note entitled "Notes on the Erysiphaceae of Manchuria" in the Transactions of the Sapporo Natural History Society, Vol. XI, Part 3. In her paper, Miss HOMMA enumerated 19 species of parasitic fungi belonging to the Erysiphaceae, some of which are again listed here with an asterisk.

In this paper, the writer has enumerated 52 species of parasitic fungi, among which 42 species were quite unrecorded by MIURA, and 10 species marked with a dagger were parasitic on new host plants. The writer wishes to express his hearty thanks to Professors S. ITO and Y. TOCHINAI for their kind guidance and constant encouragement, and also to Mr. M. KUSAMA for the determination of some of the hosts.

PHYCOMYCETES

Peronosporaceae

1. ***Bremia Lactucae*** REGEL
Hab. On *Lactuca Raddeana* MAXIM. (Yamanigana) Kichirin (July 9, 1930, H. TAKASUGI)

2. ***Peronospora aestivalis*** SYD.
Hab. On *Medicago sativa* L. (Murasaki-umagoyashi) Koshurei (June 5, 1928, H. TAKASUGI), Yugakujo (June 10, 1929, H. TAKASUGI)

3. ***Peronospora Brassicae*** GÄUM.
Hab. On *Raphanus macropoda* LEV. (Daikon) Shiheigai (Sept. 20, 1930, H. TAKASUGI). On *Brassica campestris* L. var. *pekinensis* MAK. (Hakusai) Shiheigai (Sept. 20, 1930, H. TAKASUGI), Kinshu (Oct. 6, 1931, H. TAKASUGI)

4. ***Peronospora parasitica*** (PERS.) FRIES
Hab. On *Capsella Bursa-pastoris* MOENCH. var. *auriculata* MAK. (Nazuna) Yugakujo (Oct. 20, 1932, H. TAKASUGI)

5. ***Peronospora Schleideni*** UNGER
Hab. On *Allium fistulosum* L. (Negi) Koshurei (Sept. 13 1928, H. TAKASUGI), Yugakujo (Oct. 24, 1928, H. TAKASUGI ; Oct. 15, 1932, H. TAKASUGI)

6. ***Sclerospora Oryzae*** BRIZI
Hab. On *Oryza sativa* L. (Ine) Yugakujo (July 4, 1933, H. TAKASUGI)

ASCOMYCETES

Exoascaceae

7. †***Taphrina truncicola*** KUSANO
Hab. On *Prunus glandulosa* THUNB. (Niwasakura or Chosen-niwaume) Yugakujo (May 28, 1932, H. TAKASUGI). On *Prunus mongolica* MAXIM. (Oran) Yugakujo (May 28, 1932, H. TAKASUGI)

Erysiphaceae

8. *†***Erysiphe Cichoracearum*** DC.
Hab. On *Helianthus annuus* L. (Himawari) Koshurei (Oct. 1, 1926, H. TAKASUGI)

9. ****Erysiphe Pisi*** DC.
Hab. On *Aeschynomene indica* L. (Kusanemu) Yugakujo (Aug. 29, 1929, H. TAKASUGI)

10. *†***Erysiphe Polygoni*** DC.
Hab. On *Paeonia albiflora* PALL. (Shakuyaku) Koshurei (Oct. 1, 1926, H. TAKASUGI). On *Persicaria glandulosa* NAKAI et OHKI (Oh-inutade) Yugakujo (Oct. 11, 1932, H. TAKASUGI)

11. *†***Microsphaera Alni*** SALM.
Hab. On *Castanea mollissima* BLUME (Shina-guri) Yugakujo (Oct. 18, 1932, H. TAKASUGI)

12. ****Phyllactinia Fraxini*** (DC.) HOMMA
Hab. On *Betula dahurica* PALL. (Ko-onoore) Yugakujo (Oct. 29, 1932, H. TAKASUGI)

13. ***Podosphaera Oxyacanthae*** (DC.) DE BARY
Hab. On *Crataegus pinnatifida* BGE. (Sanzashi) Kichirin (July 8, 1930, H. TAKASUGI)

14. *†***Sphaerotheca fuliginea*** (SCHLECHT.) POLLAC.
Hab. On *Cucumis sativus* L. (Kyuri) Koshurei (Oct. 16, 1926, H. TAKASUGI). On *Phaseolus radiatus* L. var. *typicus* PRAIN (Yaenari) Yugakujo (Sept. 17, 1929, H. TAKASUGI)

15. *†***Sphaerotheca Humuli*** (DC.) BURR.
Hab. On *Agrimonia Eupatoria* L. var. *pilosa* MAK. (Kinmizuhiki) Kichirin (July 8, 1930, H. TAKASUGI), Yugakujo (Oct. 24, 1932, H. TAKASUGI)

16. *†***Uncinula mandshurica*** M. MIURA
Hab. On *Populus Simoni* CARR. (Shimoni-doro) Yugakujo (Oct. 7, 1932, H. TAKASUGI)

17. ****Uncinula Miyabei*** (SALM.) SACC. et SYD.
Hab. On *Alnus japonica* SIEB. et ZUCC. (Hannoki) Yugakujo (Sept. 23, 1929, H. TAKASUGI)

18. *†***Uncinula Salicis*** (DC.) WINT.
Hab. On *Salix viminalis* L. (Manshu-kinuyanagi) Yugakujo (Oct. 7, 1932, H. TAKASUGI). On *Salix gymnolepis* LEV. et VNT. (Kawayanagi) Yugakujo (Oct. 7, 1932, H. TAKASUGI)

Hypocreaceae

19. ***Gibberella Fujikuroi*** (SAW.) WOLLENW.
Hab. On *Oryza sativa* L. (Ine) Yugakujo (July 19, 1932, H. TAKASUGI)

Mycosphaerellaceae

20. ***Mycosphaerella Cannabis*** JOHANS.
Hab. On *Cannabis sativa* L. (Asa) Koshurei (Sept. 17, 1928, H. TAKASUGI)

21. ***Mycosphaerella Maydis*** (PASS.) LINDAU
Hab. On *Zea Mays* L. (Tomorokoshi) Yugakujo (Aug. 10, 1929, H. TAKASUGI)

22. ***Mycosphaerella Schoenoprasi*** (RABH.) SCHRÖT.
Hab. On *Allium fistulosum* L. (Negi) Koshurei (Sept. 13, 1928, H. TAKASUGI)

Gnomoniaceae

23. ***Glomerella Gossypii*** (SOUTHW.) EDG.
Hab. On *Gossypium herbaceum* L. (Wata) Yugakujo (Aug. 9, 1932, H. TAKASUGI)

24. ***Glomerella Lindemuthiaum*** (SACC. et MAG.) BR. et CAV.
Hab. On *Phaseolus vulgaris* L. (Saito) Koshurei (Sept. H. TAKASUGI).

BASIDIOMYCETES

Tilletiaceae

25. ***Tilletia corona*** SCRIB.
Hab. On *Syntherisma sanguinalis* DULAC. var. *ciliaris* HONDA (Mehishiba or Ke-mehishiba) Yugakujo (Aug. 29, 1929, H. TAKASUGI and Aug. 13, 1932, WAN)

26. ***Tolyposporium bullatum*** SCHRÖT.
Hab. On *Echinochloa Crus-galli* BEAUV. subsp. *colona* HONDA var. *edulis* HONDA (Hie) Koshurei (Aug. 21, 1931, S. MASUDA)

Pucciniaceae

27. †***Puccinia Absinthii*** DC.
Hab. On *Artemisia capillaris* THUNB. (Kawara-yomogi) Yugakujo (Oct. 20, 1932, H. TAKASUGI)

28. †***Puccinia Lactucae-denticulatae*** DIET.
Hab. On *Lactuca sonchifolia* DEB. (Inu-yakushiso) Yugakujo (Oct. 20, 1932, H. TAKASUGI)

29. ***Uromyces Eriochloae*** (SYD.) SYD. et BUTL.
Hab. On *Eriochloa villosa* KUNTH. (Narukobie or Suzumeno-awa) Yugakujo (Oct. 15, 1932, H. TAKASUGI)

30. ***Uromyces Genistae-tinctoriae*** (PERS.) WINT.
Hab. On *Caragana ambigua* STOCKS, Yugakujo (Oct. 19, 1932, H. TAKASUGI). On *Caragana Chamlagu* LAM. (Muresuzume) Yugakujo (Oct. 8, 1932, H. TAKASUGI). On *Caragana frutescens* DC. (Ko-muresuzume), Yugakujo (Oct. 8, 1932, H. TAKASUGI). On *Caragana microphylla* LAM. var. *mandshurica* KOM. (Manshu-muresuzume) Yugakujo (Oct. 25, 1932, H. TAKASUGI). On *Caragana sophoraefolia* BESS. Yugakujo (Oct. 25, 1932, H. TAKASUGI)

31. ***Uromyces striatus*** SCHRÖT.
Hab. On *Medicago sativa* L. (Murasaki-umagoyashi) Yugakujo (July 10, 1931, H. TAKASUGI and Oct. 19, 1932, H. TAKASUGI)

FUNGI IMPERFECTI

Sphaeropsidaceae

32. ***Phyllosticta Dioscoreae*** CKE.
Hab. On *Dioscorea Batatas* DECNE. (Nagaimo) Yugakujo (Oct. 7, 1932, H. TAKASUGI)

33. ***Phyllosticta fragariicola*** DESM. et ROB.
Hab. On *Fragaria grandiflora* EHRH. (Oranda-ichigo) Yugakujo (Aug. 11, 1933, H. TAKASUGI)

34. ***Phyllosticta gossypina*** ELL. et MART.
Hab. On *Gossypium herbaceum* L. (Wata) Yugakujo (Aug. 9, 1932, H, TAKASUGI)

35. ***Phyllosticta oryzaecola*** HARA
Hab. On *Oryza sativa* L. Yugakujo (Aug. 16, 1930, H. TAKASUGI)

36. ***Phyllosticta Phaseolorum*** SACC. et SPEG.
Hab. On *Phaseolus radiatus* L. var. *aurea* PRAIN (Azuki) Koshurei (Aug. 3, 1928, H. TAKASUGI)

37. ***Phoma lingam*** (TODE) DESM.
Hab. On *Brassica oleracea* L. (Kanran) Yugakujo (Oct. 15, 1932, H. TAKASUGI)

38. ***Septoria Cucurbitacearum*** SACC.
Hab. On *Cucurbita moschata* DUCH. var. *melonaeformis* MAK. (Tonasu) Koshurei (July 9, 1927, Y. AKAISHI)

Mucedinaceae

39. ***Piricularia Oryzae*** BR. et CAV.
Hab. On *Oryza sativa* L. (Ine) Yugakujo (Sept. 26, 1931, H. TAKASUGI)

40. ***Piricularia Setariae*** NISHIK.
Hab. On *Setaria viridis* BEAUV. var. *purpurascens* MAXIM. (Murasaki-enokoro) Yugakujo (Aug. 9, 1929, H. TAKASUGI). On *Setaria italica* BEAUV. (Awa) Yugakujo (Aug. 9, 1929, H. TAKASUGI)

Dematiaceae

41. ***Alternaria tabacina*** (ELL. et EV.) HORI
Hab. On *Nicotiana Tabacum* L. (Tabako) Hoojo (Sept. 7, 1932, Y. AKAISHI)

42. ***Cercospora circumcissa*** SACC.
Hab. On *Prunus avium* L. (Seiyô-mizakura) Anto (Oct. 15, 1932, S. MORINAGA)

43. ***Cercospora Raciborskii*** (RACIB.) MATSUMOTO et NAGAOKA
Hab. On *Vigna sinensis* ENDL. (Sasage) Mankarei (Sept. 11, 1929, H. TAKASUGI)

44. ***Helminthosporium Maydis*** NISHIK. et MIYAKE
(*Ophiobolus heterostrophus* DRECH.)
Hab. On *Zea Mays* L. (Tomorokoshi) Yugakujo (Aug. 10, 1929, H. TAKASUGI)

45. ***Helminthosporium Panici-miliacei*** NISHIK.
Hab. On *Panicum miliaceum* L. (Kibi) Yugakujo (Aug. 10, 1929, Y. AKAISHI)

46. ***Helminthosporium turcicum*** PASSER.
Hab. On *Zea Mays* L. (Tomorokoshi) Yugakujo (Aug. 10, 1929, H. TAKASUGI). On *Andropogon Sorghum* BROT. var. *vulgaris* HACK. (Morokoshi) Yugakujo (Aug. 10, 1929, H. TAKASUGI)

47. ***Helminthosporium Yamadai*** NISHIK.
Hab. On *Panicum miliaceum* L. Yugakujo (Aug. 10, 1929, H. TAKASUGI)

48. ***Hormodendrum Mori*** YENDO
Hab. On *Morus alba* L. (Karayama-guwa) Yugakujo (Sept. 20, 1933, Y. TOCHINAI)

49. ***Macrosporium abutilonis*** SPEG.
Hab. On *Abutilon Avicennae* GAERTN. (Ichibi or Chimma) Koshurei (Sept. 17, 1926, H. TAKASUGI)

50. ***Macrosporium longipes*** ELL. et EV.
Hab. On *Nicotiana Tabacum* L. (Tabako) Hoojo (Sept. 7, 1932, Y. AKAISHI)

51. ***Macrosporium parasiticum*** THÜM.
(*Pleospora herbarum* (PERS.) RABENH.)
Hab. On *Allium fistulosum* L. (Negi) Yugakujo (Oct. 7, 1932, H. TAKAKUGI)

Sterile Mycelia

52. ***Rhizoctonia Solani*** KÜHN
Hab. On *Solanum Melongena* L. var. *esculentum* NEES (Nasu) Koshurei (April 28, 1928, H. TAKASUGI)

Phytopathological Laboratory,
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ON THE TRIPLOID JAPANESE LILY OF THE VALLEY FOUND IN THE WILD OF HOKKAIDO

BY

ISAMU STOW

(須　藤　勇)

(With 5 text-figures)

The lily of the valley, *Convallaria majaris*, is one of the most familiar and beloved wild flowers in the northern countries. There have been some cytological studies on it, namely of STRASBURGER (1888), WIEGAND (1899, 1900) and SAUER (1910). In 1924, the present writer made some preparations of the anthers of the Japanese lily of the valley, *Convallaria majaris* var. *japonica*, which was cultivated in the Botanical Garden at Sapporo, applying the ordinary paraffin method fixed with the Flemming-Bonn solution. At that time, however, he could not determine the chromosome number, on account of the very abnormal shape of the chromosomes and irregular mode of the reduction division in the pollen mother cells. So it had been assumed that such abnormal figures might be caused by inadequate fixing, till in 1928 success was attained in ascertaining the triploid nature of that plant applying the iron-acetocarmine method. Among the materials from the Botanical Garden two caryological types of *Convallaria majaris* var. *japonica* were found, one was diploid and another triploid. The writer inquired about that triploid plant of Mr. ISHIDA, the garden inspector, who had collected that plant at Tsukisappu, a suburb of Sapporo, several years before. He answered that the plant had bloomed double flowers when it was found in the field, but this character disappeared and the flower became single after it was transplanted to the Botanical Garden. According to the writer's investigation, however, several differences of outer and inner characters between the normal diploid plant and the triploid can be recognized even now.

The diploid *Convallaria majaris* var. *japonica* has eighteen bivalents in the heterotypic division of the pollen mother cell (fig. 1)[1]. The behaviour of the

1) The bivalent chromosome number 18 in the heterotypic division of the pollen mother cell of the European strain of *Convallaria majaris* was also determined (fig. 2). This number agrees wiih that reported by WIEGAND (1899, 1900), but differs from that of STRASBURGER (1888) and SAUER (1910).

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

reduction division is very regular and produces normal pollen grains and few abortive ones.

In the triploid plant, however, some irregularities of the arrangement and segregation of the chromosomes in the reduction division of the pollen mother

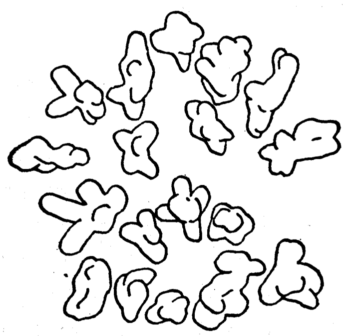

Fig. 1

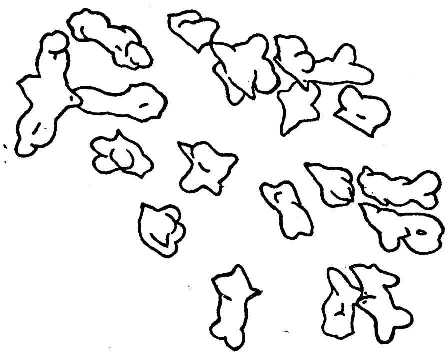

Fig. 2

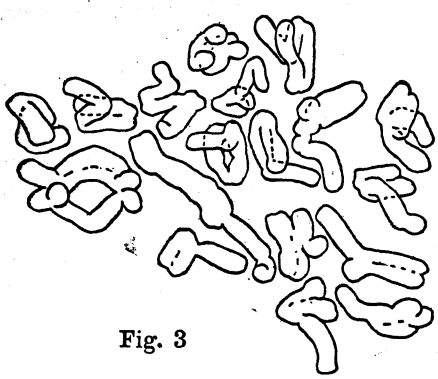

Fig. 3

Figs. 1–3 Metaphase of the heterotypic nuclear division in P.M.C.s. 1) *C. majaris* var. *japonica* diploid type, showing 18 bivalent chromosomes. 2) *C. majaris*, showing 18 bivalents. 3) *C. majaris* var. *japanica* triploid type, showing 18 trivalents.

cells were observed. There are an indefinite number of trivalents, bivalents and univalents mingled with each other in the heterotypic nuclear division and in a few cases apparently eighteen trivalents were observed (fig. 3). The univalents go to the poles at random unsplit in the heterotypic division, and they split in the homœotypic division. The size of the pollen grain is larger than that of the diploid and sometimes we can find irregular shaped or giant or many abortive ones.

The autotriploid plants generally show a tendency for the volume of the cells, the size of the organs and the whole body to increase corresponding to the increase of the chromatin quantity compared with the normal diploid plant (fig. 4, 5). Comparing the cubic values of the length of stoma of the diploid and triploid plants with each other, an approximate ratio 1 : 1.5 was determined which shows the increase of the volume of the triploid cell corresponding to the chromatin quantity (table 1). The flower of the triploid plant is not only larger than the diploid, but also the number of the anthers and petals is increased; 6–9, generally 8, in the triploid, while they ordinarily count 6 in the diploid (fig. 5).

It was noticed by several authors that the size of the leaves of the autotriploid plants is larger than the diploid. The writer's attention was paid to the form of the leaves and he found that the ratio of the breath to the length of the laminæ of the leaves of the triploid *Convallaria* is distinctly larger than that of the diploid (table 1). Under some growing conditions the triploid plants grow sometimes smaller than the normal diploid. However, the ratio of the breadth to the length of the lamina is never disturbed. Therefore, it serves as one of the most useful characters for the distinct recognition of the triploid plants. In fact, paying

Fig. 4

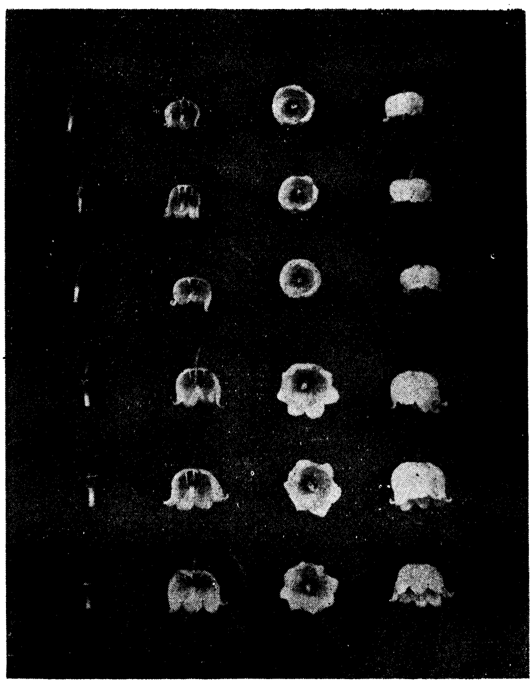

Fig 5.

Figs. 4, 5 *C. majaris* var. *japonica*. 4) aerial portion; left three plants are diploid type and the right three triploid type. 5) Flower organs; upper three rows are normal diploid type and the lower three triploid type.

attention to this characteristic point the writer found some wild triploid plants ot *Convallaria majaris* var. *japonica* and *Paris hexaphylla*. But to what extent such a method can be applied in the case of other plants is a problem to be solved in future.

It is a generally known fact that the lily of the valley grown in Abira, Hayakita, Shimamatsu, Nishitappu and Yunokawa in Hokkaido are larger than those in some other places, and it is believed that the soil or climate conditions of those districts are fit for the growth of that plant. According to the writer's opinion, the giant nature is chiefly caused by the triploid nature of the plant itself. About the origin of such triploid *Convallaria*, the following explanation seems to be probable: The reduction division of the pollen mother cells of *Convallaria majaris* var. *japonica* takes place in early May, and the atmospheric temperature of Hokkaido at that time varies to a relatively high degree, and sometimes the difference between the day and night time becomes very large. So the chance is not so small to produce the diploid pollen grain after the irregular reduction division caused by the abnormal temperature. When a normal haploid egg was fertilized with a diploid pollen, a triploid embryo may be produced. One more noteworthy fact is that the triploid *Convallraia* were found in the open field of volcanic ash soil near the active volcano, Mt. Tarumai, while in the field of ordinary soil far from any active volcano, for instance in Garugawa, the plants are diploid. The above mentioned fact seems to show that there might be some relation between the active volcano and the occurrence of the triploid plants.

Summary

1) The chromosome numbers of *Canvallaria majaris* and *C. majaris* var. *japonica* were determined. both $n=18_{II}$ in P.M.C.

2) There are wild *C. majaris* var. *japonica*, which are larger and more vigorous than the normal diploid plants. They were determined to be triploid plants.

3) The ratio of the breadth to length of laminæ of the triploid *Convallaria* is larger than that of the normal diploid. This is one of the most useful characters for the distinct recogniton of the triploid plants.

Table 1 Comparison of some morphological characters of diploid and triploid types of *Convallaria majaris* var. *japonica*.

			C. majaris	*C. majaris* var. *japonica* (diploid type)	*C. majaris* var. *japonica* (triploid type)	*C. majaris* var. *japonica* (collected at Abira)	*C. majaris* var. *japonica* (Collected at Garugawa)
number of chromosomes in P. M. C.			18_{II}	18_{II}	18_{III}	18_{III}	18_{II}
Stoma	Mean[1] (μ)			52.905±0.055	59.693±0.043	50.599±0.116	
	Standard (μ), deviation			1.317	1.048	1.976	
	Cubic ratio of mean			1.000	1.458	1.640	
Lamina	Breadth	Mean (cm)	4.599±0.0382	6.831±0.0535	10.695±0.0593	8.633±0.0608	5.920±0.1032
		Standard deviatioa (cm)	0.651	0.849	1.010	1.320	1.082
	Length	Mean (cm)	15.280±0.117	15.394±0.0805	18.682±0.131	15.995±0.111	13.430±0.2087
		Standard deviation (cm)	1.953	1.384	2.237	2.403	2.188
	Ratio	Mean (cm)	0.309±0.0024	0.444±0.0018	0.5723±0.0033	0.5495±0.0025	0.4407±0.0082
		Standard deviation (cm)	0.0410	0.0427	0.0562	0.0536	0.0371
	Correla-tion	Coefficient of correlation	0.6347±0.9351	0.7449±0.0185	0.7959±0.1198	0.7928±0.0171	0.51303±0.0696
Number of anther			6	6	(6-9) 8	(6-9) 8	6
Number of petal			6	6	(6-9) 8	(6-9) 8	6

1) The length of the stoma was msasured in distilled water.

PHYCOLOGICAL OBSERVATIONS I

BY

JUN TOKIDA

(時田 郇)

(With Plate VIII and two Text-figures)

Rhododermis Georgii (BATT.) COLLINS

in COLLINS, HOLDEN et SETCHELL, Phycotheca Bor. Amer. No. 1299; COLLINS, Notes on Algae, III, Rhodora, Aug. 1906, p. 160.

Rhodophysema Georgii BATTERS, New or Critical British Marine Algae, p. 377, Pl. 414, Figs. 8–13, 1900.

var. *fucicola* var. nov.

Plate VIII

Frond epiphytic on other algae, of larger dimension than the typical form, 1–2.5 mm in diam., partly cushion-shaped and 20–80 μ high, partly inflated and 0.3–1 mm high; tetrasporangia cruciate, 39–42 μ long, 27–30 μ in diam.; paraphyses 6-celled, 5 μ thick, up to 60 μ long.[1]

Hab. On the fronds of *Iridaea pulchra* KÜTZ., *I. laminarioides* var. *cornucopiae* J. AG., *Gymnogongrus flabelliformis* HARV., *Chondrus pinnulatus* (HARV.) OKAMURA, and *Rhodomela Larix* (TURN.) AG. Japan Sea side of Hokkaido, at Oshoro, Prov. Shiribeshi (TOKIDA, No. 416, March 1930—*The type*; Nov. 1933), and Rumoe, Prov. Teshiwo (H. ÔTANI, April 1932).

The present new variety belongs to Rhodophysema of BATTERS (l. c.), because it has an inflated frond with an inner tissue composed of large parenchymatous

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1. *Rhododermis Georgii* var. *fucicola* TOKIDA, var. nov.—Fronde in aliis algis epiphytica, crassiore, 1–2.5 mm lata, partim pulvinata 20–80 μ alta, partim inflata 0.3–1 mm alta; tetrasporangiis 39–42 μ longis, 27–30 μ crassis, cruciatim divisis; paraphysibus 6-articulatis, usque ad 60 μ longis, 5 μ crassis.

cells. It resembles *Rhodophysema Georgii* BATTERS (=*Rhododermis Georgii* COLLINS) so closely that the dimensions and the habitat are the only differences between them. (Cf. Table I). *Rh. Georgii* has been reported from the European coasts and from the Atlantic side of North America, always growing on leaves, sometimes also on exposed roots, of Zostera. Our variety is epiphytic on other red algae as mentioned above. On *Iridaea pulchra* it grows on margins as well as on surfaces, and causes the malformation of the host. The attacked surface of the host is bent convexly.

Hairs were detected by some investigators (HEYDRICH, 1903[1], Taf. 17, Fig. 5; KYLIN, 1907[2], Fig. 41 d; ROSENVINGE, 1917[3], Fig. 119, B) in the typical form of this species, but they are lacking in our variety as far as the writer has examined.

In the inflated part of the frond the cells of the basal layer always remain unchanged, being in sharp contrast with enlarged cells of the overlying inner tissue. Sometimes the basal layer is composed of two to several layers of small cells similar in size and content. According to ROSENVINGE (1917[3], p. 200, Fig. 120, A, B), in *Rh. Georgii* the cells of the basal layer are partly enlarged at an early period, and partly necessarily left unchanged in size.

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1. HEYDRICH, F., Ueber Rhododermis CROUAN. Bot. Centralbl. Bd. XIV, p. 243.
2. KYLIN, H., Studien über die Algenflora der schwedischen Westküste.
3. ROSENVINGE, L. K., The Marine Algae of Denmark. Part II.

Table I. A list of the habitat, the size of frond, etc. of all the known species and varieties of the Genus Rhododermis.

Species	*R. parasitica* BATT.	*R. elegans* CRAU.	var. *polystromatica* BATT.	*R. Georgii* (BATT.) COL.	var. *fucicola* TOKIDA
Habitat	Stipe of *Laminaria hyperborea* (BATTERS, etc.)	Glass, porcelain (CROUAN). Stones, shells and carapaces of animals, Algae (ROSENV.). *Rhodymenia palmata* (Yendo).	Stone (BATTERS).	Leaf of Zostera (BATTERS, etc.). Uncovered roots of Zostera (ROSENVINGE).	Algae (*Iridaea pulchra*, *Rhodomela Larix*) (TOKIDA).
Size of Frond	0.3–4.5 cm. in diam., 0.1–0.2 mm. thick (BATTERS). 16–150 μ thick (KUCKUCK).	Marginal part 1-cell thick, inner part 2–5 cell thick (ROSENVINGE).	50–100 μ thick (BATTERS). [There is no reason to maintain the variety (ROSENVINGE)].	40–500 μ thick (HEYDRICH). 1/100–1 mm. in diam. (HEYDR.). 0.5 mm. diam. (KYLIN). rarely exceeds 300 μ in diam. (ROSENVINGE).	1–2.5 mm. in diam. 20–80 μ or 0.3–1 mm. thick.
Size of Paraphyses	50–60 : 5 μ (BATTERS). 32–34.5 : 4–4.6 μ (KUCKUCK).	4–5-celled; 40–50 : 5–9 μ (ROSENVINGE). In some specimens paraphyses but few, or almost wanting. (ROSENVINGE).	50–64 : 5–7 μ (BATTERS).	4–6-celled; 50–70 : 5μ (KYLIN). 3–5-celled; 6 μ broad at the base (ROSENVINGE).	6-celled, 60 : 5 μ.
Size of Sporangia	28 : 12 μ (BATTERS). 32–36.8 : 18.4–20.7 μ (KUCKUCK).	24–32 : 16–20 (24) μ (ROSENVINGE). 20–21 : 18 μ (BOERGESEN).	26(–48) : 12(–21) (BATTERS).	24–30 : 14–20 μ (KYLIN). 26–32 : 21–24 μ (ROSENV.).	39–42 : 27–30 μ.
Hairs		Scattered hyaline hairs present between paraphyses or in sterile parts. (ROSENVINGE).		An älteren Exemplaren eine Menge Haare entstehen, bis 1 mm. lang (HEYDRICH). 6–8 μ thick (KYLIN). 5–7 μ thick near the base (ROSENVINGE).	
Locality	Berwick Bay, England. (BATTERS). Helgoland (KUCKUCK).	"Brest" Galliae (CROUAN). Denmark (ROSENVINGE). **Oshoro, Hokkaido** (YENDO).	Berwick Bay, England (BATTERS). Greenland (ROSENVINGE).	Scilly Island (GEORGE; BATTERS). Bai von St. Brelade auf der Insel Jersey (H. VAN. HEURCK; HEYDRICH). Sweden (KYLIN), Denmark (ROSENVINGE).	**Oshoro, and Rumoe in Hokkaido Japan.**

In 1915, *Rhododermis elegans* CROUAN was reported by K. YENDO (Notes on Algae New to Japan, III[1], p. 116) from the Bay of Oshoro near Otaru as to have been found on a two-year old segment of *Rhodymenia palmata*. Since 1930 at the same locality the writer has observed a Rhododermis, i. e. *Rh. Georgii* var. *fucicola*, which prefers to grow on a two-year old frond of *Iridaea pulchra*. As the writer has had no opportunity, unfortunately, to examine YENDO's specimen of *Rh. elegans*, nor could he collect *Rhodymenia palmata* attacked by a Rhododermis, he can say nothing about the identity of YENDO's plant with the variety in question.

Polycoryne denticulata sp. nov.

Text-figures 1 & 2

Frond pulvinate, parasitic on *Phycodrys fimbriata* (DELAPYL.) KYLIN; branches cylindrical, radiate, with a smooth surface while young, more or less denticulate or irregularly ramulose when matured; tetrasporiferous branches filiform, up to 3 mm in length and 0.6 mm in breadth, tetrasporangia oblong-obovate in shape, scattered over the surface, tetrad or obliquely cruciate in division; spermatangiferous branches filiform or clavate and denticulate, up to 3 mm in length, 0.15–0.57 mm in thickness; cystocarpiferous branches capitate with narrow pedicels up to 1.5 mm in length, 0.27–0.31 mm in diam. below, transformed into single or rarely two cystocarps above, cystocarps globose, 0.5–0.84 mm in diam[2].

Hab. Parasitic on *Phycodrys fimbriata* (DELAPYL.) KYLIN. Robben Island, Saghalien (TOKIDA, No. 468, July 1930—*The type*.)

In the Genus Polycoryne there have been described only two species, viz., *P. radiata* SKOTTSBERG[3] and *P. Gardneri* SETCHELL[4]. The former was found at Maihafen in South Ceorgia Island in the Antarctic Ocean, parasitic on *Myriogramme sp.* (*M. Smithii* (HOOK. f. et HARV.) KYLIN ?), the latter at Point Cavallo, Marin County, California, on *Heteronema Andersoniana* (J. AG.) KYLIN. The present Ochotsk species differs from either of these in having denticulate or

1. in Bot. Mag., Tokyo, Vol. XXIX, No. 343.

2. *Polycoryne denticulata* TOKIDA, sp. nov.—Fronde parasitica, pulvinata; ramis teretibus, radiantibus, novellis superficis levi, maturis puls minus denticulatis aut irregulariter ramulosis, tetrasporiferis filiformibus, usque ad 3 mm longis et 0.6 mm crassis, tetrasporangiis oblongo-obovatis, per totam superficiem sparsis, triangule vel oblique cruciatim divisis, spermatangiferis filiformibus vel clavatis, usque ad 3 mm longis, 0.15–0.57 mm crassis, cystocarpiferis usque ad 1.5 mm longis, pedicellis 0.27–0.31 mm diam., apice in cystocarpia singula, raro bina, globosa, 0.5–0.84 mm crassa transformatis.

3. in KYLIN & SKOTTSBERG, Subant. und Ant. Meeresalg., II, p. 36, Figs. 17 e, 18, Tab. I, Fig. 4, 1919.

4. SETCHELL, Parasitic Florideae II, p. 395, 1923.

ramulose branches. As to the position of the cystocarp our species is allied to the Antarctic species, *P. radiata*, rather than to the Californian, *P. Gardneri.*

The pulvinate fronds of *P. denticulata* are formed on the veins as well as on the rest of the lamina of the host plant. Frequently two fronds are found

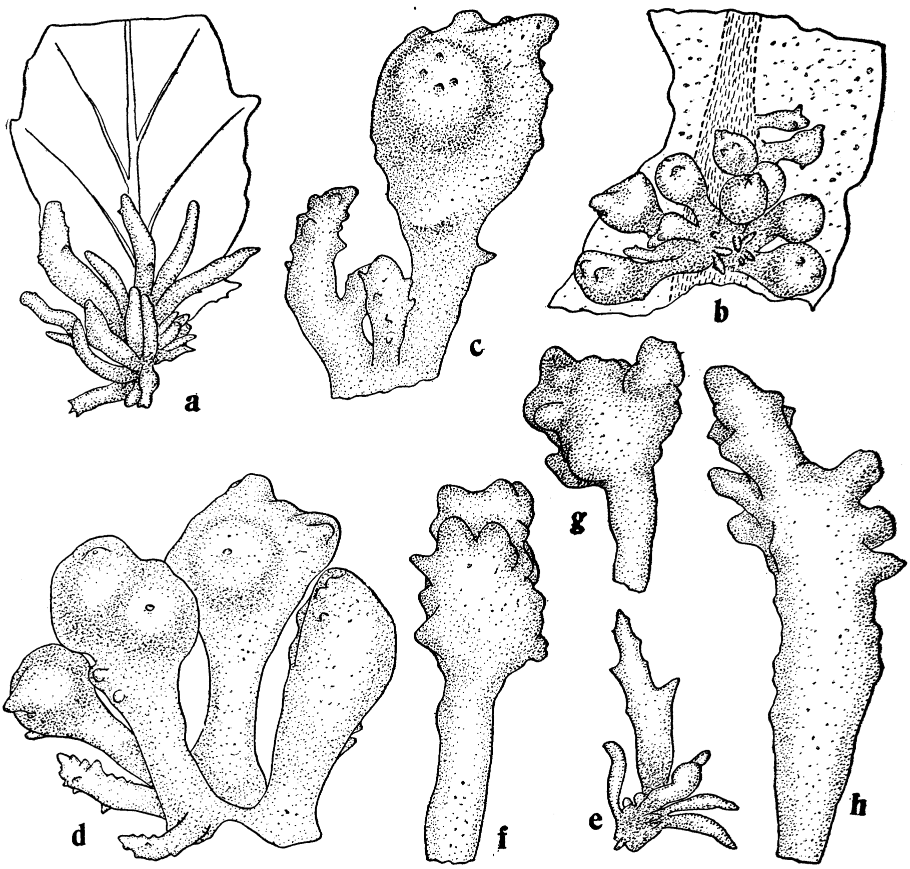


Fig. 1. *Polycoryne denticulata* TOKIDA. a. Tetrasporiferous frond on the basis of a leaflet of the host. b. Female frond on the midrib of the host. c & d. Cystocarpiferous branches. e. Male frond. f–h. Spermatangiferous branches.

a, b. ×10; e ×9; c, d, f, g, h ×25.

growing back to back, so to speak in an antipodal position, on both sides of a lamina. The identity in kind of the reproductive organs of two antipodal fronds seems to be an evidence of their development from one and the same origin immersed in the host tissue.

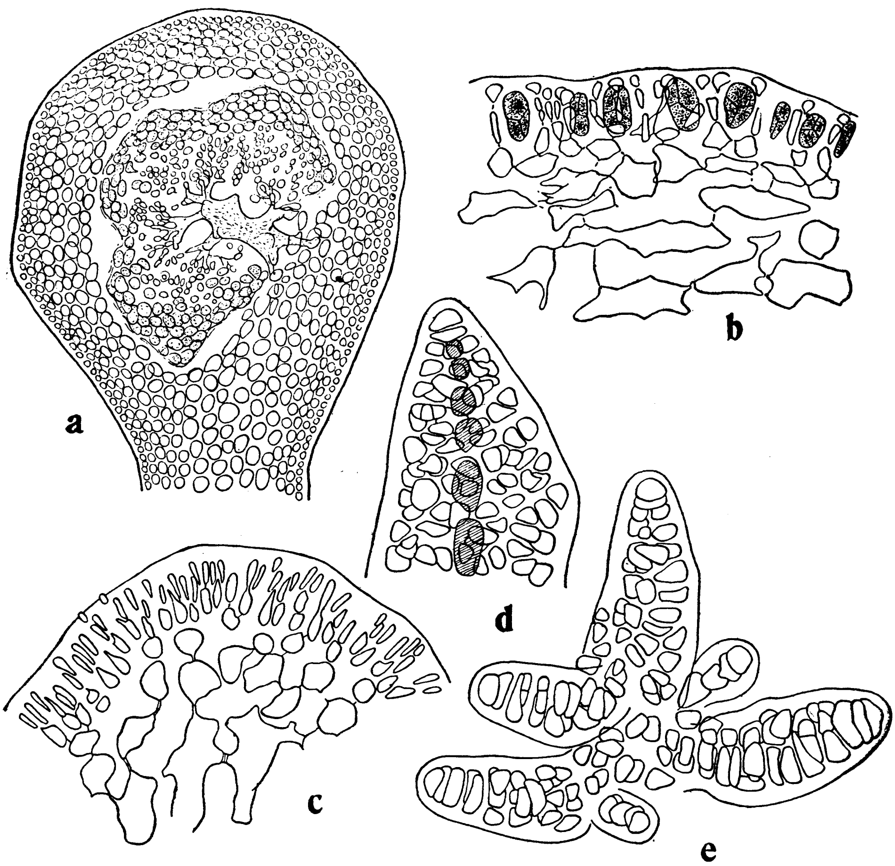


Fig. 2. *Polycoryne denticulata* TOKIDA. a. Longitudinal section of a cystocarp. b. Longitudinal section of a tetrasporiferous branch. c. Cross section of a spermatangiferous branch. d & e. Surface view of young branches; in d the axial cells shaded. a, b ×156; c, d, e ×276.

Here the writer wishes to acknowledge his indebtedness to Emeritus Prof. K. MIYABE and Prof. S. ITO for their constant advices and encouragements in the course of his phycological investigations.

December 1933.

Botanical Laboratory, School of Fishery,
Hokkaido Imperial University, Sapporo, Japan.

Explanation of Plate

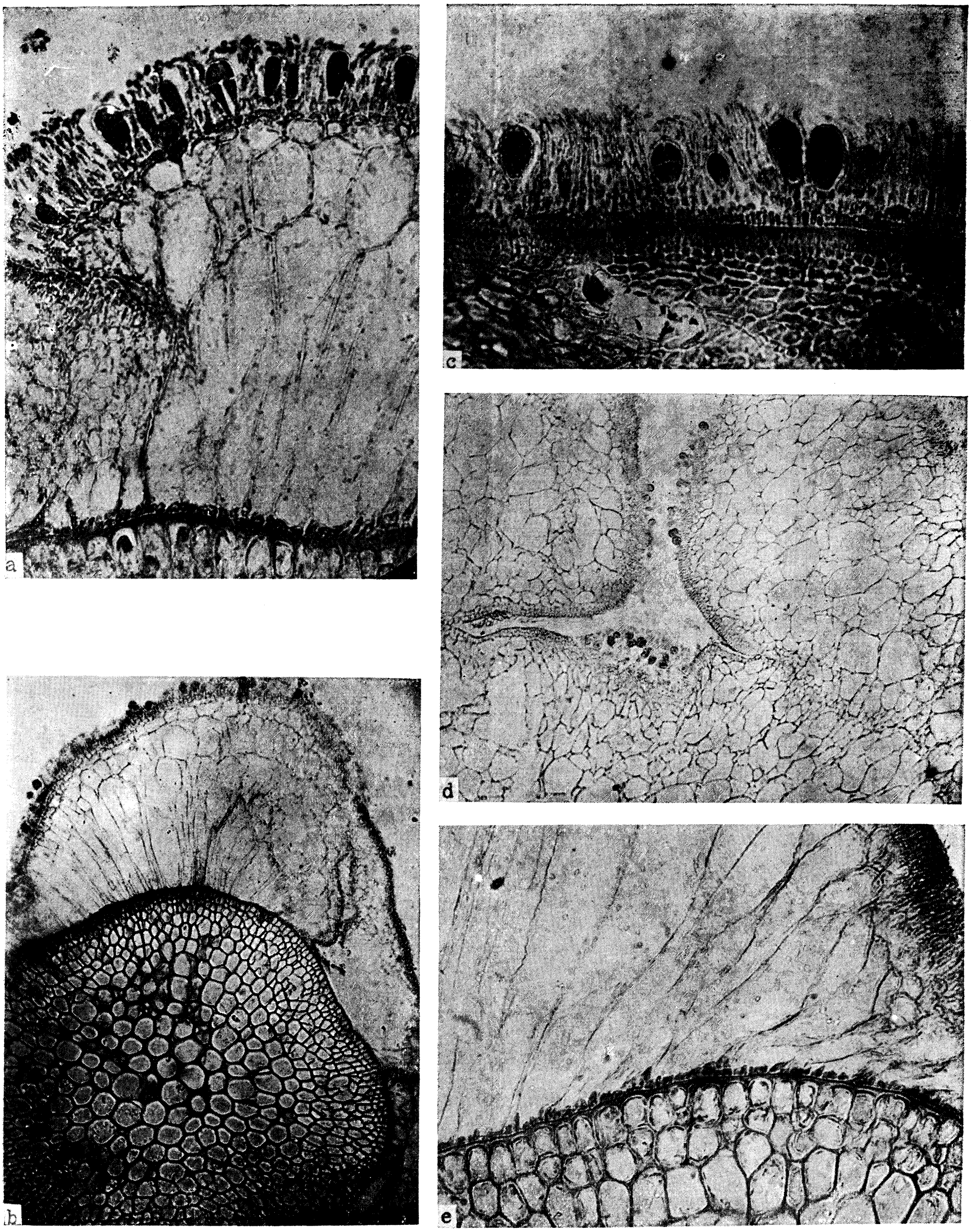
Microphotographs of
Rhododermis Georgii var. *fucicola* var. nov.

a, b and e. Vertical sections of inflated fronds epiphytic on *Rhodomela Larix*. In Fig. e the basal layer composed of one layer of small cells is shown.

c. Section of a cushion shaped fertile frond epiphytic on *Iridaea pulchra*.

d. Eccentric section of inflated fronds (epiphytic on *Iridaea pulchra*), showing the inner tissue.

a, c & e ×273; b & d ×62.



J. TOKIDA Photo.

EINE NEUE ART DES FALSCHEN MEHLTAUPILZES AUF DEM BUCHWEIZEN

VON

ICHIRO TANAKA

(田 中 一 郎)

(Mit 3 Textfiguren)

In Japan befinden sich mehrere schädliche Pilze auf dem Buchweizen, namentlich *Sclerotinia Fagopyri* HORI, welche die Sclerotien im Inneren des davon befallenen Kornes hervorbringt; *Phyllosticta polygonorum* SACC., *Ph. Fagopyri* MIURA und *Cercospora Fagopyri* NAKATA et TAKIMOTO, die Erreger der mannigfaltigen Blattflecken; eine auf den Blättern lebende Peronospora-Art; und eine Art der Gattung Sclerospora, welche die Welkenkrankheit verursacht.

Unter diesen Krankheiten ist der falsche Mehltau noch wenig bekannt, obwohl derselbe schon im Juni 1916 in Sapporo zum ersten Mal gefunden worden ist. Indessen trat dieselbe Krankheit im Jahr 1932 in der Provinz Tokachi, Hokkaido, so heftig auf, dass hier und da ein grosser Teil der Felder davon befallen wurde und völliger Blattabfall und Ernteausfall die Folgen waren. Nach den mikroskopischen Untersuchungen des diese Krankheit erregenden Pilzes musste ich ihn für eine neue Art halten, obschon er vorher als *Peronospora Polygoni* THÜMEN bezeichnet worden war. Daher werde ich hauptsächlich die Morphologie und die Nomenklatur des Erregers im Folgenden berichten.

Symptome der Krankheit Auf den befallenen Blätter erscheinen mehrere hellgrün oder gelblich verfärbte Flecken, die meistens von den Blattnerven mehrekig umgegrenzt oder etwas rundlich sind, und den Blätter verkrümmen sich am Rande nach der Unterseite. Diese Blätter färben sich schliesslich braun und fallen vorzeitig ab. An den Unterseite der Flecken kommen sehr feine, etwas grau-violette Pilzrasen zum Vorschein.

Morphologie des Pilzes Rasen dicht und fein, grau-violett. Konidienträger meist zu drei aus Spaltöffnung hervorbrechend, 240–440 μ hoch, ca. 8 μ dick, unverzweigter Stiel 2/3 lang oder länger; Krone 4–6 mal gabelig, Äste spitzwinklig abstehend, gerade oder schwach gebogen, allmählich dünner werdend, letzte Gabeln rechtwinklig, kurz oder lang pfriemlich (Fig. 2). Konidien

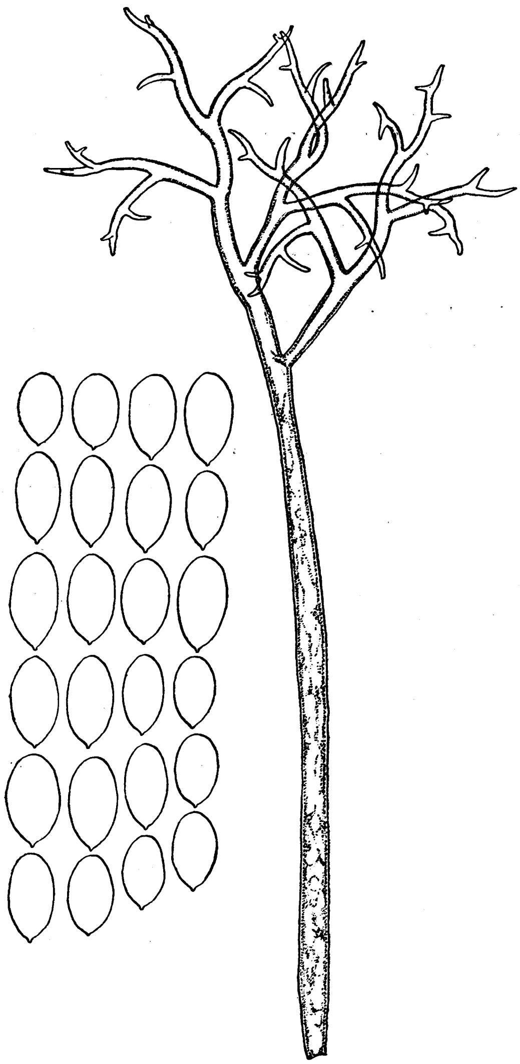


Fig. 1 Konidien **Fig. 2** Konidienträger **Fig. 3** Oosporen, oben reif und unten unreif.

ellipsoidisch, 20–30 × 14–18 μ, schmutzig-violett (Fig. 1); Oogonia rundlich, 52–55 μ im Durchmesser mit einschichtiger und dünner Wand; Oosporen gelbbraun oder schwarz-braun, kugelig, 25–30 μ; Episporen dünn und glatt, nach der Sporenreife unregelmässig zusammenfallend (Fig. 3). Somit ist es selbstverständlich, dass der genannte Pilz zur Untergruppe Effusae gehört.

Vor der taxonomischen Betrachtung musste es mir sehr erwünscht sein, unsere Art mit den verwandten Peronospora-Arten zu vergleichen. Vier Arten der Gattung Peronospora sind bisher als die Polygonaceen bewohnend beschrieben worden, namentlich *P. Rumicis* CORDA auf Rumex spp., *P. Polygoni* THÜMEN und *P. Americana* GÄUM. auf Polygonum spp., und *P. Jaapiana* MAGN. auf Rheum sp. Vergleichen wir die Konidiengrösse und die anderen systematischen Merkmale dieser Pilze, welche in der folgenden Tabelle zusammengestellt sind, so sehen wir leicht, dass diese fünf Arten voneinander abweichen.

Arten	Betreffender Pilz	*P. Rumicis*	*P. Polygoni*	*P. Americana*	*P. Jaapiana*
Konidien	20–30 × 24–18 μ	26–33 × 16–23 μ	30–40 × 15–20 μ	24–43 × 12–28 μ	25–34 × 16.5–18 μ
Konidienträger	240–440 × 8 μ	400–700 × 8–10 μ	320–420 × 9–11 μ	250–600 × 8–13 μ	225.55–329.93 μ
Verzweigung der Konidienträger	4–6 mal	3–6 mal	5–7 mal	4–8 mal	—
$\frac{\text{unverzweigter Stiel}}{\text{Ganze Länge}}$	2/3	2/3	1/2	1/2–2/3	—
Oosporen	25–30 μ diam.	—	—	19–43 μ diam.	—

Die Vergleichung dieser Messresultate ergibt einmal, dass unser Pilz in bezug auf die Grösse der Konidien kleiner als die vier anderen Arten ist und in der Länge der Konidienträger von *P. Rumicis* und *P. Americana* stark abweicht; anderseits dass *P. Polygoni* und *P. Jaapiana* in denselben mit unserem Pilz etwas verwandt sind. Aber *P. Polygoni* unterscheidet sich von unserem durch die grösseren Konidien und den Verzweigungsmodus der Konidienträger; *P. Jaapiana*, von der eine vollkommene Deskription noch fehlt, hat auch die grössren Konidien und die systematisch unterschiedene Wirtpflanze. Daher glaubte ich den in Frage stehenden Pilz als ein specielle Art ansprechen zu müssen und nannte ihn *Peronospora Fagopyri* nov. sp.

Die Artdiagnose lautet wie folgt:

Peronospora Fagopyri I. TANAKA, sp. nov.

Caespitulia hypophylla, effusa, griseo-violacea; conidiophoris e stomatibus exeuntibus, superne 4–6 ies dichotomoramosis, 240–440 μ altis, ca 8 μ crassis; ramulis sensim attenuatis; conidiis ellipsoideis, 20–30 × 14–18 μ, membrana dilute griseola; oosporis 25–30 μ, membrana fulva vel fusca.

Hab. in foliis *Fagopyri esculenti* in Japonia.

Dist. Prov. Ishikari: Sapporo (Oct. 1, 1916, R. TSUJI), Moiwa-mura (Jun. 19, 1921, Y. HOMMA; Aug. 7 1932, Y. IMAI), Kotoni-mura (Jun. 28, 1933, S. IWADARE; Jun. 28, 1933, I. TANAKA).

Prov. Tokachi: Obihiro (Jul. 28, 1932, I. TANAKA).

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ON THE RESORPTION OF UREA BY THE ROOT SYSTEM OF THE HIGHER PLANTS

BY

SENNOSUKÉ YAMAGUCHI

(山 口 千 之 助)

In the present paper some results of studies on the resorption of urea by the root system of the higher plants and on its nutrient value as a nitrogen source will be reported in a summarized form. As plant materials, seedlings of *Zea Mays* (starch corn, Sapporo eight lines) and *Glycine Soja* were employed. In the case of the ordinary water culture, the seed was germinated in sawdust watered with tap-water, and when the roots two or three inches the long seedlings were transferred to a water-culture solution of the following composition:

Urea ($CO(NH_2)_2$)	0.360 gm
Calcium chloride ($CaCl_2.\ 2H_2O$)	0.089 gm
Potassium biphosphate (KH_2PO_4)	0.250 gm
Magnesium sulphate ($Mg\ SO_4.\ 7H_2O$)	0.250 gm
Potassium chloride (KCl)	0.120 gm
Ferric chloride ($FeCl_3$. 2%)	3 drops
Distilled water	1000 c.c.
pH=4.6	

This culture solutions contains urea and calcium chloride instead of calcium nitrate as nitrogen and calcium sources. The amount of nitrogen in urea, is equivalent to that in the ordinary Knop's solution, but the amount of calcium was much lessened in order to prevent precipitation, which is due to the formation of either calcium sulphate or calcium phosphate. Experiments were conducted by the method of the ordinary water culture and sterile water culture. At the beginning and the end of experiments, the total amount of urea in the culture solution was determined, and the difference between these two determinations was regarded as the amount of urea resorbed by the root system of the plants. For the estimation of urea, the micro-Kjeldahl method for ammonia was used, combined with hydrolysis with aid of urease. The amount of free ammonia decreased or increased in the culture solution during the course of the experiment was calculated. From the result of the experiments, it was recognized that the more urea there was contained in the culture solution, the

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

more it was resorbed by the root system of the culture seedlings. But when the concentration of urea in the culture solution was very high, the growth of the seedlings in the solution was injured and various phenomena of injury to the seedlings were found, although the amount of urea resorbed by the seedlings was larger than that in the case of the low concentration.

In the case of water culture of *Zea Mays*, the most favourable concentration of urea in the solution was 0.006 mol, 0.36 gram of urea in one litre of water, although the concentration of urea in the culture solution was more or less varied according to the species of plants used, stage of the growth of plants, and other cultural conditions. The resorption of urea by the root of seedlings was influenced by the amount of other salts in addition to urea contained in the culture solution; that is, when the experiments were carried out using the above described culture solution which contains various described culture solutions various amounts of calcium chloride and potassium chloride besides urea, the amount of urea resorbed by the seedling roots was very much lessened by increasing the calcium chloride. On the contrary, with the solution containing potassium chloride to the amount of 0.002 mol, the amount of urea resorbed by seedling roots was the maximum, but when the concentration of potassium chloride in the culture solution was higher or lower than the above mentioned the amount of urea resorbed was decreased. Probably, this phenomenon may be caused as the result of the special ionic effects of K. and Ca on the permeability of the protoplasm of plants.

The hydrogen ion concentration in the culture solution played a role in the resorption of urea by the root of seedlings. The amount of urea resorbed per gram of dry weight of the root of *Zea Mays* was large at pH 5.6–6.4 and on the more acid side than this pH value, but the amount decreased at pH 6.8–7.8 and on the alkaline side.

The occurrence and amount of urease in the plants also influenced the degree of the resorption of urea by the seedling roots. It is very probable that as the cotyledon part of soy-bean contains a large amount of urease, the existense of this cotyledon accelerates the resorption of urea by the root, and also that the amount of urea resorbed by the same materials is very small, when the cotyledons are cut off at the beginning of experiments. The amount of urea resorbed by the root of soy-bean was very much influenced by photosynthesis. When the seedlings of soy-bean cultivated in the urea culture solution were transferred into tap-water, the amount of urea resorbed by the seedlings in the dark was inferior to that in the light, but the amount of free ammonia excreted into the tap-water by the root in the dark was superior to that in the light.

Such results indicate clearly that the influence of light on the resorption of urea and on the utilization of ammonia absorbed by root must be taken into consideration. In general, light is important, because seedlings can form protein from the product of photosynthesis together with the nitrogen-source absorbed from culture solutions. The seedlings in the dark can not sythesize protein, and the resorbed urea or ammonia can not be utilized. Such an accumulation of urea and ammonia hinders the further resorption of these substances, cosequently this caused the excretion of ammonia into the culture solution from the seedling roots. The urease in the plants has influence upon the resorption of urea by the seedling roots, but also acts on the transportation and utilization of urea resorbed in the plants.

Occurrence of a very small amount of urease was ascertained in the part of embryo and scutellum in the seedlings of *Zea Mays*, but in other parts such an occurrence could not be found. On the contrary, the occurrence of the urease was proved in every part of soy-bean, especially in the cotyledon. By the method of FOSSE using xanthydrol as reagent, it was ascertained that young seedlings of *Zea Mays* resorbed urea as itself and this urea resorbed was transported in the plants as urea or as ureïdes, which may be derived from urea, a part of which appeared in the drops of guttation. As every part of soy-bean contains a comparatively large amount of urease, it is very probable that the urea resorbed by the root of soy-bean was changed immediately by urease in the plants.

In the water culture of *Zea Mays* in culture solution or in tap-water, the excretion of urease from the root of seedlings was not recognized.

Under natural conditions, urea is decomposed into ammonia by the decomposing action of urobacteria in the soil and the ammonia thus formed is absorbed by the root, and it can be resorbed as itself too. In this case, if the urease occurs in the plants, it is probable that the resorbed urea is decomposed immediately into ammonia in the plant body, which can be available for protein synthesis as a nitrogen source.

When the concentration of urea in the culture solution is very high, a large amount of urea is decomposed into ammonia in a comparatively short time, and then the reaction of the culture solution become less acidic or more alkaline than at the beginning. Concequently in turn the growth of seedlings may be affected by this change of reaction. Such a secondary unfavorable change of reaction in the culture solution containing urea in the course of culture, and the high concentration of urea, which causes accumulation of urea and ammonia in the plant body, act injuliously on the growth of plants.

STUDIES ON EPICOCCUM ORYZAE ITO ET IWADARE, N. SP.

BY

SATORU IWADARE

(岩 垂 悟)

(With two text figures)

Introduction

The "Red Blotch of Rice" (Kohen-mai) is one of the most serious diseases which may impair the quality of cereal rice in Japan. It is characterized by pinkish red lesions on the hulled rice. The disease is distributed throughout Hokkaido and has been a great menace to the rice-growers owing to the deterioration of the quality and the reduction of the market value of rice.

Prof. ITO and ISHIYAMA (2) in 1929 were the first to study the disease demonstrating that it is caused by *Epicoccum neglectum* DESM. and *Epicoccum purpurascens* EHRENB. In 1932, after careful studies on the fungi lodging on and in the rice grains, K. SASAKI (1, 5) considered the latter species as a strain of *Epicoccum neglectum* DESM. Working with the same disease under the direction of Prof. ITO, the writer found that another species of Epicoccum as well as *Ep. neglectum* DESM. may be responsible for the injury. Results of the studies on the disease will be published in detail in the Reports of the Hokkaido Agricultural Experiment Station. The present paper was prepared to describe a new species of Epicoccum, one of the causal organisms of the disease under consideration.

The writer wishes to express here his sincere gratitude to Prof. S. ITO for his kind direction.

Morphological Characters and Taxonomy of the Fungus

When diseased grains were put on culture media in PETRI-dishes and kept in an incubator at 23°–25°C., the fungus under consideration made a vigorous growth on the media. Since no reproductive stage of the fungus could be found on the affected rice grains, under natural conditions, the morphological characters of the fungus on the rice culm decoction agar will be given in the following paragraph.

[Trans. Sapporo Nat. His. Soc. Vol. XIII, Pt. 3, 1934]

Mycelium: The hyphae are 3.7–6.2 μ, mostly 5.0 μ in width, branched, provided with many septa at intervals of 7–15 μ, and sometimes more or less constricted at the septa. The aerial hyphae are at first colorless but later turn into deep olive buff or light grayish olive. The submerged hyphae are at first colorless or sometimes flesh pink to eugenia red, but later assume the same color as the aerial hyphae.

Sporodochia: The sporodochia appear as fine masses, blackish in color, globose to subglobose, 45–210 μ in diameter, but sometimes they fuse into masses several times as large as a single one. The conidiophores are 2.5–7.5 μ in length, at first aniline yellow or old gold but later they assume the same color as the conidia.

Conidia: The conidia are produced singly at the tip of the conidiophore. When young they are often yellowish but the mature conidia are light grayish olive in color. At first conidia consist of single cells but when matured they are usually divided into 2 to 5 cells by longitudinal and transverse septa, granulate verrucose, globôse, subglobose or piri-form, and mostly longer than wide.

Size of the conidia more or less varies according to the media. Measurements of the conidia produced on various media are given in the following table.

Table 1. Measurements of conidia produced on various culture media

Culture No.		Culture media	Min.	Max.	Mode	Mean	Standard deviation
No. 1	Length	Rice culm decoct. agar	9.90	18.25	14.85	13.93 ± 0.18	1.78
		Apricot extract agar	9.90	18.25	13.20	13.35 ± 0.16	1.60
		Onion soy agar	9.90	18.25	13.20	13.88 ± 0.18	1.71
	Width	Rice culm decoct. agar.	9.90	16.50	11.55	11.78 ± 0.18	1.23
		Apricot extract agar	8.25	13.20	11.55	11.23 ± 0.10	1.04
		Onion soy agar	9.90	14.85	11.55	12.00 ± 0.12	1.18
No. 2	Length	Rice grain decot. agar	11.55	21.45	16.50	15.82 ± 0.21	2.06
		Apricot extract agar	9.90	16.50	14.85	13.71 ± 0.16	1.06
		Onion soy agar	9.90	23.10	16.50	16.19 ± 0.20	1.99
	Width	Rice grain decoct. agar	8.25	16.50	11.55	11.55 ± 0.12	1.25
		Apricot extract agar	6.60	13.20	11.55	10.68 ± 0.12	1.17
		Onion soy agar	8.25	16.50	11.55	12.10 ± 0.15	1.48

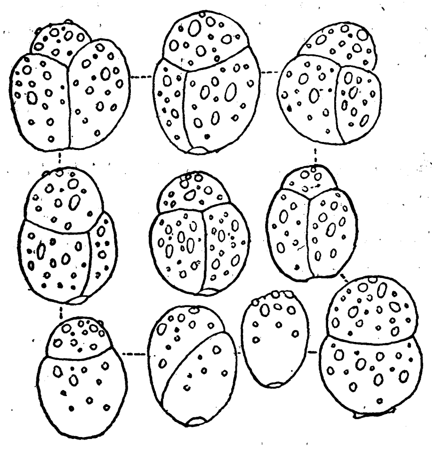

Fig. 1 Strain A

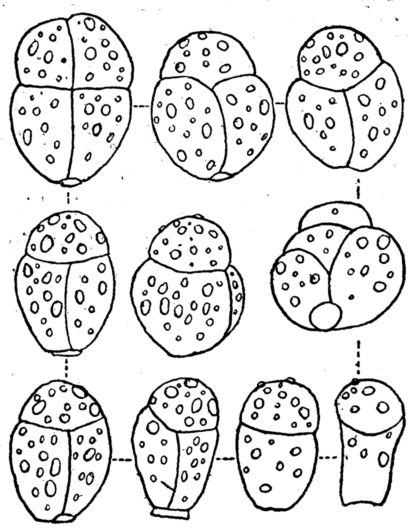

Fig. 2 Strain B

According to the above mentioned characters, the fungus under consideration undoubtedly belongs to the genus Epicoccum. Three species of the genus Epicoccum have been described to be parasitic on the rice plant: *Ep. neglectum* DESM. (4), *Ep. purpurascens* EHRENB. (4) and *Ep. hyalopes* MIYAKE (3). These three species are distinguishable from the writer's fungus in the following respects; conidia of *Ep. hyalopes* MIYAKE are smooth and one-celled, while those of the former two species are reticulate and much larger than those of the writer's fungus. Moreover the fungus seems to be different from all the other species of the same genus, which have been hitherto reported. Accordingly one comes to the conclusion that the present fungus is new to science. Its diagnosis is given as follows.

Epicoccum Oryzae ITO ET IWADARE, n. sp.

Maculis rufidulis vel rosellis, irregularis; hyphis filiformibus, ramosis, hyalinis, demum olivaceis, septatis, intervallis inter septa 7–15 μ longis, ad septum non-constrictis vel constrictis, 3.7–6.2 μ crassis; sporodochiis globosis, subglobosis, atro-fuscis, punctiformibus, 45–210 μ et caterivatim multipluribus diametris; conidiophoris sporodochiolum 2.7–7.5 μ longis, initio flavidulis tandem olivaceis; conidiis globosis, subglobosis vel piriformibus, granulato-verrucosis, 1–5 cellularis, olivaceis, 9.9–23.10 × 6.60–16.50 μ.

Hab. in fructio *Oryzae sativae* in Japonia.

Inoculation Experiment

The present experiment was carried out in order to discover the effect of the fungus on the hulled and unhulled, and likewise on the cleaned rice as well as the relation of humidity to the occurrence of the disease.

Rice grains sterilized by steam at 100° C. for 40 minutes on two consecutive days, and those surface-sterilized with an alcoholic solution of corrosive sublimate (2 gm. of corrosive sublimate added to 1 liter of 50 % alcohol), were used for the experiment. Five grams of sterilized grains were put into an ERLENMEYER-flask; a definite amount of water was added and inoculated with a small mass of the fungus. The flasks were kept in an incubator at 23° C.

The fungus developed so quickly on steamed hulled and cleaned rice and likewise on the hulled rice sterilized with corrosive sublimate that the percentage of the affected grains could be determined after three days' incubation in the case of the steamed hulled rice and after four days' incubation in the case of the other two. On the cleaned rice sterilized with corrosive sublimate, however, the disease did not appear even after a week's incubation, but thereafter the grains were gradually affected and the percentage of the decayed grains was determined after two weeks' incubation. In the case of the surface sterilized unhulled rice the grains were hulled off and the percentage of affectatian was determined after a week's incubation.

The results are given in the following table.

Table 2. Results of inoculation experiment

Inoculated on	Item / Amount of water added	1cc.	2cc.	3cc.	4cc.
Hulled rice, steam-sterilized	Number of grains used	242	244	249	247
	Number of affected grains	87	208	13	9
	Percentage of affected grains	35.95	85.25	5.22	3.64
Hulled rice, surface sterilized	Number of grains used	—	242	238	—
	Number of affected grains	—	191	108	—
	Percentage of affected grains	—	78.29	45.34	—
Cleaned rice, steam-sterilized	Number of grains used	286	*	*	—
	Number of affected grains	152	*	*	—
	Percentage of affected grains	53.14	100.00	100.00	—

Cleaned rice, surface sterilized	Number of grains used	238	234	231	254
	Number of affected grains	98	139	91	0
	Percentage of affected grains	41.18	59.04	39.39	0.00
Unhulled rice, surface strilized	Number of grains used	—	203	201	—
	Number of affected grains	—	8	8	—
	Percentage of affected grains	—	3.94	3.98	—

* Owing to the vigorous growth of the fungus the grains were so badly decayed that their number could not be determined.

As shown above, the fungus attacks hulled, unhulled and cleaned rice producing pinkish red lesions on the grains. The cleaned rice, however, seems to be less readily affected by the disease under natural conditions. Since the percentage of the affected grains was very low in the case of unhulled rice, it appears that the fungus can not readily penetrate the healthy glume to attack the endosperm. Under natural conditions the fungus probably enters the grains, penetrating the glume through the loosely closed suture line or weakened portion of the glume.

It seems that a slightly moistened condition of the rice grain is most favorable for the growth of the fungus.

Temperature Relation

1. Effect of temperature on the growth of the fungus

For the culture media of the fungus rice culm decoction agar was used. Twenty cc. of the medium were poured into a PETRI-dish, 9 cm. in diam., and a bit of the mycelium was inoculated at the center. The plate cultures were kept in incubators at 8°, 15°, 19°, 23°, 25°, 28° and 32° C. respectively. Each culture was triplicated at the respective temperatures. Measurements of the mycelial growth of the fungus and its important features at various temperatures are given in the following tables.

Table 3. Diameter of colonies of the fungus at various temperatures

Period of incubation	Diameter of colonies (cm.)						
	32° C	28° C	25° C	23° C	19° C	15° C	8° C
2 days	0.00	1.20	1.50	1.63	1.27	1.00	0.00
4 days	0.00	2.25	3.13	3.10	2.70	2.07	1.07*
7 days	0.00	2.80	5.95	5.80	5.37	3.27	1.77

* Measured after 5 days.

Table 4. Summarized characters of the fungus cultured for two weeks at various temperatures

Temp. (C.)	Characteristics of margin of colonies	Formation of aerial hyphae	Formation of conidia	Coloration of colonies	Pigment produced in the media	Remarks
32	No growth	−	−	−	−	
28	Irregularly rounded	±	++	Dark olive	Not colored	Conidia were produced in 7 days
25	Rounded	+++	++	Olive brown—buffy brown	Jasper red—olive brown	Conidia were produced in 9 days
23	Do	+++	++	Do	Do	Do
19	Do	++	+	White	Old rose	Conidia were produced in 14 days
15	Irregularly rounded	++	+	Do	Do	Do
8	Do	+	−	White—old rose	Old rose—not colored	

As shown above table, a higher temperature seems to be unfavorable for the growth of the fungus, its growth having been very scanty at 28° C. and entirely suppressed at 32° C. The fungus made a vigorous growth at a temperature from 19° to 25° C. and the optimum seems to be 23°–25° C.

The fungus produced pinkish red pigment in the medium at a temperature lower than 25° C., and its optimum seems to lie between 15° and 25° C.

2. Effect of temperature on the occurrence of the disease

Five grams of hulled rice were put into an ERLENMEYER-flask, plugged with cotton and sterilized at 100° C. in a KOCH's steam sterilizer on two consecutive days. One and half cc. of sterilized water was added to each flask and it was inoculated with a small mass of the fungus. The flasks were kept in incubators at various temperatures.

Coloration of lesions and percentage of the affected grains were determined after three days' incubation. The results are given in the following table.

Table 5. Results of inoculation experiment at various temperatures

Temp. (C.)	No. of grains used	No. of affected grains			Percent. of affected grains	Coloration of lesions
		Entirely discolored	Partially discolored	Total		
29–31	248	0	0	0	0.00	—
27–28	242	22	160	182	75.21	Eugenia red—acajou red
23–25	248	182	66	248	100.00	Vandyke red—Oxblood red
21–22	244	239	5	244	100.00	Do
19–20	245	230	15	245	100.00	Do
16–18	245	128	117	245	100.00	Eugenia red—carmins
13–15	241	7	208	215	89.21	Eugenia red—jasper red —spectrum red
11–12	244	0	50	50	20.49	Old rose
9–10	233	0	1	1	0.42	Do
6–7	244	0	0	0	0.00	—

As shown above, the disease occurred at a very wide range of temperature, from 9° to 27° C. The optimum seems to lie between 14° and 25° C. At 9° C. only one grain was affected. It is probable, however, that many more grains will be affected when the incubation period is prolonged, even though the temperature is as low as 9° C.

Summary

In the present paper it was intended to report on *Epicoccum Oryzae* ITO et IWADARE, n. sp., one of the causal fungi of the "Red Blotch of Rice", giving a description as new to science.

The fungus attacks the hulled, unhulled and cleaned rice producing pinkish red lesions on the grains. The cleaned rice is less readily affected by the fungus than the hulled or unhulled rice. It appears that a more or less moistened condition of the rice is favorable to the occurrence of the disease.

A higher temperature seems to be unfavorable to the growth of the fungus, the mycelial growth being very scanty at 28° C. and most vigorous at 23°–25° C. The fungus produces a pinkish red pigment in the culture media at a temperature lower than 25° C., and the optimum lies between 15° and 25° C. The optimum temperature for the occurrence of the disease lies between 14° and 25° C., being in close relation to the growth of the fungus and the production of the pigment.

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ON SOME SPECIES OF SEPTORIA COLLECTED IN SOUTHERN SAGHALIEN

BY

TETSUJI ISHIYAMA

(石 山 哲 爾)

(With 2 text figures)

Southern Saghalien is an interesting region from the mycological point of view, because up to the present time very little attention has been paid to fungi except rust fungus. During a period from 1929 to 1932, the writer took service in the Saghalien Central Experimet Station and collected many specimens of parasitic fungi in the district. Based upon these specimens, a report of the fungi parasitic on the important agricultural plants has previously been prepared. In the present paper, the intention is to note some interesting species of Septoria among them. The present work has been carried out in the Botanical Institute, Faculty of Agriculture, Hokkaido Imperial University in Sapporo.

The writer wishes to express here his sincere gratitude to Profs. S. ITO and Y. TOCHINAI for their valuable suggestions and he also thanks Prof. K. MIYAKE, director of the Saghalien Central Experiment Station.

Septoria consimils ELL. et MART., Jour. Myc. I, p. 100, 1885; SACC., Syll. Fung. X, p. 368, 1892; ALLESCHER, Die Pilze, VI, p. 800, 1901.

Hab. on leaves of *Lactuca sibirica* BENTH. (*Yezo-murasakinigana*).

Prov. Toyohara: Konuma (July 19, 1931).

Distrib. Japan & N. America.

Remarks. The present fungus differs from *Sept. Lactucae* by the lesions in regular shape and by the slightly larger spores. The species in new to Japan and *Lactuca sibirica* is a new host plant to it. The general characters of this fungus are as follows:—

Lesions circular or angular, grayish brown in the centre, dark brown at the margin, provided with an indistinct border. Pycinidia epiphyllous, sparsely scattered, globose, brown, with pseudoparenchymatous wall, buried in the tissue, 64–96 μ, mostly 80 μ in diam., provided with a circular ostiole. Pycnospores filiform, obtuse at the ends, straight or curved, hyaline, containing many granules, 0–3-septate, mostly 1-septate, 25–42.5 × 2.0–2.5 μ, mostly 32.5–37.5 × 2.5 μ.

Septoria Picridis sp. nov. (Text fig. 1, a-b)

Maculis epiphyllis, rotundatis vel ellipticis, 2–5 mm. diam., ochraceobrunneis vel cinereis, fusco-marginatis, saepe confluentibus; pycnidiis epiphyllis, numerosis, immersis, globoso-depressis, 64–80 μ latis, contextu parenchymatico fusco-brunneo, poro apertis; sporulis filiformibus, utrinque acutatis, curvulis, hyalinis, homogenis, 3–7-septatis, 37.5–67.5 × 1.5–2.0 μ, plerumque 45–57.5 × 1.5 μ.

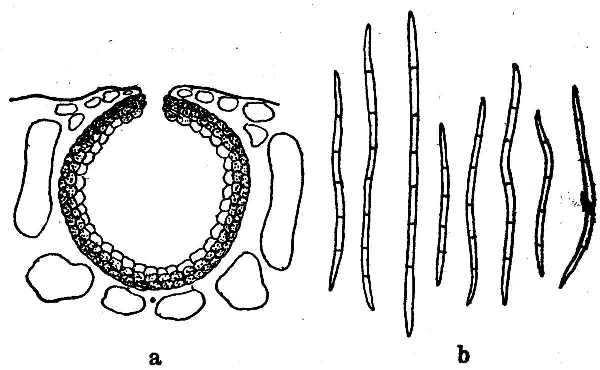


Fig. 1 *Septoria Picridis* sp. nov.
a. Pycnidium (× 300). b. Pycnosyores (× 500)

Hab. in foliis *Picridis japonicae* THUNB. (*Kôzorina*).

Prov. Toyohara: Konuma (Oct. 12, 1930).

Distrib. Endemic!

Remarks. As far as the writer is aware, the present fungus is a only species of Septoria parasitic on Picris.

Septoria Galeopsidis WESTEND, Bull. Acad. Roy. Belg. ser. II, Bd. XII, no. 7; SACC., Syll. Fung. III, p. 539, 1884; ALLESCHER, Die Pilze, VI, p. 785, 1901, DIEDICKE, Die Pilze, VII, p. 458, 1915.

Hab. on leaves of *Galeopsis tetrahit* L. (*Chishima-odorikosô*).

Prov. Toyohara: Konuma (Oct. 5, 1929).

Distrib. Japan, Europe & N. America.

Remarks. SACCARDO[1)] stated that the lesions of *Sept. Galepsidis* are hypophyllous, but they occur on the upper surface in the present specimens. Excepting this point, one can not find any distinct difference between them. For the present. the writer classified the fungus in question as *Sept. Galeopsidis* WESTEND. This species is new to Japan and its general characters are as follows:—

Lesions angular, limited by the nerves, purplish brown in color, provided with an indistinct border and prominent blackish dots in the centre. Pycnidia densely scattered on the upper surface, dark brown in color, with pseudo-

1) Syll. Fung. X, p. 530.

parenchymatous wall, erumpent, globose to subglobose or depressed-globose, 112–190×112–160 μ in diam., provided with a circular ostiole. Pycnospores filiform, somewhat olive colored in mass, with homogenous cell content, 3–7-septate mostly 4–5-septaie, 35–67.5×1–2 μ, mostly 45–50×1.5 μ.

Septoria lamiicola SACC., Mich. I, 170 & Syll. Fung. III, p. 538, 1884; ALLESCHER, Die Pilze, VI, p. 801, 1901.

Hab. on leaves of *Galeopsis tetrahit* L. (*Chishima-odorikosô*).

Prov. Toyohara: Konuma (Oct. 5, 1929).

Distrib. Japan & Europe.

Remarks. The present fungus is readily distinguished from the preceding species *Sept. Galeopsidis* WESTEND by the nature of the lesion which is white in the centre and distinctly surrounded by a dark brown border, as well as by the size of the pycnidia (48–96 μ).

This species is new to Japan and *Galeopsis tetrahit* is a new host plant to the present fungus. The general characters of this fungus are as follows:—

Lesions amphygenous, circular, 2–5 mm. in diam., grayish white in the centre, surrounded by a dark brown border. Pycnidia epipyllous, sparsely scattered, brown in color, with pseudoparenchymatous wall, globose or depressed globose, 48–96 μ, mostly 64–80 μ in diam., provided with a circular ostiole. Pycnospores filiform, somewhat acute at the ends, curved or straight, hyaline, with homogenous content, 1–5-septate, mostly 3-septate, 35.0–60.0×1.0–2.0 μ, mostly 45–50×1.5 μ.

Septoria gentianicola sp. nov. (Text fig. 2, a–b.)

Maculis epiphyllis, orbicularibus vel ellipticis, 3–10 mm. diam., ochraceis demum centro cinerescentibus, saepe confluentibus; pycnidiis epiphyllis, numerosis,

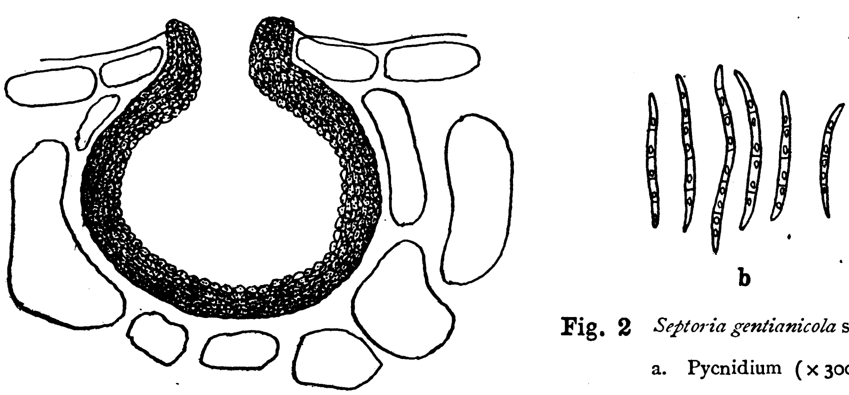


Fig. 2 *Septoria gentianicola* sp. nov.

a. Pycnidium (×300).

b. Pycnospores (×500).

subglobosis, erumpentibus, 64–128 μ, plerumque 80-90 μ diam., contextu minute parenchymatico, nigrescente, ostiolo papillari, rotundato, ca. 24 μ diam.; sporulis filiformibus, curvulis vel rectis, utrinque acutiusculis, hyalinis, guttulatis, 2–5-septatis, plerumque 3-septatis, 27.5-50.0 × 1.5–2.0 μ, plerumque 35-40 × 1.5 μ.

Hab. in foliis *Gentianae axillariflorae* LEV. et. VNT. (*Yezorindô*).

Prov. Toyohara: Konuma (Sept. 27, 1931).

in foliis *Gentianae triflorae* PALL. (*Hosoba-yezorindô*).

Prov. Shikka: Shikka (Aug. 7, 1930, H. OHTANI & Y. IMAI).

Distrib. Endemic!

Remarks. Up to the present time, four species of Septoria parasitic on Gentiana spp. have been described. The present fungus is clearly different from these species in the morophological characters. The morphological differences of these five species of Septoria are shown in the following table.

fungi	lesions	pycnidia	pycnospores	hosts
S. microspora SPEG.[1]	cinnamon in color	hypophyllous, blackish, 40–50 μ diam., beaked ostiole	filiform, somewhat acute at the ends, pluri-guttulate, pluri-septate, hayline, 20 × 1 μ	*G. asclepiades*
S. Gentianae THÜM.[2]	pale dark brown	epiphyllous, subconical	fusiform. acute at the ends, 3–5-guttulate, 1-septate, hyaline, 28 × 3 μ	*G. adscendentis* & *G. macrantha*
S. rhaphidospora C. MASS.[3]	pale dark brown	globose, black, 60–80 μ diam., somewhat papillate ostiole	filiform, guttulate, non-septate, hyaline, 18–24 × 1μ	*G. utriculosa*
S. montana TRAV.[4]	circular, ochreous	amphygenous, globose, black, 60–75 μ	cylindrical, non-septate, hayline, 20–25 × 1 μ	*G. acaulis*
S. Gentianicola T. ISHIYAMA	circular or elliptical, ochreous later dark brown at the margin	epiphyllous, subglobose, black, 64–128 μ, papillate ostiole	filiform, somewhat acute at the ends, guttulate, 3-septate, hyaline, 27.5–50 × 1.5–2.0 μ	*G. axillariflora* & *G.triflora*

1) SACC. Syll. Fung. III, p. 541.
2) THÜMEN, Pilzfl. Sibir. no. 118.
3) SACC. Syll. Fung. X, p. 376.
4) TRAVERSO, Ann. Myc. I, p. 314.

As shown in the above table, the fungus under consideration is readily distinguished from other species in several important morphological characters, especially in respect to its far longer pycnospores.

Septoria Trientalis (LASCH.) SACC., Bull. Soc. Myc. Fr. V, p. 121, 1889 & Syll. Fung. X, p. 361, 1892; ALLESCHER, Die Pilze, VI, p. 868, 1901; DIEDICKE, Pilze, VII, p. 517, 1915.

Hab. on leaves of *Trientalis europaea* L. (*Tsumatorisô*).

Prov. Ohdomari: Rûtaka (Aug. 2, 1932, N. SHIRASAKA).

Distrib. Japan & Europe.

Remarks. The present fungus is new to Japan and its general characters are as follows:—

Lesions at first angular in shape and purplish brown, later becoming circular or elliptical and grayish white with purplish brown border. The tissue at the centre of the lesion very brittle and provided with prominent blackish dots. Pycnidia amphygenous, densely scattered, globose, blackish brown in color, pseudoparenchymatous, buried in the tissue, 64-117, mostly 80–96 μ in diam., provided with a circular ostiole (ca. 20 μ in diam.). Pycnospores filiform, straight or curved, rounded at the ends, hyaline, homogenous, continuous, $17.5-30.0 \times 1$ μ, mostly $25-27.5 \times 1$ μ.

CONIDIA FOMATION IN TRICHODERMA NARCISSI TOCHINAI ET SHIMADA

BY

SHOICHI SHIMADA

(島 田 昌 一)

(With one text figure)

In 1930 and 1931 Prof. Y. TOCHINAI in collaboration with the writer reported on *Trichoderma Narcissi* TOCHINAI et SHIMADA parasitic on Narcissus bulbs. In the cultures of this fungus white aerial mycelium grew rapidly over the surface of the media, and within a few weeks after inoculation tiny mycelial knots were produced abundantly. They were white in color at first, turning gradually to deep green in pace with the formation of conidia.

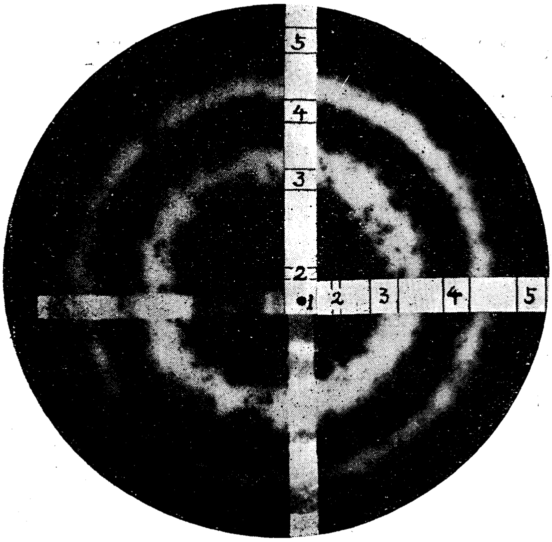
During an investigation of this fungus, it was found that the cultures kept in the dark yielded no conidia while those in the light always produced a copious number of conidia. The cultures grown under the diurnal change of diffused light in the laboratory room developed alternate zonations of mycelia with and without conidia. From these facts, it is evident that the light exerts certain beneficial effects upon the formation of conidia of the fungus.

Hence, an experiment was carried out to ascertain the effect of light upon the formation of conidia of this fungus. Twenty cubic centimetres of onion decoction agar were poured into sterilized Petri dishes, 9 cm. in diameter. Each plate was inoculated at the centre with a bit of the mycelium. Some of these plate cultures were kept in the dark and the others were exposed to diffused daylight during a definite period of time noted as follows:

(1) January, 8, 11.30 a.m. 1932 (inoculated)
(2) January, 9, 9.30 a.m.—4.30 p m.
(3) January, 11, 11 a.m. —4.30 p.m.
(4) January, 12, 9.30 a.m.—4.30 p.m.
(5) January, 13, 9.30 a.m.—4.30 p m.

The peripheral margin of the mycelial growth at the end of each period was carefully lined with ink on paper strips pasted crosswise on the under surface of each dish. On the 14th of January, the entire surface of the culture medium was occupied uniformly by the fungus mycelium. From this date on

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3. 1934]



they were exposed to a diurnal alternation of daylight and darkness. On the 18th of January, concentric zones of the mycelium with and without conidia were found as shown in the text figure, in which white zones represent the mycelium with dark green conidia and the numbers denote the sequence of exposure to light. Three white, conidia-bearing zones are found in the culture, covering the peripheral region of the fungus growth which have been exposed to the light, and likewise an inner region of mycelia grown in the dark immediately next to the former. In the remaining parts of the culture the mycelial knots bearing conidia were very scarce and scattered. Such zonation has never been found in cultures grown continuously in the dark. These facts seem to show that the growth of mycelium in diffused daylight causes the production of conidia in the subsequent fungus growth and that light may act as a causal stimulus for the formation of conidia. BISBY working with *Fusarium discolor sulphureum*, reported that macroconidia were formed on the portion grown under the influence of daylight. However, the writer's observations on the fungus under consideration differ somewhat from BISBY's results. On the outer margin of the mycelial growth exposed to light which is designated as 2 in the text figure, no conidia were produced. In this case the culture might have been too young to produce conidia.

In conclusion, the writer wishes to express his sincere thanks to Prof. S. ITO and Prof. Y. TOCHINAI for their kind advices.

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ON THE OCCURRENCE OF THE WILT DISEASE OF SESAME IN JAPAN

BY

MUTSUO TERUI

(照 井 陸 奥 生)

In August, 1932, the writer's attention was drawn to a number of wilted sesame plants (*Sesamum indicum* L.) in the Experimental Field of the Faculty of Agriculture, Hokkaido Imperial University in Sapporo. After careful research, it was ascertained that this disease was due to a Fusarium. As far as the writer is aware, the Fusarium wilt of sesame has never previously been reported from Japan and even in India where the disease has been known since 1926 it has not been thoroughly studied. Accordingly the writer carried on an investigation of the morphology and physiology of the causal fungus. Since a full account of the study was given in the Journal of Plant Protection Vol. XX, No. 11, 1933, only its outlines will be presented in this paper.

Symptoms. The symptoms of the disease are those of a typical wilt. The affected plants suddenly begin to wilt and the leaves become irregularly wrinkled and droop, turning blackish brown in color. The stem also assumes a blackish brown color and may be covered with numerous pink-colored sporodochia of hemispherical shape, 0.5 mm. in diameter. The roots turn from gray to blackish. The entire plant eventually dies.

Morphology of the causal fungus. Vegetative hyphae hyaline, septate, profusely ramifying and 1.5–5.2 μ in width. Conidiophores branching; microconidia produced in a head, one-celled, rarely septate, ovoidal to ellipsoidal, sometimes slightly curved, hyaline and $5\text{–}23.5 \times 2.5\text{–}5.5\ \mu$; macroconidia lunulate, 3–5 septate, 3-septate spores $20.8\text{–}44.2 \times 2.6\text{–}4.5\ \mu$, 4-septate ones $36.4\text{–}49.4 \times 3\text{–}5\ \mu$, 5-septate ones $41.6\text{–}52.0 \times 4\text{–}5\ \mu$, cinnamon buff colored in mass; chlamydospores apical or intercalary.

Cultural characters of the causal fungus. The fungus grows vigorously on onion-, potato-, malt-, rice-, and oat-decoction agar while the mycelial growth is meagre on apricot decoction agar. The aerial mycelia are abundant

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

on onion-, and potato-decoction agar. The conidia are produced on these two culture media and likewise on malt decoction agar.

Temperature relations. The fungus in question made a most vigorous growth at a temperature of 23–30°C and it is likely that the optimum lies around 30° C. The mycelial growth was remarkably suppressed at 34° C.

Pathogenicity of the fungus. Young sesame plants 2–3 cm. high were inoculated with the fungus from a pure culture on their leaves and stems with or without wounds. Some of these plants wilted showing manifestations similar to those of plants affected under natural conditions. Some other plants exhibited only discolored areas at the points of inoculation, remaining otherwise healthy. In such discolored portions, however, the mycelium could be revealed.

Taxonomy of the fungus. According to BUTLER (1926) *Fusarium vasinfectum* ATK. causes a wilt disease of the sesame plant in India. NARASIMHAN (1929) also reports that the same fungus affects sesame and Bengal gram (*Cicer arctinum*). The fungus under consideration is also regarded as identical with *Fusarium vasinfectum* ATK., although there is a slight difference in size of macroconidia of these fungi.

In conclusion, the writer wishes to express his sincere thanks to Profs. S. ITO and Y. TOCHINAI for their kind advices.

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NOTES ON THE LAGENIDIACEAE IN JAPAN

BY

YOSIO TOKUNAGA

(徳 永 芳 雄)

(With three text-figures)

No record has ever been published in Japan on the Ancylistales, one of the smallest and most interesting groups of lower fungi. SKVORTZOW described four species of this group from Manchuria including *Myzocytium megastomum* DE WILDEMAN and *Lagenidium enecans* ZOPF, which belong to the Lagenidiaceae. In the course of his studies on the Japanese aquatic fungi, the present writer found some members of this group parasitic on various algae. The present paper has been prepared to record three species of them. The family Lagenidiaceae consists of three genera, Achlyogeton, Myzocytium and Lagenidium. In this paper, it is proposed to include in this family the genus Aphanomycopsis established by SCHERFFEL.

The writer wishes to express here his sincere appreciation to Prof. S. ITO for his valuable directions and cordial encouragement throughout the present investigation.

Achlyogeton entophytum SCHENK

in Bot. Zeit. XVII, p. 398, pl. XII, fig. A, 1859; SOROKIN, in Rev. Mycol. XI, p. 139, pl. LXXXI, fig. 122, 1889; v. MINDEN, in Krypt. Fl. Mark Brand. V, p. 429, 1915; MARTIN, in Mycologia, XIX, p. 188, fig. 1 (c, d), 1927.

Thallus endobiotic, consisting of an unbranched tube, at maturity divided by the septa into 2-9 cells, each of which functions as a sporangium, prominently constricted at the septum; sporangia subelliptical, 15.6–33.6 μ in length, 9.6–20.4 μ in breadth, with hyaline, thin membrane; exit-tubes single, more or less long, up to 60 μ in length, approximately 3.6 μ in breadth; zoospores at once encysting at the mouth of the exit-tube, forming a globose aggregation of tiny spheres as in Achlya, about 4 μ in diameter, later swimming away leaving their cyst behind; sexual organs unknown.

Hab. In the cells of *Cladophora* sp. Lake Akan, Prov. Kushiro (Aug. 20, 1931).

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

Distrib. Europe, N. America, Central Asia and Japan.

This fungus was found attacking *Cladophora* in company with *Myzocytium entophytum* SCHENK in the same manner as has been noted by SCHENK and MARTIN. SCHENK has illustrated the emergence of a uniciliate zoospore from each of the cystospores. Although it was not actually observed, FITZPATRICK suggested that the secondary zoospore in this fungus may be laterally biciliate as in other members of the family. With the present material, the emergence of a secondary zoospore could not be observed and accordingly it remains unsolved whether or not FITZPATRICK's statement is actually the case. A spherical, thick-walled resting spore was observed by MARTIN, but its functions remained obscure. A peculiar, thick-walled body with a thin-walled companion cell was found in the sporangia of our fungus. It is perhaps the resting spore of a fungus of Olpidiopsis parasitic on Achlyogeton, but its zoosporangium was not observed.

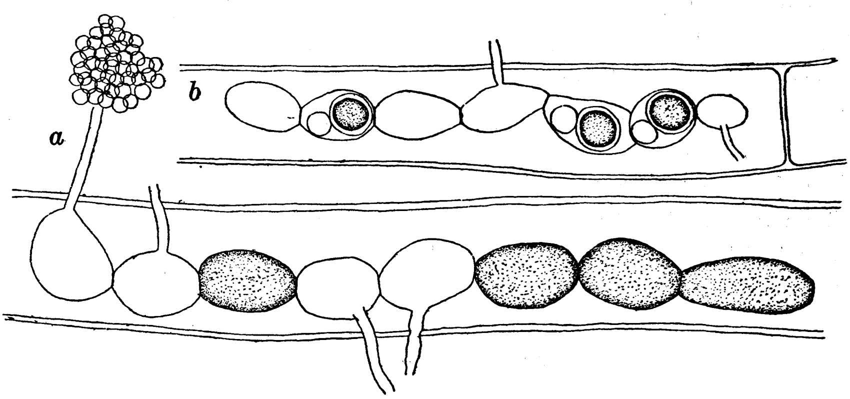

Fig. 1 *Achlyogeton entophytum* SCHENK

a. Sporangia in a cell of *Cladophora* sp. and spherical aggregation of zoospores. ×540.
b. Resting spores of parasite in the sporangia. ×540.

Myzocytium proliferum SCHENK

Ueber das Vorkommen kontraktiler Zellen im Pflanzenreich, p. 10, 1858; ZOPF, in Nova Acta Acad. Leop. XLVII, p. 159, pl. XIV, figs. 6–34, 1884; v. MINDEN, in Krypt. Fl. Mark Brand. V, p. 430, 1915; MARTIN, in Mycologia, XIX, p. 188, fig. 1 (a, b), 1927; SKVORTZOW, in Arch. Protistenk. LVII, p. 206, fig. 10, 1927.

Syn. *Pythium proliferum* SCHENK (not DE BARY), in Verhandl. Phys. Med. Ges. Würzburg, IX, p. 20, pl. I, figs. 30–47, 1857. *Pythium globosum* WALZ, in Bot. Zeit. XXVIII, p. 554, pl. IX, figs. 13–19, 1870, pro parte. *Lagenidium* *globosum* LINDSTEDT, Syn. der Saproleg. p. 54, 1872; REINSCH, in Jahrb. Wiss. Bot. XI, pl. XVII, figs. 6–12, 1878.

Thallus endobiotic, consisting of 2–12 sexual and asexual cells which connect with each other into a simple or rarely branched chain; sporangia broad elliptical to spherical, 14.4–24 μ in diameter, with a single, long exit-tube; zoospores developing in a vesicle which is formed by the discharge of the contents of sporangia at the mouth of the exit-tube as in Pythium, kidney-shaped, approximately $10 \times 6\ \mu$, with two cilia near the hilum; oogonia and antheridia similar to sporangia in shape and size; oospores solitary, not filling up the oogonial cavity, spherical, 14.4–20.4 μ in diameter, with smooth, thick membrane and an excentric globule.

Hab. In the cells of *Spirogyra Jürgensii* KÜTZ. Bannosawa near Sapporo, Prov. Ishikari (June 21, 1931).

In the cells of *Spirogyra* sp. Sapporo, Prov. Ishikari (July 24, 1931).

In the cells of *Cladophora* sp. Lake Akan, Prov. Kushiro (Aug. 20, 1931).

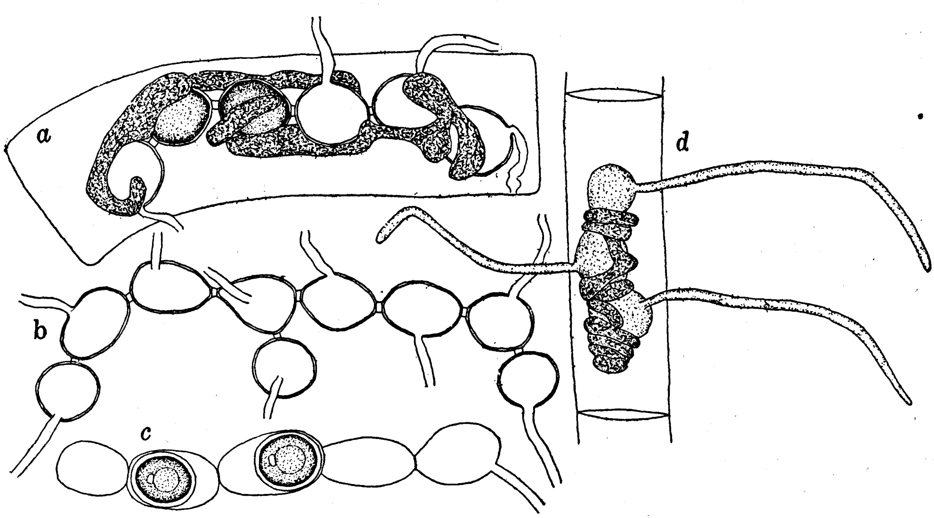

Fig. 2 *Myzocytium proliferum* SCHENK

a. Sporangia in a cell of *Spirogyra* sp. ×540. *b.* Sporangia arranged in a branching chain. ×540. *c.* Fungus from *Cladophora* sp. consisting of oogonia, antheridia and sporangium. ×540. *d.* Abnormal germination of sporangia in a cell of *Spirogyra Jürgensii.* ×540.

Distrib. Europe, N. America, China and Japan.

In the fungus occurring on Spirogyra the septa separating each sporangium are very thick, up to 2.4 μ, while in the fungus on Cladophora they are very thin. In ZOPF's illustration, there are various types of septa in the same host plant.

In the fugus found on *Spirogyya Jürgensii*, the thallus was two- or three-celled and smaller in size. In this fungus a peculiar phenomenon was observed concerning the germination of sporangium. When the mature sporangia were mounted in a drop on a slide-glass, covered with cover-glass and sealed with paraffin, they germinated by a germ-tube which elongated exceedingly but produced no zoospores.

Aphanomycopsis bacillariacearum SCHERFFEL

in Arch. Protistenk. LII, p. 14, pl. I, figs. 31–35, pl. II, figs. 36–48, 1925; SPARROW, in Mycologia, XXV, p. 530, pl. XLIX, fig. 14, 1933.

Thallus endobiotic, at first consisting of a cylindrical, unbranched tube, later richly branched, provided with long or short, often somewhat inflated twigs, septate at indefinite intervals into a number of cells at maturity, without prominent constriction at the septum, each component cell functioning as a sporangium or an oogonium; sporangia cylindrical or tubular, unbranched or irregularly branched, often lobed, widely variable in length, up to 150 μ long, 4.8–16.8 μ in diameter; exit-tubes single for a sporangium, very long, up to 150 μ in length, about 4.8 μ in breadth; zoospores on leaving the sporangium coming to rest at once in a hollow sphere at the mouth of the exit-tube, encysting there as in Achlya, later swimming away leaving their cyst behind, in encysting globular, 6–7.2 μ in diameter, in swimming kidney-shaped, narrower in front, provided with two cilia near the hilum, containing an oil drop; oogonia (?) intermixed with sporangia in a thallus, terminal or intercalary, cylindrical, medially expanded, 15.6–21.6 μ in breadth, provided with no periplasm; antheridia absent; oospores (?) one or two, laying loosely in an oogonium, spherical, 14.4–19.2 μ in diameter, with smooth, thick membrane and a large oil globule, germination unknown.

Hab. On *Surirella* sp. Maruyama near Sapporo, Prov. Ishikari (July 31, 1931; Aug. 22, 1932).

On *Navicula* sp. Maruyama near Sapporo, Prov. Ishikari (Aug. 22, 1932).

Distrib. Europe, N. America and Japan.

This fungus has been described by SCHERFFEL from Hungary parasitizing on Pinnularia, Epithemia and other diatoms. Our fungus seems to be almost identical with SCHERFFEL's species except in the septation of mature thallus. SPARROW has very recently reported this organism from North America. His fungus consists of a simple, unbranched tube, which is thought to be a reduced, one-celled form of the species. SCHERFFEL has described oospores which had been formed asexually in the swollen, non-septate (?) parts of the intramatrical hyphae. In our material, no sexual fusion was found among these bodies. It seems that they resemble the resting spore of Achlyogeton found by MARTIN. It is not definitely known whether these bodies are the sexual organ or not since their functions remain obscure.

The genus Aphanomycopsis was treated by SCHERFFEL as a member of the Saprolegniaceae together with the genus Ectrogella which is reasonablly considered to belong to the Olpidiaceae in Chytridiales. FITZPATRICK has noted this genus as somewhat imperfectly known and falling near Aphanomyces in Saprolegniaceae. SCHERFFEL pointed out that the characters of contents of vegetative cells are also characteristics of the Saprolegniaceae. Since the genus in question possesses some similarities to Aphanomyces in the character of cell contents and zoospore emergence, he placed the former in the Saprolegniaceae. His description of the genus is quoted partially as follows:

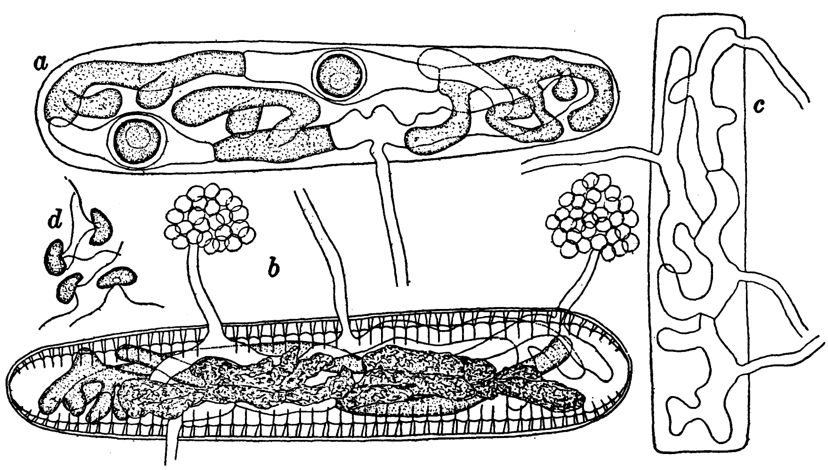

Fig. 3 *Aphanomycopsis bacillariacearum* SCHERFFEL

a. Sporangia and oogonia in *Surirella* sp. ×540. *b.* Showing the habitat of the fungus in *Surirella* sp. ×320. *c.* Empty thallus, whose contents have been entirely extruded, in *Navicula* sp. ×320. *d.* Zoospores in secondary active period. ×540.

"Schlauchinhalt vorerst mattglänzende Plättchen und dazwischen eingestreute, stärker lichtbrechende kleine Körnchen führend, also schollig. Später wie von wässeriger Flüssigkeit erfüllt erscheinend; in dem Wandbelag wenige winzige, glänzende, runde Körnchen, die Ortsveränderungen zeigen (*Aphanomyces*-Habitus). Nachher reich an feinen, glänzenden Körnchen, einen nach innen unregelmässig konturierten, verschieden dicken Wandbelag bildend, von deutlichem Saprolegniaceen-Habitus."

The writer proposes to transfer the genus to the Lagenidiaceae in Ancylistales, based on the following two points:

1. Absence of typically developed mycelium.
2. Thallus completely transformed into the reproductive organs at maturity.

In the Saprolegniaceae, the mycelium is well developed and consists of thread-like hyphae. The thallus functions in a relatively small part in reproduction at maturity, certain specialized cells being cut off from the hyphae to function as reproductive organs. The remainder of the thallus, however, retains its vegetative character.

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A BRIEF NOTE ON THE ACTION OF THE TOP OF A PLANT UPON THE ABSORPTION OF WATER BY THE ROOT

BY

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(田 川 隆).

(With one text-figure)

SACHS, in his classical work, has observed how much water the top of *Nicotiana latissima* could absorb and how much sap could exude from the stump when it was separated from the base of the stem. Exudation of 15 cc. of sap from the basal stump and the absorption of 200 cc. of water by the shoot during five days were ascertained. The water absorption by the top of the plant is 15 times as much as that by the stump and therefore this dispro-portin between them may tell us something about the relations of water economy in plant life. RENNER (1911) has removed the top of a plant and the stump was connected with a suction pump. He estimated the suction force of the plant shoot developed by transpiration at 10–20 atm. by noting the propor-tional relation between the amount of water absorbed by the transpiring top of the plant and that by the decapitated plant root under the application of a suction pump to the stump. RENNER (1929) has also removed the tops of sunflower seedlings and attached calibrated narrow glass tubes to the stumps in which the exudation of water could be determined from the movement of water meniscus in the tubes, the water surrounding the roots being replaced by glucose solutions of varied concentrations. The suction force of the stumps was estimated at about 1.6–4.2 atm. using a concentration of glucose solution in which no further exudation of water from the stumps happend. JOST (1916) and KÖHNLEIN (1930), however, could find no proportionality between the amount of water exuded from the stump of the decapitated plant and the in-tensity of the suction by a pump. The latter has also estimated the suction force of stumps of maize at 2.5 atm. using a similar method to RENNER's (1929). LACHENMEIER (1932) suggested that the increase of transpiration causes the increase of water absorption by the plant root and lately KRAMER (1932, 1933) came to the conclusion that the role of the plant root in the absorption of water

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

had been greatly over-emphasized and that it is important only as an absorbing filter surface.

As seen from the literature stated above, it seems it should be taken into consideration that the suction force of the top of the plant developed by transpiration, may play some important rôle in the absorption of water by the plant root. The experiments reported in the present work were conducted to ascertain the action of the top of the plant upon the water absorption by the plant root under varied atmospheric moisture condition. Material and method are similar to those used before and described in the previous paper[1] of which details are omited here.

In the previous paper the writer has reported the fact that the decapitated plant stopped water absorption in a sucrose solution of a more diluted concentration than the intact plant did in a solution of some certain concentration and that a very slight absorption was again recognized. This difference of the suction force between the intact and the decapitated plant mainly results from an additional action of the shoot of the former. This relation may be expressed by the following formulae :

$$S_i = S_d + T \qquad \text{or} \qquad T = S_i - S_d$$

where S_i is the suction force of the intact plant, S_d is the suction force of the decapitated plant and T is the suction force of the top of the plant developed by transpiration.

Originally the suction force of the intact plant (S_i) is very dependent upon the degree of transpiration, accordingly the existence of some certain proportionality between the atmospheric moisture and the transpiration should be taken into consideration. Now to ascertain the suction force of the intact plant under varied atmospheric moisture the critical concentration of a sucrose solution, in which no water absorption can happen, was estimated. The results are shown in the following table and each Δ-valus was estimated by the cryoscopic method.

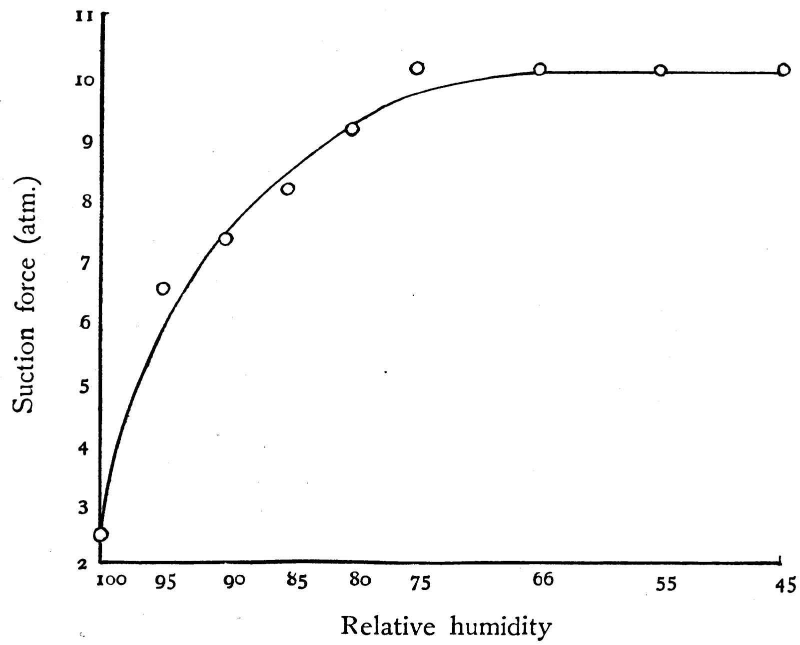
Relat. humidity (%)	100	95	90	85	80	75	65	55	45
Conc. of sol. (Δ)	0.33	0.67	0.75	0.81	0.89	0.99	0.99	0.99	0.99
Osmotic press. (atm.)	3.98	8.07	9.03	9.76	10.72	12.04	12.04	12.04	12 04

The decapitated plant root stopped the absorption of water in the sucrose solution of Δ=0.13 (1.57 atm), accordingly the suction force of the shoots (T) derived from the formulae stated above applying this value to them is shown in the following table.

1) Japan. Jour. of Bot. Vol. VII, 1934.

Relat. humidity (%)	100	95	90	85	80	75	65	55	54
Suction force of shoot (atm.)	2.41	6.50	7.47	8.19	9.15	10.47	10.47	10.47	10.47

The experimental results stated above are represented in the following graph.



One can see a certain proportionality between the suction force of the top of the plant developed by transpiration and the atmospheric moisture, because in the relatively moistened air some inverse proportion was recognized between them, but under a drier atmospheric condition the suction force of the plant shoot was almost constant in spite of the decrease of the atmospheric moisture. Under these conditions, it seems needful to take into consideration that the closing of stomata and the depression of transpiration resulting from it may play some part in this relation.

In another experiment, it is very interesting to note that the suction force of the intact plant shoot of which the stem and leaves were covered with vaseline was estimated at 2.4 atm. which is also the same as that of the saturated atmospheric condition.

From the experimental results stated above the suction force of the top of plant under the varied atmospheric moistures are 2—8 times as much as that of the root itself, accordingly the suction force of the top of plant on the absorption of water by the root should be taken into consideration as a very important factor, but the suction force of the root itself is not to be ignored as by KRAMER (1932, 1933) who regarded it as a mere absorbing filter surface, because it is estimated at about 1.57 atm.

Seasonal fluctuation of the suction force was also recognized. The values determined in summer time, which are shown in the previous paper, were a little larger than those which were estimated in winter.

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CATENULATE CONIDIA FORMATION IN OPHIOBOLUS MIYABEANUS ITO ET KURIBAYASHI

BY

MASAYUKI SAKAMOTO

(坂 本 正 幸)

(With one plate and one text-figure)

Introduction

In December 1933, during the course of the investigation on physiologic specialization in *Ophiobolus Miyabeanus* (the perfect stage of *Helminthosporium Oryzae* BREDA DE HAAN), the causal fungus of the sesame spot disease of rice plant, which had been isolated from the affected grains and leaves, the writer found the occurrence of a chain-form fructification which consisted of conidia much smaller than the ordinary ones. Such a case has never been reported in the present fungus nor in other congeneric species, so far as the writer is aware.

C. DRECHSLER[1], working with some graminicolous species of *Helminthosporium*, reported that *Helminthosporium gramineum* occasionally showed a tendency to produce a secondary spore successively from a primary conidium. Usually it gave rise to a single secondary spore, which sometimes might grow out into a sporophore bearing half a dozen spores. He[2] also reported that in *Helminthosporium catenarium* and *Helminthosporium cyclops* parasitic on *Cinna arundinacea* and *Danthonia spicata* respectively, a similar fructification usually occurred, and moreover in the latter species a small unicellular conidium was proliferated from a sporophore by a budding process. Y. NISHIKADO[3] also reported much frequent occurrence of *Alternaria*-like conidial production in *Helminthosporium teres*, occasionally forming seven to eight secondary conidia on a conidium, and he suggested that it was not appropriate to include this species in the genus *Helminthosporium* on account of such a critical characteristic.

In *Helminthosporium Oryzae*, however, as far as the writer is aware, there

1) C. DRECHSLER: Some graminicolous species of *Helminthosporium*. Journ. Agric. Res., XXIV, pp. 641-739, 1923.

2) C. DRECHSLER: Ibid.

3) Y. NISHIKADO: Studies on the *Helminthosporium* Disease of *Gramineae* in Japan. 1928. (In Japanese)

has been no report concerning the occurrence of such an aberrant fructification. In the present paper the writer will give a brief description of catenulate conidia-production in the present fungus as well as the germination and the subsequent development of microconidia[1] in hanging drop cultures.

The writer wishes to express here his sincere appreciation to Prof. S. ITO for his constant kind directions, and also to present his heartiest thanks to Prof. Y. TOCHINAI for his valuable critisisms.

Microscopical Observations

A number of diseased grains and leaves of rice plant, sterilized superficially with 0.1 % aqueous solution of mercuric chloride, were put on rice-culm decoction agar plate in a PETRI-dish. After a week's incubation at a temperature of 26° C. in an incnbator, the culture medium was covered with vigorous hyphal development extending from the affected materials. By microscope under a low magnification there could be readily observed among the abundant normal fructifications, many aberrant fructifications, in chain-form, usually branching, appearing somewhat similar to that characteristic in members of the genus *Alternaria* (Fig. 1).

Fig. 1 A photomicrograph of catenulate conidia-production in *Helminthosporium Oryzae* on rice-culm decoction agar, ×180.

They consist of a number of one or two celled, rarely three or more celled, microspores (Pl. IX, figs. 1–2). They are oval to elliptical, sometimes oblong or cylindrical in shape (Pl. IX, figs. 1–3), and lighter in color than an ordinary conidium, sometimes being almost hyaline. They are 20-4 2×7-4.2 μ in size, rarely up to 40 μ in length. The wall is more or less thick and the spores are slightly or not constricted at the septum (Pl. IX, figs. 1-3).

In a simple type of catenulate fructification the chain does not

1) In this paper the writer will call every small spore consisting of a chain-form fructification a "microconidium", as in the case of the genus *Fusarium*.

branch, while in a compound type it branches three or four times, the number of spores amounting to fifty or more (Fig. 1). These microconidia may not readily separated from each other, when mounted in water on the slide, although there could be observed no "joint" connecting them with each other (Pl. IX, figs. 1–3). Sometimes certain microconidia were papillated at their apices to bear the proliferated spores, which have usually been observed on the microconidia localized at the branching point of a chain (Pl. IX, figs. 2-3). Moreover the distal part of the microconidia is not marked with a hilum as shown in the budding spore of *Helminthosporium cyclops* by C. DRECHSLER[1].

Hanging Drop Culture

In tap water these microconidia readily germinate at room temperature projecting an almost hyaline germ tube, about 5.6-7.0 μ in width (Pl. IX, figs. 10-13). Two or more celled conidia occasionally germinated at the cells at both ends (Pl. IX, figs. 15–16). Y. NISHIKADO and C. MIYAKE[2] stated that in the case of the germination of an ordinary conidium of the present fungus, the germ tube tightly adhered to the surface of the host plant or the slide glass by means of the mucilaginous outer layers of the wall, and that such mucilaginous layers were easily demonstrated by staining in a dilute gentian violet solution and mounting in water. In the case of germination of a microconidium of the present fungus a similar mucilaginous substance was produced as shown in Pl. XI, figs. 14-16. Such adhesive nature of the germ tube seems to indicate that these microconidia perhaps may be capable of infecting the tissues of the host plant.

The writer made monosporous hanging drop cultures in van Tieghem cells, in particular starting with a unicellular microconidium. Apricot decoction was used as a nutrient solution. Germination was secured in a few hours (Pl. IX, figs. 10-13), and after two days' incubation at a temperature of 26°C. the hyphal development was so vigorous that it could be seen with the naked eye. Hyphal fusion or anastomosis occurred very frequently. The manner of germination and the subsequent hyphal development was quite similar to that of a normal conidium. After three days' incubation only a few ordinary conidia were produced and after four days microconidia as well as ordinary conidia were developed abundantly.

At first an ordinary conidium grows out into an apical prolongation which is almost hyaline and more or less swollen, resembling an incipient germ tube

1) C. DRECHSLER: Ibid., Pl. 33, Aa-Abb and Abc.

2) Y. NISHIKADO and C. MIYAKE: Studies on the *Helminthosporiose* of the rice plant. Ber. Ohara Inst. f. landw. Forschungen, Bd. 11, SS. 135-195, 1922.

in its appearance (Pl. IX, figs. 6-7). This apical prolongation soon begins to constrict at the basal part growing into a primary conidium borne on the apical cell of the conidium (Pl. IX, fig. 8). This primary microconidium also may grow out again into an apical prolongation and produce a secondary spore by means of constriction (Pl. IX, fig. 9). The fructification thus produced becomes further complicated generally producing two or three lateral conidial chains (Fig. 1 and Pl. IX, fig. 2), which develop in a manner somewhat similar in appearance to that characteristic of the members of the genus *Alternaria*. Sometimes these catenulate fructifications are produced directly on the terminal of a sporophore in the same manner as above described (Pl. IX, figs. 2, 4 and 5).

The catenulate conidial production in the present fungus may be regarded as one of the characteristic features peculiar to certain strains of the fungus, rather than as the influence of environmental conditions, because such a catenulate tendency could not be found in the other strains of the fungus grown in the same PETRI-dish.

Explanation of plate

The following figures are all drawn by the aid of a camera lucida and the magnification is × 530.

Fig. 1. Catenulate conidia proliferated from the terminal cell of an ordinary conidium.

Fig. 2. Catenulate conidia produced directly on a sporophore.

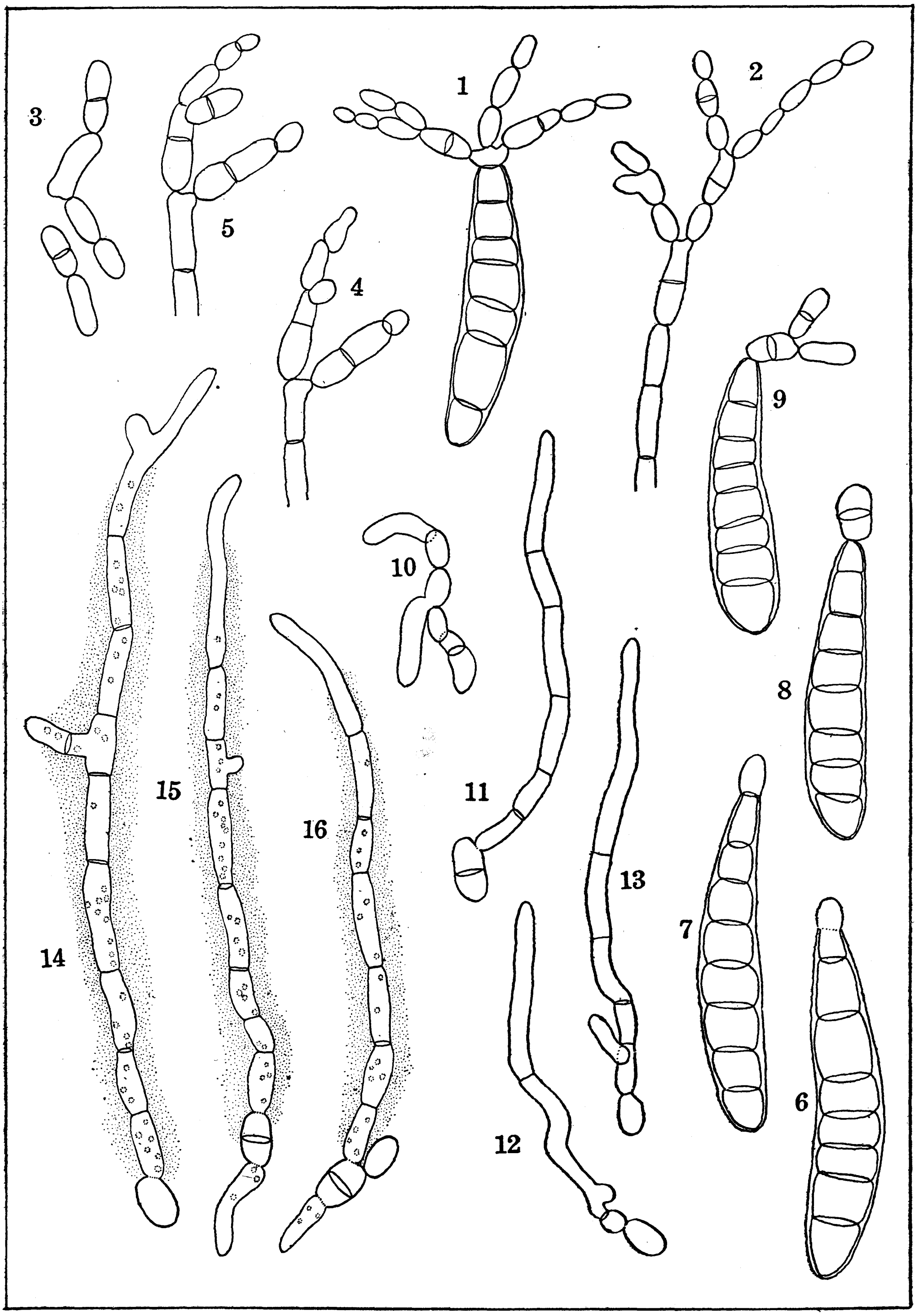
Fig. 3. Catenulate microconidia.

Fig. 4 & 5. Showing the progressive development of catenulate fructification by budding.

Fig. 6-9. Showing the proliferating process of a primary microconidium from an apical cell of an ordinary conidium.

Fig. 10-13. Germinating microconidia.

Fig. 14-16. Showing the mucilaginous sheath of a germ tube stained with gentian violet.



M. Sakamoto del.

STUDIES ON THE TRANSMISSION OF BROAD BEAN MOSAIC

BY

YUZABURO IMAI

(今 井 勇 三 郎)

It is a well known fact that insects play an important rôle in the dissemination of most virus diseases of plants. In our country the evidence that dwarf disease of rice plant is transmitted by the leafhopper, *Nephotettix apicalis* MOTSCH. var. *cincticeps* UHL. has been shown as early as in 1906 by the Imperial Agricultural Experiment Station and likewise by the Shiga Agricultural Experiment Station. This is the first virus disease of plants shown to be transmitted by an insect. KURIBAYASHI(1) (1926) has reported that bean mosaic is disseminated by the aphid, *Macrosiphum solani* KALT. as well as by the red spider. Recently he (2) (1931) found that the leafhopper, *Delphacodes striatellus* FALL. transmits the stripe disease of rice plant. No other evidence has been shown to indicate the possible relationship between certain insects and virus diseases of plants in Japan. This paper has been prepared for the purpose of recording the experimental transmission of broad bean mosaic by three species of aphids, *Aphis laburni* KALT., *Acyrthosiphon pisi* KALT. and *Rhopalosiphum persicae* SULZ.

The writer gratefully acknowledges his indebtedness to Prof. S. ITO for his valuable suggestions.

Symptoms of broad bean mosaic

BÖNING (3) (1927) described in detail the symptoms of broad bean mosaic, stating that there are two distinct types of disease, "Marmoriermosaik" and "Nervenmosaik". The symptoms of the disease under consideration closely resemble those of "Marmoriermosaik."

(1) KURIBAYASHI, K.—On the seed transmission of bean mosaic. (in Japanese) Journ. Pl. Protect. 13 : 199–210. 1926

(2) ————————, Studies on stripe disease of rice plant. (in Japanese) Nagano Agr. Exp. Sta. Bull. 2 : 45–69. illust. 1931

(3) BÖNING, K.—Die Mosaikkrankheit der Ackerbohne (*Vicia faba* L.). Forsch. a. d. Gebiet Pflanzenkr. 4 : 43–111. illust. 1927

The most remarkable features of the disease are mottling on the foliage and the dwarfness of the plant as in the other mosaic diseases of plants. The first symptom to be discerned is a slight clearing of the veins or numerous clear spottings on the leafblade. Subsequently light green areas appear along the veins gradually turning into yellowish green while dark green portions which are irregular in shape develop adjoining the light green areas and become bluish green. The dark green portions sometimes swell up producing blisters scattered on leaflets whereas the yellowish green areas on the newly developed leaves are markedly suppressed from growth and remain unthickened. Affected leaflets are smaller and narrower than the normal ones. Curling down, wrinkling and waving of the margin of the leaflets are generally observed on the leaves in advanced stages of the disease. Sometimes the point of the leaflet is divided into two portions and other malformed leaves frequently appear in mosaic plants. The young shoots and leaves which developed after infection invariably show the symptoms, while the older leaves which have almost completed their growth before infection appear entirely normal. The petioles of affected leaves are as long as the normal ones but occasionally shorter than normal. Mottling develops also on the stipules. The growth subsequent to infection is much arrested, the plant becomes remarkably stunted, the internodes shortened, and the succeeding shoots and leaves remain slender and small, while the axillary buds which should normally remain dormant grow into numerous diminutive shoots.

Transmission of broad bean mosaic by *Aphis laburni* KALT.

On June 30, 1932, the aphids, *Aphis laburni* KALT. were allowed to feed upon a broad bean plant affected with the mosaic disease. Two days later some of these aphids were transferred to a healthy broad bean plant enclosed in an insect proof cage. In two weeks the plant began to show the typical mottling of mosaic on the foliage. On July 3, certain aphids from the same culture as above were transferred to two healthy broad bean plants. In this case, too, infection was produced in one of these plants two weeks after the transfer of the aphids.

Accordingly a series of transmission experiments were carried out with this species of aphid. Five aphids reared on diseased broad bean plants were transferred to each young broad bean plant enclosed in an insect proof cage. Newly born offspring of the aphids were removed with a camel's hair brush every day in the first week and later every other day. In two weeks all the aphids on the plant were removed and killed. Seven out of 10 inoculated plants contracted the mosaic disease. In the other series of experiments the aphids were allowed to feed upon healthy broad bean plants for 1 to 7 days. One hundred and twenty plants in all were infested with the aphids reared on diseased plants and 32 of them became diseased. The infective aphid was able to transmit the disease to a healthy plant after one day's feeding and the incubation period of the virus in the plant averaged 15 days under the writer's conditions.

The attempts to transmit the disease to beans, garden peas and sweet peas by this aphid were successful, 10, 6 and 12, respectively out of 30 inoculated plants having contracted the diesease. The details of the experimental results and the symptoms developed on these plants will be reported in another publication. All the attempts to transmit the disease to lucerne, Adzuki beans and soy beans failed. The parthenogenetically produced progeny of viruliferous aphids could not transmit the disease showing that the infective principle of the broad bean mosaic is not "hereditary."

Transmission of broad bean mosaic by *Acyrthosiphon pisi* KALT.

On May 7, 1932, Mr. K. KAWAI brought the writer some broad bean plants affected with mosaic disese which had been collected in the Experimental Fields of the Imperial Agricultural Experiment Station at Nishigahara, Tokyo. The aphids, *Acyrthosiphon pisi* KALT. (=*Macrosiphum pisi* KALT.) began to appear on these plants in a few days. These aphids were transferred to healthy broad bean plants in order to test their ability to transmit the disease. In two weeks one of these plants began to show faint mosaic symptoms which subsequently became more and more pronounced. A series of transmission experiments were, therefore, carried out with this aphid in the same way as in the case of *Aphis laburni*. Thirty-eight plants in all were infested with the aphids bred on diseased broad bean plants and infection was secured in only 4 of them. It seems that this aphid transmits broad bean mosaic less readily than *Aphis laburni* KALT. Thirty plants of sweet peas were also inoculated by means of the aphid and 4 of them contracted the disease.

Transmission of broad bean mosaic by *Rhopalosiphum persicae* SULZ.

In the course of these experiments it happened that some individuals of the peach aphid, *Rhopalosiphum persicae* SULZ. which were abundant on tobacco plants in the green house migrated to the broad bean plants affected with mosaic disease. Some of these aphids were found feeding upon healthy garden pea plants which had been placed by the mosaic broad bean plants. In about two weeks the garden pea plants began to show the symptom of mosaic. Consequently it was supposed that some aphids which had picked up the virus migrated to garden pea plants producing infections in these plants. A series of experiments were carried out in order to obtain more definite evidence to indicate it. Throughout three experiments 30 broad bean plants were subjected to the infestation of the aphids reared on the mosaic broad bean plants and 13 of them became infected, the percentage of infection amounting to 43 %.

Artificial inoculation with the juice of mosaic broad bean plant

Thirty grams of the leaves and stems of mosaic broad bean plants were thoroughly ground in a sterilized mortar adding 20 cc. of sterilized water and filtered through two thicknesses of thin cotton cloth. A large drop of the inoculum thus prepared was placed with a sterile scalpel on a leaf axil and with a sterile needle about 30 pricks were made through the fluid. Two inoculations were made on each plant on the axils at the basal part of the stem. Sixty young broad bean plants were thus inoculated by needle pricks. In 6 to 15 days after inoculation 29 plants showed the symptom of mosaic. The other plants remaind healthy until the experiments had been finished. Fourteen check plants which had been pricked with a sterile needle were also free from the disease.

The attempts to infect young broad bean plants with the juice of crushed viruliferous aphids gave negative results.

Discussion and conclusion

As a result of these experiments it was ascertained that broad bean mosaic was transmitted by three species of aphid, i. e. *Aphis laburni* KALT. (=*A. rumicis*), *Acyrthosiphon pisi* KALT. (=*Macrosiphum pisi*) and *Rhopalosiphum persicae* SULZ. (=*Myzus persicae*). BÖNING[1] (1927) was the first to prove experimentally that certain aphids are responsible for the dissemination of broad bean mosaic. According to him *Aphis fabae* (=*A. rumicis*), *Macrosiphum pisi* and *Rhopalosiphum viciae* transmit it. It was subsequently confirmed by MEULEN[2] (1928) and MERKEL[3] (1929). The present writer found that the peach aphid, *Rhopalosiphum persicae* also acts as an insect vector of the mosaic disease of the broad bean. It appears that these species of aphids are unequally endowed with the

(1) loc. cit.

(2) MEULEN, J. G. J. VAN—Voorloopige onderzoek naar de specialisatie en de infectiobronnen der mosaikziekten van landbouwgewassen. Tijdschr. Pflanzenziekt. 34 : 155–176. 1928 (orignal not seen)

(3) MERKEL, L.—Beitrage zur Kenntnis der Mosaikkrankheit der Familie der Papilionaceen. Zeitschr. Pflanzenkr. 39 : 289–347. illust. 1929

ability to transmit the disease, *Aphis laburni* being capable of transmitting the disease most easily, *Rhopalosiphum persicae* the next, and *Acyrthosiphon pisi* least readly. In this connection it is noteworthy that *Aphis laburni* multiplies itself most readily on the broad bean plant, *Acyrthosiphon pisi* the next and *Rhopalosiphum persicae* is less abundant on this plant. As a matter of fact the former two species only are found feeding upon the broad bean plant in the fields.

It was rather striking that some plants infested with viruliferous aphids did not contract the disease whereas the same individuals of aphids produced infection in the other plants under similar conditions. This might be explained on the assumption of any one of the following cases: either certain viruliferous aphids sometimes fail to produce infection in healthy plants for some unknown reason or certain individual plants resist the virus of mosaic disease. When numerous aphids were allowed to feed upon one plant, infection was produced more easily as compared with the case when a plant was subjected to the feeding of a few aphids. This may be due to the fact that there exist non-viruliferous aphids which were bred on mosaic plants.

The broad bean mosaic was transmitted to the garden pea, sweet pea and bean by *Aphis laburni* and to the sweet pea by the agency of *Acyrthosiphon pisi*. The former aphid failed to transmit the disease to the lucerne, Adzuki bean and soy bean. The infective aphid was able to transmit the virus to a healthy broad bean plant after one day's feeding. The incubation period of the virus in the plant was generally 6 to 10 days but rarely as long as 3 to 4 weeks while that in the insect carrier seemed to be very short. The parthenogenetically produced progeny of viruliferous aphids could not transmit the disease showing that the infective principle is not "hereditary."

It is worthy of note that BÖNING was unable to transmit the broad bean mosaic to healthy plants by artificial inoculation with the mosaic plant juice, whereas the writer successfully transmitted the disease through the plant juice. However, it is not definitely known whether both the disease under consideration and BÖNING's broad bean mosaic are caused by the same virus.

MORPHOLOGICAL AND SYSTEMATIC STUDIES ON FEMALE FLOWERS OF MULBERRY TREES

BY

TEIKICHI HOTTA

(堀 田 禎 吉)

With regard to the classification of mulberry trees in Japan, a considerable number of papers have appeared, among which are notable those by Dr. KOIZUMI, Dr. YENDO, and Dr. NAKAI. The present writer has engaged in morphological studies of mulberry flowers in order to ascertain whether or not the systematic features mentioned by Dr. KOIZUMI concerning some species of mulberry trees and certain cultivated forms, prevail in all tne wild and cultivated mulberry trees spread over this country; and whether there exist such morphogical relations among the forms of flowers and those of leaves as were formerly mentioned by the writer himself. This paper is prepared to report a part of the results of these studies, the details of which will be published later.

My gratitude is due to Prof. S. ITO and Dr. M. TATEWAKI for their constant guidance, to Prof. emeritus K. MIYABE and Dr. Y. TOCHINAI for their kind suggestions and advice, and also to experimental stations, and agricultural sericultural colleges all over the country for the specimens which they so kindly supplied.

Length and width of stigma, style, and female flower.

The following table is based upon the results of the author's observations on the materials obtained Spring during the four years from 1931 to 1934. Fresh materials were preferred when available, but it was necessary at times to use specimens preserved in a solution made of 3 parts alcohol and 1 part formalin. The figures in the table denote the mean values of three measurements. Blanks show that the specimens treated were found either imperfect or wanting in part. Numbers attached to Noguwa denote the number of specimens. Length of female flowers is measured from the base of the ovary to the branching point of the stigma.

Item / Name	Stigma		Style		Female Flower		Ratio of length of style to that of female flower	Ratio of width of style to that of female flower
	Length	Width	Length	Width	Length	Width		
	mm	mm	mm	mm	mm	mm	%	%
Azuma-shidare	2.30	0.20	1.20	0.48	1.87	1.37	64.2	87.6
Aoki	1.48	0.19	0.60	0.47	1.50	1.30	40.0	46.2
Akaki	2.24	0.25	0.87	0.51	1.99	1.99	43.7	43.7
Aka-ichihei	2.50	0.30	0.77	0.56	2.03	2.04	37.9	37.7
Azumi-ichihei	2.63	0.37	—	—	2.23	2.33	—	—
Azumi-guwa	3.13	0.35	1.12	0.56	3.58	2.80	31.3	48.7
Ao-shodo	1.40	0.28	0.10	0.40	2.27	1.97	4.4	5.1
Akame-yanagida	1.95	0.23	0.80	0.58	1.90	1.84	42.1	43.5
Aokawa-rosoh	2.00	0.30	—	—	1.80	1.90	—	—
Bishamon	2.00	0.35	0.10	0.60	2.00	2.10	5.0	4.8
Bashoh	1.60	0.30	0.30	0.58	1.80	2.20	16.7	13.6
Bankoku-soh	3.90	0.21	0.60	0.75	2.00	1.80	30.0	33.3
Date-akaki	1.85	0.28	1.10	0.50	1.87	1.86	58.8	59.1
Daioh-nishiki	1.93	0.29	—	—	2.07	2.00	—	—
Date-ichibei	1.78	0.24	0.23	0.50	1.80	2.00	12.8	11.5
Daruma	1.77	0.25	—	—	2.03	1.78	—	—
Daihoh-guwa	1.93	0.28	1.27	0.57	2.03	2.10	62.6	60.5
Daikoku-guwa	1.27	0.30	0.37	0.58	2.20	2.00	16.8	18.5
Dainoh-nishiki	1.83	0.30	0.37	0.61	3.20	1.68	11.6	22.0
Dohsan-guwa	—	—	1.03	0.40	1.99	2.40	51.8	42.9
Dohri-guwa	0.97	0.23	0.40	0.57	1.70	1.70	23.5	23.5
Echigo-aojiku	1.90	0.26	0.44	0.47	1.77	1.77	24.9	24.9
Eishichi	1.70	0.28	0.40	0.52	2.97	2.80	13.5	14.3
Fukushima-ohha	2.07	0.24	0.34	0.49	2.27	2.15	14.9	15.8
Fusoh-maru	1.60	0.33	0.13	0.45	2.90	2.40	4.5	5.4
Fushoh	1.57	0.17	0.28	0.50	1.82	1.50	15.4	18.7
Fushimagari-guwa	1.70	0.30	1.20	0.40	2.00	1.90	60.0	63.2
Futo-yamato	1.80	0.30	0.30	0.50	1.90	2.00	15.8	15.0
Furisode	1.24	0.20	0.60	0.43	1.40	1.26	42.9	34.1
Fure-kijinba	2.30	0.30	—	—	1.50	1.30	—	—
Fuka-yamagi	2.20	0.25	—	—	1.70	1.20	—	—
Fuse-ryuh	1.47	0.33	—	—	3.07	2.83	—	—
Fuhki-nishiki	2.10	0.21	0.70	0.50	1.40	1.30	50.0	53.8

Fuki	1.80	0.30	0.85	0.48	1.10	1.20	77.3	70.8
Futsu No. 5	2.05	0.20	0.60	0.54	3.00	2.90	20.0	20.7
Fuyeh	2.14	0.40	0.13	0.57	1.90	1.80	6.8	7.2
Gorohji	1.50	0.23	0.93	0.47	2.14	2.28	43.5	40.8
Gosho-erami	1.71	0.39	0.49	0.53	2.34	2.22	20.9	22.1
Ginryuh	1.42	0.26	0.64	0.57	1.84	1.72	34.8	37.2
Geboh-guwa	1.80	0.23	0.40	0.35	1.40	1.30	28.6	30.8
Gunma-bandoh	1.75	0.23	0.33	0.59	1.70	1.60	19.4	20.6
Gobo-guwa	2.65	0.14	1.90	0.59	2.10	2.00	90.5	95.0
Gunma-akagi	2.87	0.30	0.71	0.61	2.05	1.76	34.6	40.3
Gorohji-wase	1.60	0.37	1.10	0.44	1.89	1.97	58.2	55.8
Gin-bashoh	1.49	0.20	0.32	0.39	1.86	1.51	17.2	21.2
Ginbuto	1.63	0.21	0.31	0.42	1.40	1.55	22.1	20.0
Hiroe-guwa	1.40	0.30	0.20	0.60	2.40	2.60	8.3	7.7
Hirashimizu-wase	1.50	0.40	—	—	1.90	2.70	—	—
Hikojiroh	1.80	0.40	—	—	2.04	1.90	—	—
Hosoe	1.20	0.20	0.50	0.40	0.90	1.00	55.6	50.0
Hikae-guwa	2.10	0.30	0.10	0.60	1.70	1.70	5.9	5.9
Hotei	1.60	0.40	0.90	0.50	2.00	1.60	45.0	56.3
Hachijyoh-guwa	1.60	0.25	1.00	0.58	2.10	2.20	47.6	45.5
Hokunoh No. 10	2.19	0.19	1.42	0.40	1.92	1.86	73.9	76.3
Heijiroh	1.70	0.40	0.33	0.60	2.30	2.20	14.3	15.0
Hida-kuwa	1.88	0.33	1.05	0.55	1.55	1.52	67.7	69.1
Hassun-guwa	1.63	0.21	0.57	0.47	1.40	1.48	40.7	38.5
Hime-guwa	1.60	0.20	1.70	0.28	2.20	2.20	77.3	77.3
Hime-zuru	2.00	0.20	0.70	0.50	1.80	1.70	38.9	41.2
Haruiro-guwa	2.07	0.26	—	—	2.87	2.47	—	—
Isama-guwa	1.50	0.27	—	—	2.00	2.07	—	—
Iwase	2.03	0.38	0.37	0.57	2.30	2.17	16.1	17.1
Ichinose	0.29	0.22	0.40	0.67	1.80	1.77	22.2	22.6
Ihagi-wase	1.85	0.29	—	—	1.90	1.70	—	—
Itari No. 1	1.58	0.21	—	—	1.80	1.40	—	—
Izu-wase	1.80	0.30	1.00	0.30	2.60	2.00	38.5	50.0
Ichibei	2.09	0.24	1.09	0.55	2.18	2.23	50.0	48.9
Iriyama-takasuke	1.30	0.26	0.40	0.58	1.07	1.43	37.4	27.9
Izumi	1.80	0.28	0.27	0.45	1.53	1.60	17.6	16.9
Juhshima	2.05	0.17	0.77	0.51	2.12	1.84	36.8	41.8
Jiuhbei-guwa	1.48	0.21	0.59	0.50	1.00	1.08	59.0	54.6

Jiusen	1.60	0.67	0.30	0.53	2.30	2.20	13.0	13.6
Kuro-wase	2.11	0.20	—	—	2.50	2.40	—	—
Koban-wase	1.90	0.26	0.13	0.64	1.90	1.85	6.8	7.0
Kinkai-nezumigaeshi	1.37	0.16	—	—	3.00	2.50	—	—
Kasuga	1.54	0.51	0.20	0.59	1.65	1.60	12.1	12.5
Kataneo	1.93	0.31	0.23	0.60	2.23	1.79	10.3	12.8
Kohsen	1.64	0.61	0.53	1.17	1.54	1.30	34.4	40.8
Kohsen No. 2	1.03	0.15	1.01	0.23	2.40	1.72	42.1	58.7
Kumonryuh	1.98	2.10	0.55	0.41	2.90	3.20	18.9	17.2
Kunimasu	1.91	0.30	0.39	0.43	1.20	1.25	32.5	31.2
Kairyoh-aoichi	2.47	0.25	0.97	0.44	1.83	1.63	53.0	59.5
Kenmochi-soh	0.87	0.26	0.50	0.51	2.49	2.36	20.1	21.2
Kohhai-juhmonji	1.43	0.30	—	—	2.30	1.87	—	—
Keisoh	1.38	0.22	0.33	0.49	2.80	2.72	11.8	12.1
Kin-bashoh	2.10	0.37	1.06	0.51	2.75	2.20	38.5	48.2
Kairyoh-juhmonji	1.50	0.30	—	—	2.07	1.87	—	—
Kairyoh-wasejuhmonji	1.93	0.38	—	—	1.67	1.20	—	—
Kinjiyoh	2.33	0.40	0.50	0.60	2.07	2.03	24.2	24.6
Kurimoto	2.41	0.33	0.11	0.60	1.90	1.60	5.8	6.9
Kani-kobore	2.93	0.30	0.47	0.70	2.80	2.43	16.8	19.3
Kozaemon	2.15	0.22	0.52	0.19	2.50	2.40	20.8	21.7
Kokusoh No. 13	1.76	0.25	0.26	0.50	1.93	1.69	13.5	15.4
Kokusoh E	1.72	0.16	0.22	0.49	1.80	1.60	12.2	13.8
Kanoh-guwa	2.10	0.27	0.96	0.60	1.60	1.60	60.0	60.0
Kurome-yamato	1.63	0.20	0.35	0.50	1.50	1.80	23.3	19.4
Kanrasoh	1.79	0.24	0.30	0.51	2.30	1.67	13.0	17.9
Kairyo-nezumigayeshi	1.52	0.25	0.25	0.54	2.28	2.24	10.9	11.2
Kairyo-rosoh	1.63	0.21	—	—	2.20	2.20	—	—
Kinryuh	1.03	0.24	1.10	0.60	2.50	2.07	44.0	53.1
Kaneko	2.25	0.24	0.99	0.51	2.06	2.25	48.1	44.0
Kanoh	2.17	0.22	0.17	0.60	1.73	1.53	9.8	11.1
Kyuhei	1.83	0.23	0.21	0.53	1.25	1.20	16.8	17.5
Kunitomi	1.76	0.27	0.40	0.46	1.80	1.67	22.2	23.9
Kuwaichi	2.70	0.22	0.46	0.55	2.30	2.20	20.0	20.9
Kanshichi	1.97	0.30	0.43	0.53	1.47	1.53	29.3	28.1
Kurokobore	1.27	0.21	0.57	0.46	1.90	1.80	30.0	51.7
Kasoh	1.10	0.20	0.13	0.57	2.60	2.37	5.0	5.5
Kurokomaki	2.89	0.14	1.30	0.32	2.10	2.40	61.9	54.2

Kokusoh No. 7	1.30	0.26	—	—	1.50	1.60	—	—
Kame-kuwa	1.90	0.16	1.53	0.46	2.70	1.67	56.7	91.6
Kanime	2.23	0.35	0.27	0.57	2.33	2.10	11.6	12.8
Kanton-guwa	2.15	0.26	—	—	2.80	2.65	—	—
Kahachi	1.70	0.24	0.97	0.48	2.05	2.00	47.3	48.5
Kokusoh No. 70	1.61	0.21	0.12	0.51	2.70	2.95	4.4	4.1
Koshiori-hime	2.77	0.22	0.67	0.49	1.70	1.60	39.4	41.9
Kokusoh No. 17	1.54	0.21	—	—	1.90	2.00	—	—
Kuro-kasuga	1.33	0.28	—	—	2.57	2.73	—	—
Kurimoto-wase	2.39	0.25	—	—	1.80	2.05	—	—
Kuroki-ichihei	1.97	0.30	0.40	0.50	2.03	1.98	19.7	20.2
Kokusoh No. C	2.07	0.30	—	—	2.00	2.00	—	—
Kubota-wase	2.10	0.21	0.30	0.50	1.80	2.00	16.7	15.0
Kohtaku-kinkobore	1.30	0.40	—	—	2.20	1.90	—	—
Kyuzaemon-kobore	2.30	0.22	0.10	0.50	1.20	1.40	8.3	7.1
Kiriko-chirimen	2.28	0.21	0.39	0.49	2.10	1.50	18.6	26.0
Motoyemon	1.80	0.26	0.50	0.53	1.40	1.50	35.7	33.3
Makuwa	2.85	0.42	0.92	0.52	2.46	2.08	37.4	44.2
Maruha-guwa	2.06	0.25	1.03	0.66	2.00	1.95	51.5	52.8
Murasaki-wase	1.85	0.19	0.71	0.45	2.19	1.89	32.4	37.6
Mizuuchi guwa	1.87	0.24	0.52	0.44	1.88	1.89	27.7	27.5
Mizusawa-guwa	1.70	0.29	0.50	0.45	1.93	1.74	25.9	28.7
Mikawa-kamekuwa	1.23	0.33	0.52	0.63	2.03	2.05	25.6	25.4
Miran No. 5	2.12	0.30	—	—	2.10	2.03	—	—
Mikino-kobore	1.88	0.24	0.98	0.37	2.02	1.80	48.5	54.4
Midori-nishiki	2.00	0.22	0.27	0.59	2.00	2.00	13.5	13.5
Mikawa-aomerokuroh	1.73	0.25	0.18	0.50	1.60	1.40	11.3	12.9
Muneshige-guwa	1.80	0.25	0.80	0.40	2.00	2.10	40.0	38.1
Medaka-wase	1.93	0.29	—	—	2.23	2.03	—	—
Midare-guwa	1.63	0.29	—	—	2.43	2.27	—	—
Mamono	—	—	0.70	0.52	1.80	1.87	38.9	37.4
Motoyamato	1.90	0.30	0.57	0.47	2.05	2.03	27.8	28.1
Mizukuguri	2.07	1.87	0.47	0.41	1.90	1.70	24.7	27.6
Mikawa-nakajima	2.30	0.30	1.10	0.60	2.00	2.30	55.0	47.8
Mitsume-guwa	1.93	0.30	0.43	0.50	2.30	1.90	18.7	22.6
Mizushima-wase	2.20	0.20	0.40	0.50	2.40	2.30	16.7	18.7
Mukashi-yamato	1.42	0.20	0.97	0.50	2.00	1.70	48.5	57.1
Makado-guwa	1.45	0.31	0.51	0.45	1.80	2.10	28.3	24.3

Manji-guwa	3.10	0.30	0.20	0.60	3.00	2.90	6.7	6.9
Nakamagi	1.83	0.28	0.19	0.59	2.40	1.94	7.9	9.8
Kaganuma-guwa	1.94	2.04	0.36	0.67	2.15	1.85	16.8	1.95
Nohjiyoh	2.80	0.23	0.40	0.43	1.80	1.65	22.2	24.2
Noda-guwa	2.20	0.30	0.80	0.57	2.30	2.40	34.8	33.3
Norimune-guwa	1.50	0.22	0.30	0.60	2.30	2.40	13.0	12.5
Nemurasaki	2.20	0.20	1.70	0.60	2.40	2.20	70.8	77.3
Nagasawa-guwa	1.63	0.21	0.20	0.40	1.83	1.81	10.9	10.9
Nezumigayeshi	1.86	0.24	0.40	0.49	1.38	1.40	28.9	28.6
Nishiyamato	1.90	1.80	0.27	0.60	2.10	2.00	12.9	13.5
Nagase-guwa	1.73	0.26	—	—	2.15	2.20	—	—
Nagasode-guwa	2.11	0.23	0.29	0.49	2.30	2.20	12.6	13.2
Noguwa 1	2.27	0.19	1.47	0.51	2.40	2.73	61.3	53.8
Noguwa 2	1.90	0.13	1.63	0.47	2.93	3.17	55.6	51.4
Noguwa 3	1.70	0.19	1.53	0.50	2.20	2.87	69.5	53.3
Noguwa 4	1.85	2.25	1.65	0.85	2.41	3.60	68.5	45.8
Noguwa 5	2.40	0.20	1.70	0.50	2.40	2.50	70.8	68.0
Noguwa 6	2.10	0.20	1.33	0.47	3.10	3.13	42.9	42.5
Noguwa 7	1.60	0.20	1.23	0.45	2.37	3.37	51.9	36.5
Noguwa 8	1.43	0.18	1.00	0.28	2.50	2.57	40.0	38.9
Noguwa 9	1.40	0.20	1.10	0.50	2.37	3.07	46.4	35.8
Noguwa 10	1.77	0.20	1.63	0.50	2.83	3.10	57.6	52.6
Noguwa 11	1.83	0.27	2.33	0.50	2.47	2.80	94.3	83.2
Noguwa 12	2.27	0.19	1.73	0.45	2.93	3.50	59.0	49.4
Noguwa 13	2.23	0.18	1.40	0.60	2.43	2.40	57.6	58.3
Noguwa 14	1.17	0.25	1.07	0.50	1.57	1.57	68.2	68.2
Noguwa 15	2.57	0.20	1.37	0.33	2.53	3.07	54.2	44.6
Noguwa 16	3.43	0.17	1.10	0.48	2.53	2.60	43.5	42.3
Noguwa 17	1.90	0.18	1.27	0.43	2.43	2.83	52.3	44.9
Noguwa 18	1.30	0.23	1.17	0.52	2.60	3.13	45.0	37.4
Noguwa 19	1.80	0.20	2.03	0.48	2.60	3.67	78.1	55.3
Noguwa 20	1.93	0.19	0.83	0.43	2.37	2.80	35.0	29.6
Noguwa 21	0.77	0.20	1.33	0.30	2.27	3.00	58.6	44.3
Noguwa 22	1.33	0.21	1.60	0.50	2.63	3.13	60.8	51.1
Noguwa 23	2.27	0.24	1.50	0.57	2.60	3.20	57.7	46.9
Noguwa 24	2.33	0.26	2.07	0.58	2.97	3.57	69.7	57.9
Noguwa 25	1.23	0.23	1.23	0.52	2.70	3.77	45.6	32.6
Noguwa 26	1.30	0.16	1.50	0.48	2.33	2.63	64.4	57.0

Noguwa 27	1.83	0.22	1.87	0.47	2.37	3.07	78.9	60.9
Noguwa 28	1.43	0.20	1.53	0.32	2.57	3.27	59.5	46.8
Noguwa 29	2.20	0.20	1.17	0.53	2.30	2.57	50.9	45.5
Noguwa 30	1.37	0.22	1.23	0.37	2.60	3.20	47.3	38.4
Noguwa 31	1.50	0.20	1.30	0.47	3.17	4.40	41.0	29.5
Noguwa 32	1.07	0.22	1.70	0.37	2.37	3.33	71.7	51.1
Noguwa 33	1.23	0.20	1.40	0.58	2.33	3.30	60.1	42.4
Noguwa 34	2.00	0.20	1.83	0.43	2.43	2.47	75.3	74.1
Noguwa 35	1.47	0.27	1.17	0.45	2.33	3.90	50.2	30.0
Noguwa 36	2.60	0.20	1.63	0.43	2.67	2.77	61.0	58.8
Noguwa 37	2.20	0.22	1.30	0.48	2.13	2.07	61.0	62.8
Noguwa 38	1.70	0.21	1.33	0.40	2.53	3.93	52.6	33.8
Noguwa 39	2.07	0.19	2.40	0.57	2.43	4.40	98.8	54.5
Ohfushi-magari	1.61	0.18	0.49	0.41	2.10	1.70	23.3	28.8
Ohshima-guwa	1.32	0.23	1.03	0.47	1.95	1.85	52.8	55.7
Ohso-guwa	1.47	0.22	1.23	0.52	2.67	2.43	46.1	50.6
Ohkane-guwa	1.67	0.21	0.60	0.42	1.43	1.37	41.9	43.8
Ohba-guwa	1.95	0.37	1.28	0.53	1.98	1.94	64.6	65.9
Otome-tsubakiguwa	1.73	0.27	0.40	0.57	1.93	1.73	20.7	23.1
Ohba-tanaka	1.93	0.28	0.97	0.58	2.20	2.13	44.1	45.5
Ohshuh-guwa	2.87	1.40	0.30	0.70	2.70	2.80	11.1	10.7
Ohchirimen	2.73	0.18	0.75	0.59	2.60	2.70	28.8	27.8
Ohba-wase	1.33	0.25	0.39	0.48	2.38	2.43	16.4	16.0
Oh-wase	1.51	0.26	0.39	0.38	2.00	1.86	19.5	20.9
Okinawa-guwa	2.20	0.33	1.53	0.57	2.38	2.30	64.3	66.5
Ohzeki-juhmonji	1.43	0.31	—	—	2.67	2.33	—	—
Ohkura-ohba	2.08	0.34	0.16	0.68	2.03	1.88	7.9	8.5
Onna-kunitomi	—	—	0.76	0.43	1.70	1.33	44.7	57.1
Ohdate	1.93	0.29	0.50	0.51	1.50	1.53	33.3	32.7
Ohba	1.93	0.30	0.63	0.49	2.03	1.97	31.0	31.9
Ohgon	1.13	0.23	0.83	0.37	2.40	1.99	40.7	41.7
Obata	0.66	0.30	0.47	0.42	1.67	1.67	28.1	28.1
Kokoku yasoh	1.71	0.31	0.30	0.38	1.90	1.80	15.8	16.7
Kisoh	1.98	0.86	0.48	0.44	2.07	1.85	23.2	25.9
Kohachi	2.00	0.26	0.18	0.51	2.33	2.28	7.7	7.9
Kokuroh-wase	1.70	0.33	0.79	0.60	1.90	2.00	41.6	39.5
Kokunojiyoh	2.62	0.21	0.27	0.55	2.40	2.43	11.3	11.1
Ryuhzan	1.80	0.21	—	—	2.53	2.53	—	—

Ryohmen-guga	1.87	0.30	—	—	1.67	1.53	—	—
Shiro-goboh	2.10	0.20	1.28	0.47	2.10	1.90	60.9	67.4
Shina-kanton	2.70	1.93	0.55	0.63	1.70	1.80	32.4	30.6
Shiromeryuh	2.08	0.19	—	—	1.90	1.80	—	—
Satomi	1.36	0.17	1.66	0.57	2.40	3.00	69.2	55.3
Shuhu	2.07	0.30	0.32	0.68	1.77	1.52	18.1	21.1
Seijuhroh	1.99	0.50	0.39	0.52	2.34	2.18	16.7	17.9
Shinshiro	1.88	2.05	0.39	0.42	1.83	1.65	21.3	23.6
Shiro-makado	1.50	2.63	0.28	0.48	1.80	1.50	15.6	18.7
Shihoh-maru	2.03	1.90	0.25	0.51	2.00	1.95	12.5	12.8
Shiroishi-guwa	2.40	0.20	0.63	0.52	1.60	1.35	39.4	4.67
Suji-kuwa	2.03	0.31	0.40	0.57	2.07	1.67	19.3	23.9
Sodefuri	—	—	2.62	3.20	4.00	3.90	65.5	67.2
Sosuke-wase	2.63	0.24	0.59	0.48	1.93	1.63	30.6	36.2
Sagami-wase	2.35	0.22	0.20	0.60	2.00	1.90	10.0	10.5
Sakigake-wase	1.53	0.28	—	—	1.90	2.05	—	—
Sanshuh-wase	2.02	0.20	1.34	0.47	2.70	2.40	49.6	55.8
Shimizu-wase	2.00	0.19	0.47	0.44	2.40	2.20	19.6	21.4
Saiichi	2.23	0.15	0.44	0.51	1.80	2.00	24.4	22.0
Shiro-nezumigaeshi	2.05	0.34	0.76	0.62	1.50	1.78	50.7	42.7
Shimamura-wase	1.87	0.25	—	—	2.20	2.20	—	—
Shohji	1.79	0.31	0.44	0.53	1.80	1.70	24.4	2.59
Shamu	1.83	0.31	—	—	3.07	2.93	—	—
Sohsuke	2.03	0.24	1.00	0.43	2.13	1.87	46.9	53.5
Shirakiyamato	2.00	0.28	0.50	0.51	1.73	1.63	28.9	30.7
Shiroume-kuwa	2.17	0.22	1.10	0.44	2.10	1.87	52.4	58.8
Sapporo-guwa	1.53	0.26	—	—	2.20	2.20	—	—
Shikishima	3.36	0.45	1.17	0.95	3.17	2.89	36.9	40.5
Shimamura	2.00	0.22	0.17	0.56	2.13	1.87	7.9	9.1
Sunakawa-nishiki	1.67	0.24	—	—	2.10	1.93	—	—
Senmatsu	1.65	0.35	0.46	0.44	2.32	2.29	19.8	20.1
Shidare-guwa	1.45	0.21	—	—	2.17	1.97	—	—
Shuhkakuichi	2.17	0.29	—	—	2.69	2.49	—	—
Shiro-shidare	1.30	0.20	—	—	2.40	2.00	—	—
Shirome-keisoh	1.33	0.22	—	—	1.99	1.98	—	—
Shinjiyo-nishiki	1.30	0.27	0.43	0.40	2.13	2.07	20.2	20.8
Suigen	2.10	0.24	0.23	0.47	1.43	1.37	16.1	16.8
Shihohsaki	1.48	0.23	—	—	2.30	1.70	—	—

Shihoh	2.60	0.27	0.35	0.55	2.00	2.30	17.5	15.2
Tsuruta	1.98	0.30	0.59	0.58	1.99	1.86	29.6	31.7
Tanba-gengoroh	2.04	0.23	0.17	0.67	2.30	2.50	7.4	6.8
Toyokuni	2.60	0.45	0.26	0.53	2.80	2.60	9.3	10.0
Tako-wase	1.90	0.26	0.54	0.46	1.57	1.88	28.9	28.7
Tenryuh	1.53	0.20	0.16	0.46	1.90	2.00	8.4	8.0
Teikoku-guwa	1.76	0.20	0.57	0.44	2.90	2.70	19.7	21.1
Taiwan-wase	1.81	0.20	0.45	0.45	3.20	2.60	14.1	17.3
Tokusen	1.43	0.23	0.29	0.44	1.95	1.80	14.9	16.1
Tohkyoh-ohha	2.53	0.22	0.49	0.50	1.20	1.10	40.8	44.5
Tsukimaru	1.60	0.30	2.00	1.80	3.60	3.20	55.6	62.5
Takatomi	1.93	0.20	1.07	0.52	2.73	2.57	39.2	42.0
Taiyoh	2.03	0.30	1.13	0.53	1.40	1.59	80.7	71.1
Taishohsen	2.21	0.27	0.61	0.56	2.15	1.74	28.4	35.1
Tama-chijimi	1.33	0.40	0.80	0.61	1.60	1.42	50.0	56.3
Takagi	1.36	0.40	0.63	0.80	2.13	2.23	29.6	28.3
Tanba-akagi	2.00	0.40	0.93	0.46	2.20	2.50	42.3	37.2
Takao-guwa	2.13	0.40	0.53	0.47	1.67	1.50	31.7	35.3
Tanba-maru	2.26	0.30	0.60	0.37	2.50	2 23	24.0	26.9
Tsubaki-guwa	2.06	0.23	0.44	0.39	1.40	1.20	31.4	36.7
Tako	2.05	0.25	0.67	0.47	1.84	1.95	36.4	34.4
Tsukasa-guwa	1.07	0.30	0.23	0.68	1.50	1.37	15.3	16.8
Tamba-kunitomi	1.53	0.20	0.67	0.44	2.23	2.03	30.0	33.0
Takara-guwa	1.67	0.23	—	—	2.00	2.07	—	—
Tanbagi	1.67	0.25	0.57	0.53	2.42	2.24	23.6	25.4
Takasuke	1.97	0.31	0.54	0.57	1.96	1.98	27.6	27.3
Tsuchiba	2.57	0.20	0.58	0.47	2.20	2.00	26.4	29.0
Tohsuke	2.04	0.19	1.03	0.58	2.53	2.30	40.7	44.8
Toyorame	1.57	0.23	0.37	0.57	1.60	1.70	23.1	21.8
Tohsuke-wase	1.80	0.28	0.53	0.52	2.00	2.10	26.5	25.2
Uriguwa	2.13	0.30	0.56	0.52	1.27	1.27	44.1	44.1
Uguisu-wase	1.84	0.31	1.56	0.54	2.00	1.89	78.0	82.5
Wakanoura	1.60	1.70	0.35	0.38	2.20	2.40	15.9	14.6
Wasukejuhmonji	1.50	0.35	—	—	2.83	2.67	—	—
Wase-juhmonji	1.45	0.32	—	—	3.80	5.00	—	—
Yasunaka-guga	1.87	0.22	0.51	0.59	2.20	2.20	23.2	23.2
Yamagata-kunitomi	1.63	0.26	0.53	0.53	1.80	1.67	29.4	31.7
Yadome	1.80	0.26	1.07	0.60	2.07	1.91	51.7	56.0

Yanagida	1.68	0.30	0.63	0.50	1.48	1.61	42.6	39.1
Yaei	1.60	0.26	0.10	0.30	2.70	3.10	3.7	3.2
Yajima	1.50	0.30	0.20	0.37	1.50	1.40	13.3	14.3
Yamato-guwa	1.23	0.30	0.70	0.50	1.73	1.57	40.5	44.6
Yamanaka-takasuke	2.24	0.42	0.42	0.47	1.55	1.63	27.1	25.8
Yokoyama-wase	1.40	0.20	1.70	0.43	2.30	2.20	73.9	77.3
Yoshitoku	1.40	0.22	1.40	0.50	2.20	2.40	63.6	58.3
Yaheiji	3.40	0.32	0.50	0.50	1.80	1.80	16.7	16.7
Yoh-guwa	1.00	0.20	0.15	0.50	1.70	1.80	8.8	8.3
Yuhgiri	1.90	0.28	0.50	0.50	1.90	1.65	26.3	30.3
Yohro-guwa	1.97	0.29	0.23	0.60	2.07	1.92	11.1	11.9
Yohkaichi	1.60	0.29	0.53	0.54	1.93	1.87	27.5	28.3
Yenshuh-takasuke	2.03	0.23	1.78	0.54	2.00	2.01	89.0	88.6
Zizan	1.40	0.18	0.28	0.84	2.77	2.03	10.1	13.8

The above shown results of observations of the female flowers of both wild and cultivated mulberry trees in Japan may be summarized as follows:---

1. Among the species now considered indigenouns to Japan, ***morus bombycis*** KOIDZ., *Morus acidosa* GRIFF., *Morus Kagayamae* KOIDZ., and the apparently allied races are characterized by a longer style. The ratio of the length of style to that of female flower is over 25 % in the races apparentlo allied to *Morus bombycis* KOIDZ., e. g. Tohsuke, Aoki, Hida-kuwa; over 45 % in ***Mrusu*** *Kagayamae* KOIDZ.; and over 50 % in the races apparently allied to *Morus acidosa* GRIFF., e. g. Okinawa-guwa.

2. In foreign species the above-mentioned ratio is ratner small, being roughly estimated at less than 25 % in *Morus alba* LINN. e. g. Kumonryu, Suji-kuwa, and Senmatsu; in *Morus murticaulis* PARR. e. g. Kurimoto, Eishich, and Kasuga; and their apparently allied races. This ratio is smaller in *Morus Multicaulis* PARR. than in *Morus alba* LINN. The style is wanting in a few races of the former, e. g. Fukayamagi, Fuseryu, and Nagase. Only a few exceptions are found in the above-mentioned ratio of the width of the female flower to that of the style.

3. Such is also the case in the ratios between either length or width of the stigma and those of the style respectively, with only a few exceptions.

4. The ration of the length of style to that of the female flower is almost in proportion to the ratio of the length of leaf tip to that of leaf blade.

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DISTRIBUTION OF THE FAMILIES AND GENERA OF BUTTERFLIES WITH THE SPECIAL REFERENCE TO THOSE OF THE JAPAN-EMPIRE

BY

SHONEN MATSUMURA

(松 村 松 年)

1. Fam. *Papilionidae*

This is a cosmopolitan family, 3 genera being found in Japan, Korea and Formosa.

1. *Luehdorfia* CRÜG.—A palaearctic genus, being distributed from Japan to Korea, also known in Formosa and China, especially in the alpine regions. We have 2 species in Japan.

2. *Papilio* L.—A cosmopolitan genus, being nearly 500 species known in the world. In Japan, Korea and Formosa, we have 35 species.

3. *Sericinus* WEST.—A palaearctic genus, being only known from Korea, Amur and China.

2. Fam. *Parnassiidae*

1. *Parnassius* LATR.—This genus is known from the Palaearctic, Nearctic and Oriental Regions. In Japan and Korea we have only 4 species.

3. Fam. *Pieridae*

This is also a cosmopolitan family and the following 18 genera are known in the Japan-Empire:

1. *Anthocaris* BSD.—A palaearctic genus, being found in Saghalien and Korea; in the central part of Japan we can find it only at the alpine regions. We have only one species in the Japan-Empire.

2. *Aporia* HB.—A palaearctic genus, being found in the northern part of Japan, and Korea. We have only 2 species in Japan.

3. *Appias* HB. (*Tachyris* WALLGR.)—This is known from the Oriental and Australian Regions, being only found in Okinawa and Formosa. We have 6 species in the Japan-Empire.

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

4. *Betaporia* MATS.—An oriental genus, being distributed only in Formosa and China. We have only one species in Formosa.

5. *Catopsilia* HB.—This is known from the Oriental and Australian Regions, being very few species of this genus found in South-America. This is distributed only in the subtropical part of Kiushu, Okinawa and Formosa, having 4 representatives.

6. *Colias* F.—A common palaearctic genus, being found also in South- and North-America. In the Japan-Empire we have 4 species.

7. *Delias* HB.—An oriental and Australian genus, being only 3 species represented in Formosa.

8. *Gonepteryx* LEAD—A common palaearctic genus, only one species of it being found in South-America (Argentine). We have in our faunistic region only 4 species, two of which are found in Formosa, especially in the mountainous region. From Hokkaido and Saghalien we have no representative.

9. *Hebomoia* HB.—An oriental genus, being common in the subtropical and tropical regions of Japan as in Okinawa and Formosa, being represented by a single species.

10. *Huphina* MOOR.—An oriental and Australian genus, being found only in the subtropical region as in Formosa, represented by 2 species.

11. *Ixias* HB.—Also an oriental and Australian genus, being represented by a single species in Formosa.

12. *Leptidia* BILD.—A palaearctic genus, being found in all parts of the Japan-Empire except Saghalien and Formosa. It is represented by a single species.

13. *Leptosia* HB.—An oriental genus, being found in the mountainous region of Formosa, represented by a single species.

14. *Leucochloë* RÖB.—Also a genus known from the Palaearctic Region, being found in Korea, represented by a single species.

15. *Midea* HB.—A palaearctic genus, being found in all parts of the Japan-Empire, except Saghalien, Okinawa and Formosa.

16. *Pieris* SCHRK.—A cosmopolitan genus, being common in the Palaearctic Region, extending to the subfrigid zone, represented by 4 species.

17. *Prioneris* SCHRK.—This is an oriental and Australian genus, being common in Formosa, represented by a single species.

18. *Terias* SWAINS. (*Eurema* HB.)—This is distributed throughout the Palaearctic, Oriental, Australian and Nearctic Regions, represented by 7 species. This is not found in Hokkaido, even though it is very common at Aomori near Hakodate.

4. Fam. ***Danaidae***

This is distributed in the Palaearctic, Oriental, Australian, Polynesian, Nearctic and Neotropical Regions, being common in the subtropical regions, represented by 3 genera in the Japan-Empire.

1. *Danais* LATR.—A cosmopolitan genus in the tropical and subtropical regions, represented by 12 species, being not rare even in the central part of Japan.

2. *Euploea* F.—Nearly a cosmopolitan genus in the subtropical and tropical regions, being found in Okinawa and Formosa, represented by 8 species.

3. *Hestia* HB.—An oriental genus, being found in Formosa and Okinawa, especially being abundant in the southern part of the former island.

5. Fam. ***Acraeidae***

We have only one genus of this family in Formosa.

1. *Acraea* F. (*Pareba* DBL.)—This genus is widely distributed in the Oriental Region, the larva being very injurious to the fibrous plants as rhamie, hemp, jute, etc.

6. Fam. ***Satyridae***

This is widely distributed over the world, being a cosmopolite; in the Japan-Empire we have the following 13 genera:—

1. *Aphantopus* WALLGR.—This genus is known from Korea, being represented by a single species.

2. *Coenonympha* HB.—This is a palaearctic genus, being distributed in Saghalien, Hokkaido, Honshu and Korea; only 3 species are known in the Japan-Empire.

3. *Elymnias* HB.—This is an oriental genus, being known from Formosa, represented by a single species.

4. *Erebia* DALM.—This is a palaearctic alpine genus, being known from Saghalien, Hokkaido, Honshu and Korea, represented by 3 species.

5. *Lethe* HB.—This genus is widely distributed in the Palaearctic Region, some being found in the mountainous parts of the Oriental Region; 19 species are known from the Japan-Empire.

6. *Melanargia* MEIG.—This is a palaearctic genus and only one species is known from Korea.

7. *Melanitis* F.—This is known from the Oriental, Australian and Polynesian Regions, some species being distributed in the Palaearctic Region, represented by 2 species.

8. *Mycalesis* HB.—This is distributed especially in the subtropical region, some species of which are known from the Palaearctic Region. In the Japan-Empire we have 8 species, being unknown from Hokkaido and Saghalien.

9. *Neope* BUTL.—This is a palaearctic genus, some species of it being known from the mountainous parts of the subtropical part of Formosa. In the Japan-Enpire we have 6 species.

10. *Oeneis* HB.—This is known from the alpine part of the Palaearctic Region, being found also in the table-land of Saghalien, represented altogether by 3 species.

11. *Palaeonympha* W. MAS.—This genus is only known from the mountainous part of Formosa, being represented by a single species.

12. *Pararge* HB.—This is a palaearctic genus, being known from Saghalien, Hokkaido, Honshu, Kiushu and Korea. In the Japan-Empire we have only 2 species.

13. *Satyrus* LATR.—This is widely distributed in the Palaearctic Region, especially abundant in the northern part of Japan, represented by 2 species. One species of them is known from the mountainous part of Formosa.

14. *Ypthima* HB.—This is a palaearctic genus, being widely distributed in the Japan-Empire, represented by 13 species.

7. Fam. ***Amathusiidae***

This is known from the Oriental and Neotropic Regions, being represented by a single genus in Formosa.

1. *Stichophthalma* FELD.—This is distributed only in the mountainous part of Formosa, represented by a single species.

8. Fam. ***Nymphalidae***

This is a cosmopolitan family, being represented by the following 35 genera in Japan.

1. *Abrota* MOOR.—We have only one species of this oriental genus, which is only distributed in the mountainous part of Formosa.

2. *Apatura* F.—This is a palaearctic genus, being widely distributed in Japan except in Saghalien. We have 7 species in the Japan-Empire.

3. *Araschnia* HB.—This is a palaearctic genus, being widely distributed in Hokkaido.

4. *Argynnis* F.—This is also a palaearctic genus, being rarely found in the mountainous part of Formosa, and altogether 21 species being known from the Japan-Empire.

5. *Atella* DBL.—This is an oriental genus, widely distributed in China and India, but very rare in Japan, only few specimens being found in Kiushu and Okinawa.

6. *Callinaga* MOOR.—This is common in the mountainous part of Formosa, being an oriental genus, distributed in China and India. Only one species is known from Formosa.

7. *Cirrochroa* DBL.—In Formosa only one species is known, being caught only in the mountainous part. This is also distributed in China and India.

8. *Cupha* BIEB.—This is common in Formosa, being represented by one species, distributed also in China and India.

9. *Cyrestis* BSD.—We have in Japan and Formosa only one species, being common in the latter region, but few in the former.

10. *Diagora* SNELL.—This is widely distributed in the Japan-Empire, represented by a single species, being common even in Hokkaido.

11. *Dichorragia* BUTL.—In Japan and Formosa is not rare, being distributed in the mountainous part. In the northern part of Japan and in Hokkaido it is absent. Only one species is known.

12. *Doleschallia* FELD.—This is rare in Japan, being caught only once in Okinawa.

13. *Ergolis* BSD.—An oriental genus, known from Formosa, being represented by a single species. This is also distributed in China and India.

14. *Eriboea* HB.—This is an oriental genus, known from Okinawa and Formosa, represented by two species.

15. *Euthalia* Hb.—This is an oriental genus, known from the mountainous part of Formosa, being represented by 4 species.

16. *Helcyra* FELD.—This is found in the mountainous part of Formosa, being represented by only one species.

17. *Hestina* WEST.—In Okinawa and Formosa this is quite common, being found in the mountainous part, represented by a single species.

18. *Hypolimnas* HB. (*Diadema* BSD.)—This is widely distributed in the Palaearctic, Oriental, Australian and Polynesian Regions, being rarely found at Kiushu. This is represented by 3 species in the Japan-Empire.

19. *Issoria* HB.—This is only known from the Polynesian Region, being represented by a single species.

20. *Kallima* WEST.—An oriental genus, being common in Okinawa and Formosa. We have one species in the Japan-Empire.

21. *Limenitis* F.—This is common in the Palaearctic Region, being found also in the mountainous part of Formosa and Okinawa. We have 7 species in the Japan-Empire.

22. *Melitaea* F.—A palaearctic genus, not common in Japan, being found also in the northern part of Saghalien, but not yet known in Hokkaido. In the Japan-Empire we have 5 species.

23. *Neptis* F.—In the Palaearctic and Oriental Regions this genus is widely distributed, being found in the mountainous part of Formosa, represented by 13 species.

24. *Pantoporia* HB. An oriental genus, being found in Okinawa and Formosa, represented by 5 species.

25. *Penthema* WEST.—This genus is known from Formosa, being found in the mountainous part, represented by only a single species.

26. *Polygonia* HB.—A palaearctic genus, being found especially in the mountainous part of the central Japan, being less in Formosa. We have 3 species represented in the Japan-Empire.

27. *Precis* HB. (*Junonia* HB.)—This genus is known from the subtropical and tropical regions, being found in Okinawa, Formosa and the Polynesian Islands. We have 6 species represented in the Japan-Empire and our mandate Polynesian Region.

28. *Pyrameis* HB.—A cosmopolitan genus, being widely distributed in the Japan-Empire, represented by 2 species.

29. *Rahinda* MOOR.—An oriental genus, only one species being known from Formosa, restricted in the mountainous part.

30. *Sasakia* MOOR.—This genus is widely distributed in the Japan-Empire, being represented by 2 species, known also from Hokkaido and Korea.

31. *Sephisa* MOOR.—This is an oriental and palaearctic genus, having few representatives in Korea and Formosa. We have 2 species in the Japan-Empire.

32. *Symbrenthia* HB.—An oriental genus, only known from Formosa, being represented by 2 species.

33. *Timelaea* LUC.—This is also an oriental species, being known from Formosa, represented by a single species.

34. *Vanessa* F.—A common palaearctic genus, being rarely found in the mountainous part of Formosa. In the Japan-Empire we have 5 species.

35. *Yoma* DOH.—This is distributed in the mountainous part of Formosa, being represented by a single species.

9. Fam. ***Libytheidae***

We have only one genus of *Libytheidae* in the Japan-Empire.

1. *Libytheia* F.—This is a cosmopolitan genus, being known from Hokkaido, Honshu, Shikoku, Kiushu and Formosa, represented by 2 species.

10. Fam. ***Nemobiidae*** (*Riodinidae*)

In the Japan-Empire this is only represented in Formosa and Okinawa, having the following 2 genera:

1. *Abisara* FELD.—This oriental genus is only distributed in the alpine region of Formosa and Okinawa, being relatively difficult to capture.

2. *Dodona* HEW.—This is locally distributed in Formosa, being represented by a single species, found in certain localities as Torin, Hori, Karenko, etc.

11. Fam. ***Lycaenidae***

This is a cosmopolitan family, being represented by 37 genera in the Palaearctic and Oriental Regions.

1. *Amblypodia* HORSF. (*Arhopala* BSD.)—This is known from the Palaearctic as well as the Oriental Region, being not found in Hokkaido. We have 6 species represented in the Japan-Empire.

2. *Aphnaeus* HB.—This is also known from the Palaearctic and Oriental Regions, being common in Formosa, but rare in the central Japan, represented altogether by 5 species.

3. *Bindahara* DIST.—This genus is widely distributed in the Polynesian Region, being found in Ponape, represented by a single species.

4. *Callophrys* BILD.—This is known from Saghalien, being represented by a single species.

5. *Camena* HEW.—This is an oriental genus, being distributed in the mountainous part of Formosa, represented by a single species.

6. *Castalius* HB. (*Taraka* NIC.)—This genus is known from the whole Japan except Saghalien, being rare in Formosa.

7. *Catachrysops* BSD.—One representative is known from Formosa, being widely distributed also in China and India.

8. *Catapoecilma* BUTL.—This genus is known from Formosa, being represented by a single species.

9. *Chilades* MOOR.—This is an oriental genus, being represented by 2 species in Formosa.

10. *Chliaria* MOOR.—An oriental genus, known from Formosa, represented in the alpine region.

11. *Chrysophanus* HB.—This is a palaearctic genus, being widely distributed in the whole Japan and Korea, represented by 3 species.

12. *Curetis* HB.—This is distributed in the Palaearctic and Oriental Regions, but rare in the northern part of Japan, represented by 2 species.

13. *Cyaniriodes* MATS.—An insular genus, being restricted only in the

Bonin Islands, represented by a single species.

14. *Deudorix* HEW.—An oriental genus, being known from the alpine region of Formosa, represented by 3 species.

15. *Euchrysops* BUTL.—This is also an oriental genus, only two species being known from Okinawa and Formosa.

16. *Everes* HB.—A widely distributed genus in the Palaearctic and Oriental Regions, being represented by 3 species.

17. *Horaga* MOOR.—This is known from Formosa, represented by a single species.

18. *Ilerda* DBL.—This genus is known from Formosa, being widely distributed in the Oriental Region, represented by a single species.

19. *Jamides* HB.—In Formosa only one species of this genus is known, which is widely distributed in the Oriental, Australian and Polynesian Regions.

20. *Lampides* HB.—This is widely distributed in the Oriental Region, but less in the temperate part of the Palaearctic, being represented by 3 species.

21. *Lycaena* F.—This is a cosmopolitan genus, being widely distributed in the Palaearctic Region, represented by 19 species.

22. *Lycaenopsis* FELD.—This is known from the Palaearctic and Oriental Regions, being represented by 11 species.

23. *Mahathala* HEW.—An oriental genus, known from Formosa, being represented by a single species.

24. *Megisba* MOOR.—This is known from Okinawa and Formosa, having only one representative of this genus.

25. *Nacaduba* MOOR.—This is an oriental and Polynesian genus, known from Okinawa, Formosa and Ponape, represented by 6 species.

26. *Niphanda* MOOR.—A palaearctic genus, known from the southern part of Japan and Korea, represented by a single species.

27. *Pithecopis* HORSF.—An oriental genus, known from Formosa, represented by 2 species.

28. *Rapala* MOOR.—This genus known from the Palaearctic and Oriental Regions, represented by 9 species.

29. *Satsuma* MURR.—This is a palaearctic genus, being widely distributed in the whole Japan, found mostly at the mountainous region.

30. *Shijimia* MATS.—This is an oriental genus, being known from Formosa, represented by a single species.

31. *Spalgis* MOOR.—An oriental genus of a small size, being represented by a single species in Formosa.

32. *Tajuria* MOOR.—Two species of this genus are represented in Formosa, all being alpine Lycaenids.

33. *Tarucus* MOOR. This is an oriental genus, having one representative in Formosa.

34. *Thecla* F.—This genus is known from the Palaearctic and Oriental Regions, being represented by 10 species.

35. *Una* NIC.—(*Orthomiella* NIC.)—This is known from the alpine part of Formosa, being locally distributed, represented by a single species.

36. *Zephyrus* DALM.—This is also a widely distributed palaearctic genus, being found also in the alpine region of Formosa, represented by 27 species.

37. *Zizera* MOOR.—A palaearctic genus, widely distributed through the whole Japan, represented by 3 species.

12. Fam. ***Hesperidae***

In the Japan-Empire we have 27 genera, being mostly palaearctic.

1. *Abraximorpha* NIC.—This is an oriental genus, being found only in the alpine part of Formosa, represented by a single species.

2. *Adopoea* BILD.—This genus is know from the Palaearctic Region, distributed all over the Japan, Korea and Saghalien, and 3 species are known in the Japan-Empire.

3. *Aeromachus* NIC.—This is restricted in the Palaearctic Region and the mountainous part of Formosa, being represented by a single species.

4. *Ampittia* MOOR.—In Formosa this is represented by 3 species, being found in the table-land as well as in the alpine part of Formosa.

5. *Augiades* HB.—A palaearctic genus, 3 species being known from the Japan-Empire, but yet unknown from Formosa.

6. *Badamia* MOOR.—A common genus found in Formosa, represented by a single species, widely distributed also in China and India.

7. *Celaenorrhinus* HB.—This is an oriental genus, being represented by 4 species, locally distributed in Kiushu, Okinawa and Formosa.

8. *Erynnis* SCHRK.—A palaearctic genus, distributed in Saghalien, Honshu, Shikoku, Kiushu; only 2 species are known from the Japan-Empire.

9. *Halpe* MOOR.—This is distributed in the Palaearctic and Oriental Regions, being found in Saghalien, Hokkaido, Shikoku, Kiushu, Korea and Formosa, represented by 3 species.

10. *Hasora* MOOR.—An oriental genus, being distributed in Okinawa and Formosa, represented by 3 species.

11. *Hesperia* LATR.—This genus is known from the Palaearctic Region, being distributed in Honshu and Korea, having 2 representatives.

12. *Heteropterus* DAM.—This is only known from Korea, by one species being represented.

13. *Ismene* SWAINS.—This genus is known from the Palaearctic and Oriental Regions, represented by 2 species.

14. *Isoteinon* FELD.—A palaearctic genus, being distributed also in the mountainous part of Formosa, but unknown from Hokkaido, represented by one species.

15. *Leptalina* MAB.—A palaearctic genus, being widely distributed, but locally in Hokkaido, represented by a single species.

16. *Lobocla* MOOR.—A palaearctic genus, being known only from Korea, represented by a single species.

17. *Notocrypta* NIC.—This is distributed in the Oriental Region, being known from Kiushu, Okinawa and Formosa, represented by one species.

18. *Pamphila* F.—This is known only from the Palaearctic Region, being quite common in Saghalien, Hokkaido and the mountainous part of Japan, represented by 2 species.

19. *Parnara* MOOR.—This genus is widely distributed in the Palaearctic and Oriental Regions, being represented by 14 species.

20. *Rhopalocampta* WALLGR.—This is an oriental genus, being distributed in the temperate part of Japan, as well as in Okinawa and Formosa; we have only one representative in the Japan-Empire.

21. *Satarupa* MOOR.—A widely distributed genus, being unknown in Hokkaido, rare in the northern part of Japan, represented by 4 species.

22. *Seseria* MATS.—This is known only from Formosa, represented by a single species.

23. *Suastus* MOOR.—An oriental genus, being only known from Formosa, represented by a single species.

24. *Tagiades* HB.—This genus is known from the mountainous part of Formosa, being represented by a single species.

25. *Telicota* MOOR.—This is known from the Oriental Region, being found in Okinawa and Formosa; we have only 2 representives in the Japan-Empire.

26. *Thanaos* BSD.—A palaearctic genus, being widely distributed throughout Japan and Korea, represented by a single species.

27. *Udaspes* MOOR.—An oriental genus, being also widely distributed in Formosa, represented by a single species.

ON THE LIFE-HISTORY OF TWO SPECIES OF LEPTOCERID CADDIS-FLIES INJURIOUS TO THE RICE-PLANT*

BY

SATORU KUWAYAMA

(桑 山 覺)

[With four text-figures]

It is usual to consider that caddis-flies are beneficial insects because their larvae are not only most important food materials for fresh-water fishes, but also play a rôle in the control of aquatic weeds. As an exceptional case, the larvae of *Limnophilus flavicornis* FABRICIUS have been regarded by ORMEROD (*5*)[1] and THEOBALD (*6*) as one of the most serious pests in water-cress culture in England. In Japan, however, since MATSUMURA (*4*) recorded *Setodes* sp. in 1899 as a pest in lowland rice-fields in the Province of Ishikari, Hokkaido, serious damages have often been caused by this and other species of Trichoptera in certain rice-fields in Hokkaido and Honshu. As the writer (*2*) pointed out in 1929 these injurious caddis-flies can be classified into at least four species as follows:

1. *Setodes argentata* MATSUMURA
2. *Oecetis nigropunctata* ULMER
3. *Limnophilus correptus* MACLACHLAN
4. *L. amurensis* ULMER

In this paper it is the purpose to give a preliminary note on the life-history and habits of the former two, viz. Leptocerid species. The larvae of these two insects are generally known as "Doro-tsuto-mushi" (mud-case bearing worms) by farmers in Hokkaido.

Setodes argentata MATSUMURA

Setodes argentata, MATSUMURA (as MACLACHLAN), Cat. Inj. Ins. Jap., 24 (nom. nudum) (1906); MATSUMURA, Syst. Ent., I, 194 (1907); MATSUMURA, Manual Inj. Ins. Jap., I, 146–147, Fig. 149 (1910); TAKAHASHI, Inj. Ins. Crops, 94-96 (1916); MATSUMURA, Appl. Ent., I, 478–479, Pl. XIX–Fig. 1 (1917); MATSUMURA, Manual Inj. Ins. Jap., Rev. ed., I, 416–418, Fig. 146 (1920); MURATA, Ins. inj. Cereals, 423–424, Pl. III–Fig. 1 (1927); OKAJIMA, Proc. Third Pan-Pacific Sci. Congr., II, 2064–2065 (1928);

* Contributions from the Section of Entomology, Hokkaido Agricultural Experiment Station.

1) Reference is made by italic number in parenthesis to "Literature cited."

KUWAYAMA (as MATSUMURA), Bul. Hok. Agr. Exp. Sta., XLVII, 5–16, Figs. 1–6 (1928); KUWAYAMA, Rep. Jap. Assoc. Advanc. Sci., V, 196, Fig. 2A. C.D (1929); MATSUMURA, Agr. Ent., 134, Pl. VI-Fig. 1 (1930); KUWAYAMA, Icon. Ins. Jap., 1510, Fig. 2987 (1932); MATSUMURA, Cons. Jap. Inj. Ins., 353–354, Fig. 146 (1932); TATEISHI, Mushi, V, 109 (1932).

Setodes sp., MATSUMURA, Jap. Ent., 81 (1898); MATSUMURA, Inj. Ins. Jap., 274–277, Fig. 120 (1899); KUWAYAMA, Bul. Hok. Agr. Exp. Sta., XLII, 43 (1926).

Setodes iris, MATSUMURA (nec HAGEN), Inj. Ins. Crops, 121–122, Pl. VI-Fig. 1 (1927); MATSUMURA, 6000 Illus. Ins. Jap.-Emp., 1130, 1 fig. (1931); MATSUMURA, Illus. Common Ins. Jap., V, 2 & (3), Pl. I-Fig. 7 (1933).

General Distribution: Hokkaido, Honshu, Kyushu.

Adult[1]: Length of body, 4.5–5 mm. Expanse, 13–14 mm. Head and thorax deep brown, with dense, long concolorous hairs. Abdomen yellowish green to dark yellow. On the vertex three silvery-white stripes in a ﾉ|ヽ-form. Eyes dark brown. Palpi pale brown, with concolorous hairs. Antennae very long, more than twice as long as the fore-wing, the basal half of each joint silvery-white and the apical half blackish gray; basal joint bulbous and grayish brown. On the dorsal parts of the pro- and mesothorax run two silvery-white stripe. Legs yellowish brown; spurs 0–2–2. Fore-wings slender and somewhat acute; membrane pale gray and subhyaline, densely clothed with golden-brown or somewhat fulvous pubescence, and provided with 20 to 22 black-margined silvery-white stripes, scattered over the whole surface, consisting of pubescence, the stripes on the basal half rather long and that on the apical rather short; fringes comparatively long and yellowish brown. Hind-wings acute, smoky-grayish subhyaline, with sparse pubescence, iridescent; neuration fuscous; fringes very long and smoky-gray.

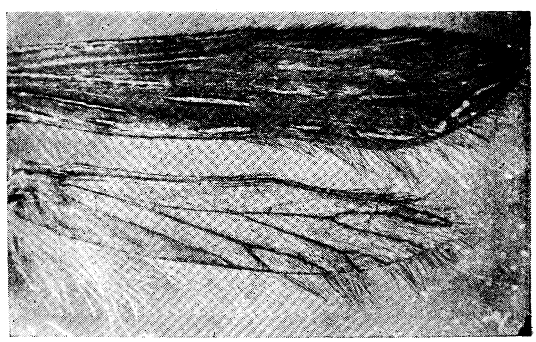


Fig. 1

Wings of *Setodes argentata*

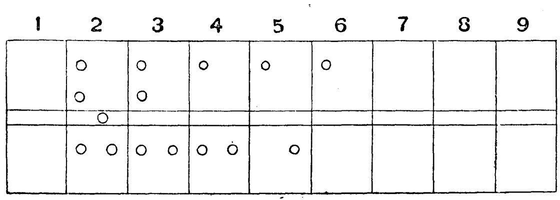
(Ca. × 12)

Egg and egg-mass: More than one hundred and fifty eggs are enclosed in a translucent but slightly dirty brownish spherical mass of jelly, 4–5 mm. in diameter. They are arranged in a spiral inside the jelly. The egg is greenish yellow and about 0.2 mm. in diameter.

Larva: Length, 7–8 mm., and maximum width of abdomen, 1.3 mm., in

1) Description of the genital organs is omitted here being not significant for the purpose of this paper.

the full-grown state. Body in life yellowish green. Head, dark brown in ground colour, with many round blackish spots scattered on it; middle and posterior parts of frons and vicinity of eyes yellowish brown. Eyes black. Antennae distinct, dark brownish. Mouth-part well defined, brownish, mandibles blackish brown in colour, stout and chisel-shaped, deeply grooved, with about five teeth on the inner margin, the middle tooth being very sharp and long. Dorsal plates of prothorax uniform dark brown, with blackish posterior margin; mesothorax with homologous but rather smaller plates; metathorax without distinct chitinous plates. Legs dark brownish, with numerous long swimming hairs; fore-leg the shortest, stout, the hind-leg the longest, slender. The first abdominal segment bearing three spacing humps, the mid-dorsal one being prominent and horn-shaped, while the lateral two are ovoidal with a thick fringe of fine hairs. Gills simple, filamentous and rather small; they occur on the second to sixth abdominal segments, as shown in the following diagram:



No distinct lateral line on the abdomen. The terminal segment bears an indistinctly delimited chitinous plate on which about ten brownish spots are scattered, and which is provided with long brownish bristles along the dorso-posterior margin. A pair of fleshy large prolegs bear also several long and short hairs, and each terminates in a movable chitinous brownish drag-hook.

Pupa: Length, 6–7 mm. Width, 1 mm. In life the body bright green, except the head and thorax which are brownish yellow with slight greenish tinge. Eyes reddish brown. Antennae whitish with dark grayish annulations, very long and coiled about the posterior end of the body. Labrum very small, not protruded at the anterior margin which is provided with a few long bristles. Mandibles reddish brown, very long and slender, with small teeth along the curved inner margin. Palpi very long. Both anterior and posterior wing-sheaths similar in shape, very acute at apex, being extended to the middle of the sixth abdominal segment. Legs light yellow, the hind tarsus being very long. Near the anterior margin of each tergum of the third to sixth segments occur two yellowish brown chitinous knobs studded with a few blunt spines, and near the posterior margin of the fifth tergum two additional elliptical homologous knobs are situated. A double line of dark brownish chitin run on both dorsal and ventral sides of the abdomen. Lateral line of soft yellowish hairs begins on the third segment and forms a loop under the eighth segment. Gills simple as in the larva. The ninth segment is long and slender, and the genitalia of the adult may be seen on the ventral side; this segment terminates with a pair of long spiniform reddish brown processes, which taper suddenly at the middle and are studded with brownish bristles on the distal half.

Case: Length, 9–11 mm. Width, 1–1.2 mm. at the anterior end, 0.7–0.9 mm. at the posterior end. Cylindrical, straight or slightly curved, composed of very fine sand grains and much silk, forming a smooth and very tough case. The anterior edge crosses the long axis of the case at a right angle.

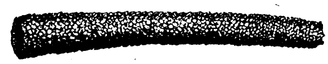


Fig. 2

Case of *Setodes argentata*

(Ca. × 4)

Seasonal history and habits: According to the observations in Hokkaido, this caddis-fly produces only one generation per year. It passes the winter as larva in case hidden beneath the roots of rice-plants and weeds, or not very deep under the ground of the bank of the foot-paths between rice-fields. The larvae leave their hibernating places as early as the middle of May, and commence to feed on the young shoots of rice-plants, especially on roots, being most active in calm and warm daytime. They may continue to injure as late as early July. However, early matured larvae begin to pupate in the middle of June. At the time of pupation, the case is attached to the submerged stem of a rice-plant by silk. The pupal case is closed at both ends with discoid membranes consisting of sand. The anterior closing membrane is provided with a central perforation and the posterior one is located a short distance from the end. After seven to ten days of pupal stage, the adults commence to emerge at the end of June and continue to do so until early September, especially abundantly during July. During this season hordes of adults may be seen among the bushes and trees along the infested rice-fields, literally by thousands. The adult is easily attracted to artificial light in evening. The Kamikawa Branch of the Hokkaido Agricultural Experiment Station at Nagayama, Kamikawa district, Province of Ishikari, attempted to ascertain the time of appearance of the adult by light traps. The following table shows the total number attracted to light during the season from 1925 to 1929 inclusive. Two light trap apparatuses used consisted of an electric lamp of 10 candle power each and additional one used in 1925 consisted of a kerosene lamp of 2 candle power. These lights were placed at the center of the experimental field.

Date / Number of adults	June		July						
	21–25	26–30	1–5	6–10	11–15	16–20	21–25	26–31	1–5
Total number attracted	—	502	3,860	10,101	7,767	4.427	1.534	1,008	6
Percentage of ditto	—	1.66	12.79	33.48	25.75	14.67	5.09	3.34	0.02

	August					September			
Date	6–10	11–15	16–20	21–25	26–31	1–5	6–10	11–15	16–20
Total number attracted	—	—	277	253	388	33	11	—	—
Percentage of ditto	—	—	0.92	0.84	1.29	0.11	0.04	—	—

The eggs are laid in a mass, surrounded by jelly; as many as over one hundred eggs may occur in one mass. These egg-masses are laid on the surface of the water, and as the jelly becomes swollen they deposit on the mud ground. The eggs hatch in about two weeks, and as soon as the larvae develop they commence to form around themselves a case made of minute sand grains mixed with silk. The young larvae in this season do not injure rice-plants, but the hibernated larvae are sometimes very ravenous feeders on rice-plants in the next spring. Usually these caddis-worms injure the rice-plants directly sown in the lowland fields, while the young shoots of rice-plants in the seed beds as well as the plants transplanted from the seed beds are entirely free from this pest.

Oecetis nigropunctata ULMER

Oecetis nigropunctata, ULMER, Deutsch. Ent. Zeitschr., 1908, 345–346, Figs. 4–7 (1908); MATSUMURA, 6000 Illus. Ins. Jap.-Emp., 1130, 1 fig. (1931); KUWAYAMA, Icon. Ins. Jap., 1509, Fig. 2986 (1932); MATSUMURA, Illus. Common Ins. Jap., V, 2 & (3), Pl. I-Fig. 8 (1933).

Oecetis nigropunctatus, KUWAYAMA, Rep. Jap. Assoc. Advanc. Sci., V, 197, Fig. 2B (1929).

General Distribution: Hokkaido, Honshu, Shikoku, Korea.

Adult[1]: Length of body, 5–6 mm. Expanse, 16–19 mm. Head and thorax brown, clothed with grayish brown hairs mostly; abdomen bright green in life and yellowish brown in older specimen. Eyes dark brown. Palpi brown, with grayish brown hairs. Antennae long, twice as long as the fore-wing, grayish yellow with narrow fuscous annulations which are less distinct toward the terminal joints; basal joint bulbous. Legs grayish yellow; spurs 0–2–2. Fore-wings slender and subacute, brownish subhyalin, but rather sparsely clothed with pale brownish pubescence; round dark brownish spots on all anastomoses of veins, terminals of veins at the outer margin and also on greater parts of

1) Description of the genital organs is also omitted here for the reason mentioned before.

transverse veins; these spots are bordered with light coloured portions. In older individuals, the neuration is distinctly brownish, and as the pubescence is entirely lost the wings appear lustrous. The fringes on the outer and posterior margins are dense and dark brown. Hind-wings narrow and much shorter than the fore-wings, grayish hyaline, iridescent, sparcely pubescent with gray, and with dark brownish fringes which are long on the inner margin; neuration yellowish brown.

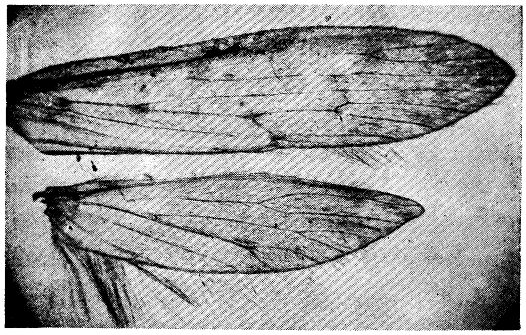


Fig. 3
Wings of *Oecetis nigropunctata*
(Ca. × 8)

Egg and egg-mass: The egg-mass consists of a spherical mass of grayish translucent jelly 5–6 mm. in diameter, in which about 300 eggs are imbedded. The egg is also spherical and about 0.2 mm. in diameter, greenish yellow in colour.

Larva: Length, 8–9 mm.; width 1.3 mm. Head large as compared with the width of the abdomen. Body in life light green. Ground colour of the head pale straw-yellow with dark brownish spots on the dorsal surface, except brownish frons. Eyes black. Antennae rather long, yellowish brown. Labrum comparatively large, trapezoidal in shape, with a deep cleft at the middle of the anterior margin, on this cleft four notches are engraved making three dentations. Mandibles reddish brown, broad at base, sharply pointed, and curved inward, with two large pointed teeth at the middle of the inner margin, and many small denticles in the portion from the base to the first tooth. Prothoracal shield very large, transverse, and straw-yellow mottled with oval brownish spots on the posterior half. Dorsal plates of mesothorax straw-yellow, with dark oval spots; metathorax without chitinous plates. Legs light yellow, the apex of each segment blackish. Fore-leg somewhat broad and flat; the middle longer and less stout; the hind the longest of all and slender; both the latter two provided with numerous long swimming hairs. First abdominal segment has a prominent conical dorsal spacing hump and two ovoidal lateral humps provided with a thick fringe of fine hairs pointed forward. Lateral fringe present, but rather thin. Terminal segment provided with a few long bristles along the posterior margin, but without chitinous dots. Large and long colourless gills arise singly on each of the second to eighth abdominal segments inclusive; arrangement as shown in the following diagram:

1	2	3	4	5	6	7	8	9
	o	o	o	o	o	o	o	
	o							
	o	o	o	o	o	o	o	

Prolegs not chitinized, bearing many microscopic hairs at the base, and provided with a few long dark brownish bristles; drag-hooks reddish brown, stout, acutely curved and sharply pointed.

Pupa: Length, 8-9 mm. Width, 1.8 mm. Body in life bright cobalt green. On the eve of emergence the head and thorax become brownish and the wing-sheaths are tinged with black, and legs reddish brown. Eyes dark brown. The long antennae are coiled about the posterior end of the body, passing about twice around. Labrum comparatively large, quadrate, rounded at the anterior angle, with a triangular protuberance at the middle of the anterior margin, and with a few long hairs. Mandibles reddish brown on the apical half, longer than the labrum, broadly based and sharply pointed, curved inward, with fine denticles along the inner margin, the basal four or five being comparatively large and pointed. Palpi very long. The anterior and posterior wing-sheaths similar in shape, sharply pointed. Legs yellowish brown. A pair of dorsal chitinous knobs studded with two curved brownish spines are arranged on the anterior part of the third to seventh abdominal segments respectively. Two additional transverse chitinous knobs which are provided with six curved brownish spines appear along the posterior margin of the fifth segment. Two dark brownish chitinous lines extend down on both the dorsal and ventral sides of the abdomen. Lateral line of soft yellowish hairs begins on the third, and forms a loop under the eighth segment. The gills simple and filamentous as in the larva, and the gill formula is almost identical. Two small groups of bristles on the dorso-lateral sides of the ninth segment, pointed forward, evidently holding the coil of the antennae in place. The genitalia of the adult may be seen on the ventral side. The posterior end of the body is terminated with two chitinous spiniform light brownish appendages which are very long measuring about 1.5 mm.

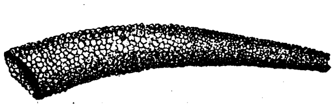


Fig. 4
Case of *Oecetis nigropunctata*
(Ca. × 4)

Case: Length, 10 mm. Width, anterior, 2 mm., posterior, 0.8-1 mm. An elongate conical case of rather fine sand, smooth as in *Setodes argentata*, neatly fitted; the posterior half often curved. The anterior edge crosses the long axis of the case at an angle of about 60°.

Seasonal history and habits: The life-history of this species is very similar to that of *S. argentata*, and the larvae of both always live in the same rice-field. There is only one generation in a year, and it overwinters in the larval stage in its case as does the preceding species. The larvae leave their winter-quarters early in the spring, and commence to feed ravenously on the young shoots of rice-plants, and may continue to do so as late as early July. On the other hand, the pupation begins to occur during the middle of June. The adults begin to appear during a period from the end of June to August; they are especially abundant during the middle part of August, and disappear by the middle of September. Using the same light trap apparatus as in the survey of *S. argentata* during 1925 to 1929, the Kamikawa Branch of the Hokkaido Agricultural Experiment Station examined the number of adults attracted during the above-mentioned period. The data are summarized in the following table:

Date / Number of adults	June		July						
	21–25	26–30	1–5	6–10	11–15	16–20	21–25	26–31	1–5
Total number attracted	260	752	6.009	9.947	12,515	6.650	6,644	4,938	4,708
Percentage of ditto	0.10	0.28	2.23	3.69	4.65	2.47	2.47	1.83	1.75

	August					September			
	6–10	11–15	16–20	21–25	26–31	1–5	6–10	11–15	16–20
Total number attracted	23,049	48,514	137,918	5,321	1,567	390	177	40	5
Percentage of ditto	8.56	18.07	51.19	1.97	0.58	0.18	0.06	0.01	0.00

Eggs are deposited in a mass on the surface of water from early July to late August. The egg-mass is spherical in shape and consists of jelly. About three hundred eggs are imbedded in a mass and sink down to the bottom of the water by swelling of the jelly. Eggs hatch in from one to two weeks, and the larvae live in the water, feeding on weeds or decayed plant debris, attaining nearly a half length of the full-grown state. The injuries done by this insect are also restricted to the rice-plants directly sown in the lowland fields.

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EINE NEUE GATTUNG UND EINE NEUE ART DER UNTERFAMILIE *METOPIINAE* (*HYM. ICHNEUM.*)

VON

TOICHI UCHIDA

(内 田 登 一)

(Mit 4 Textfiguren)

In vorliegender Arbeit habe ich eine von Herren Prof. Dr. T. ESAKI aus Kiushu und H. WADA aus Shikoku gesammelte, sehr interessante, neue Art der echten Schlupfwespen beschrieben; sie gehört zu einer neuen Gattung von der Tribus *Tylocomnini*, deshalb habe ich hier sie mit einem neuen Gattungsnamen „*Cerataspis*" belegt.

Im Jahre 1931 wurde eine neue Unterfamilie der Ichneumoniden —*Metopiinae*— von G. HEINRICH[1] aufgestellt, und alle zur Unterfamilie gehörenden Arten haben an den beiden vorderen Beinpaaren nur einen einfachen Trochanter als das wichtigste unterfamiliesche Merkmal. In jener Zeit in dieser Unterfamilie sind die Tribus *Alomyini*, *Metopiini*, *Exochini* und *Orthognathellini* einzubegreifen, von denen die letztere nicht in Japan vorkommt; zu dieser Unterfamilie habe ich noch eine Tribus, welche ein Mittelglied zwischen den Metopiinen und den Exochininen bildet, in dieser Untersuchung hinzugefügt. Bekanntlich haben viele Hymenopterologen die Tribus *Alomyini* in den Ichneumoninen und die anderen Tribus in den Tryphoninen gestellt und bis heute habe ich auch diese Tribus in solchem System behandelt, von jetzt an möchte ich jedoch sie als die Tribus einer eigenen Unterfamile *Metopiinae* behandeln.

Herren Prof. Dr. T. ESAKI und H. WADA, die mir dieses wertvolle Material geliefert haben, spreche ich an dieser Stelle meinen besten Dank. Zum Schluss drücke ich Herrn Prof. Dr. S. MATSUMURA für seine freundlichste Anleitung in aller Beziehung.

Cerataspis gen. nov.

Fühler etwas länger als der Körper, fadenförmig, aber gegen das Ende zugespitzt, die Geisselglieder eng an einander stossend. Augen neben den

1): Konowia, Bd. X, p. 29 (1931)

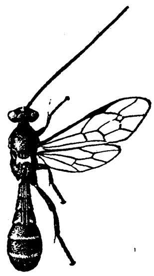


Fig. 1

Cerataspis clavata UCH. (♂) (×2½)

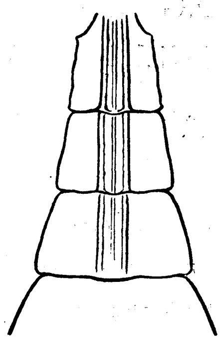


Fig. 2

Die Basis des Hinterleibs von oben gesehen (♂)

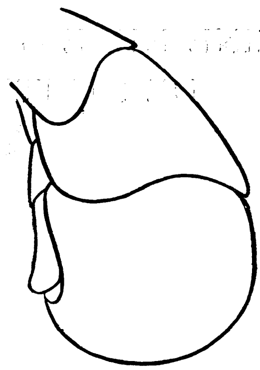


Fig. 3

Das Ende des Hinterleibs von der Seite gesehen (♂)

Fühlern ganz schwach ausgerandet. Stirn zwischen den Fühlern mit scharfem Kiel; Gesicht länger als breit, schwach aufgetrieben; Clypeus nicht vom Gesicht getrennt. Thorax dick; Mesonotum ohne Parapsidenfurchen; Schildchen fast vierseitig, mit spitz vorstehenden Hinterecken, beiderseits scharf gerandet, in der Mitte schwach eingedrückt. Propodeum kurz, hinten ziemlich steil abfallend, ganz gefeldert; Costula kräftig; Luftlöcher oval. Areola im Vorderflügel gross, kurz gestielt; Nervellus etwas unterhalb der Mitte gebrochen. Beine nicht besonders dick; Klauen dicht gekämmt, nur die hintersten an jeder Endhälfte nicht gekämmt. Hinterleib breit sitzend, keulenförmig; 3 Basalsegmente je mit parallelen Längskielen, das 2te und 3te Segment fast quadratisch, die übrigen quer, das letzte (6te) sehr gross, am Ende zugerundet.

Genotypus: *Cerataspis clavata* UCHIDA (sp. nov.)

Diese Gattung verwandt mit der Gattung *Tylocomnus* HOLMGR.,[2] unterscheidet sich aber von ihr durch die folgenden Merkmale: 1) Schildchen fast vierseitig, beiderseits gerandet, mit deutlich vorstehenden Hinterecken wie bei der Gattung *Metopius* PANZ.[3] 2) Hinterleib von oben gesehen fast keulenförmig; das 6te Segment am Ende zugerundet. 3) Die 3 Basalhinterleibssegmente je am Rücken mit 3 parallelen Längskielen. 4) Beine nicht besonders dick; Klauen gekämmt.

Cerataspis clavata sp. nov.

♀. Kopf deutlich quer, hinter den Augen steil abfallend, dicht grob punk-

2): *Tylocomnus* HOLMGREN, Oefvers. Svensk. Vet. Akad. Förh., XXX, p. 76 (1873)

3): *Metopius* PANZER, Krit. Rev., II, p. 78 (1806) tiert, dicht fein weisslich behaart; Gesicht kaum gewölbt, dicht runzelig punktiert; Stirn fast glatt; Ocellen gross; Mandibeln dick, kurz, mit 2 kleinen, ungleichen Zähnen, der obere länger. Thorax matt, dicht grob punktiert und dicht fein pubescent; Schildchen grob runzelig punktiert, die Basalgrube mit 3 dicken, kurzen Längskielen. Propodeum zerstreut grob runzelig punktiert, lang weisslich behaart; Area superomedia fast hexagonal, in der Mitte schwach x-förmig gekielt. Flügel subhyalin; Radialnerv an der Basis schwach gebogen; Nervulus hinter der Gabel; Nervus parallelus hinter der Mitte der Brachialzelle; der untere Aussenwinkel der Discoidalzelle ein rechter. Hinterleib dicht grob punktiert, die Punktierung der 3 letzteren Segmente dichter und kleiner als die der 2 Basalsegmente; das erste Segment länger als breit, seine Luftlöcher gross, vor der Mitte liegend; das 2te und 3te fast quadratisch, die übrigen deutlich quer. Körperlänge: 12 mm.

Kopf mit den Fühlern, Thorax, Hinterleib und Beine schwarz, weisslich pubescent; die Fühler unten schwärzlichbraun; Gesicht grösstenteils, Vorderschenkel am Ende, ihre Schienen vorn, das 4te Hinterleibssegment mit Ausnahme der Basis, das folgende am Hinterrand und die Bauchseite des Hinterleibs rein gelb. Bohrer dick. Stigma im Vorderflügel sowie auch die Nerven schwärzlich.

♂. Der 2te Kiefertaster kurz, nicht aufgetrieben. Area superomedia fast hexagonal, glatt und glänzend. Flügel fast hyalin, nur am Randmal etwas verdunkelt. Beide Palpan, Vorder- und Mittelschienen, ihre Tarsen an jeder Basis, Schildchen an der Spitzenhälfte, je eine Linie unter den Tegulen, am Hinterrand des 4ten und 5ten Hinterleibssegments und die 4 basalen Bauchsegmente rein gelb; 3 Basalsegmente des Hinterleibs je am Endwinkel gelbbraun gefleckt. Hinterschienen an der Basis weiss geringelt; alle Schienenendsporen weisslich. Körperlänge: 10 mm.

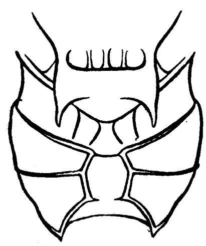


Fig. 4
Schildchen und Propodeum von oben gesehen (♂)

Fundorte: Shikoku und Kiushu. **Holotypus:** ♂, Kiushu (Hikosan, am 8. VIII, 1933, leg. T. ESAKI). **Allotypus:** ♀, Shikoku (Tosa, VIII, 1932, leg. H. WADA).

Japanische Name: *Kombo-himebachi.*

(Aus dem Entmologischen Institut der Kaiserlichen Hokkaido Universität in Sapporo, Japan)

DIE CRYPTODERMINEN JAPANS *(COL. CURC.)*

VON

HIROMICHI KÔNO

(河 野 廣 道)

(Mit 1 Figur)

Die vorliegende Arbeit enthält 2 Cryptoderminen-Arten aus unsrem faunistischen Gebiet: eine schon bekannte Art, *Cryptoderma fortunei* (WATERHOUSE), aus Kiushu und Shikoku, und eine neue Art aus Formosa.

Hiermit spreche ich Herrn Prof. Dr. S. MATSUMURA für seine freundliche Unterstützung meinen besten Dank aus.

Subfam. ***Cryptoderminae*** BOVIE

Cryptoderminae BOVIE, Gen. Ins., 70, p. 1 (1908).
Oxyrrhynchidae LACORDAIRE, Gen. Col., Vol. 7, p. 308 (1866).

Gattung ***Cryptoderma*** RITSEMA

Cryptoderma RITSEMA, Notes Leyd. Mus., Vol. 7, p. 54 (1885); BOVIE, Gen. Ins., 70, p. 2 (1908).
Oxyrhynchus SCHÖNHERR, Disp. Méth. Curc., p. 77 (1826).

Bestimmungstabelle der Arten

1″ Schrägbinde der Flügeldecken den ersten Punktstreifen nicht überragend, in der Mitte verdickt .... *C. fortunei* (WATERHOUSE)
1′ Schrägbinde der Flügeldecken überragt den ersten Punktstreifen, in der Mitte kaum verdickt .... *C. formosense* n. sp.

1. *Cryptoderma fortunei* (WATERHOUSE)

Oxyrhynchus Fortunei WATERHOUSE, Trans. Ent. Soc. Lond., (2), Vol. 2, p. 172 (1853); ROELOFS, Ann. Soc. Ent. Belg., p. 188 (1875).

Cryptoderma fortunei BOVIE, Gen. Ins., 70, p. 2, Pl. 1, f. 2 (1908); MATSUMURA, 6000 Illustr. Ins. ap., p. 282 (1931).

Fundorte: Shikoku (Awa, 1 ♂, 1/VIII. 1913, 1 ♀, 20/VII. 1913, 1 ♀, 10/VIII. 1913, E. GALLOIS); Kiushu (Jiono, 1 ♀, Prof. S. MATSUMURA, Kumamoto, 1 ♂, 15/VII. 1907, Nagasaki, 1 ♀, 5/VIII. 1913); China.

Japanischer Name: *Ô-shiro-obizô.*

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

2. ***Cryptoderma formosense*** n. sp. (Fig. 1)

Cryptoderma fortunei MIWA, nec WATERHOUSE, Rep. Dep. Agr. Governm. Research Ins. Taihoku, 55, p. 257 (1931).

Bekleidung sehr dicht, bräunlich grau bis braun; Fühler etwas heller; Halsschild mit 3 weissen Streifen; Flügeldecken in der vorderen Hälfte mit einer weissen Schrägbinde, welche schräg von aussen nach innen und hinten gerichtet und bis zur Naht reichend; das 3te und 4te Bauchsegment an den Seiten weiss; Rüssel vor der Fühlerbasis kahl und schwarz. Körper zerstreut braun behaart.

Kopf und Rüsselbasis zerstreut punktiert, Rüsselbasis mit einer Mittelfurche. Rüssel ungefähr so lang wie das Halsschild, gebogen, vor der Fühlerbasis beim Männchen spärlich punktiert, beim Weibchen unpunktiert. Halsschild so lang wie breit, weitläufig punktiert und schwach verrunzelt, die breiteste Stelle liegt in der Mitte, an den Seiten stark abgerundet, in der Mitte mit einem schwachen Längskiel, an der Basis zweibuchtig; Augenlappen schwach. Schildchen klein, rundlich, Flügeldecken ein wenig breiter als das Halsschild, die abwechselnden Zwischenräume der Punktstreifen rippenartig erhöht und einreihig kurz behaart. Unterseite zerstreut punktiert; die 2 ersten Bauchsegmente in der Mitte beim Männchen stark, beim Weibchen schwach niedergedrückt; Analsegment in der Mitte bei beiden Geschlechtern quer vertieft. Beine mässig kräftig. Jede Schiene an der Spitze gekrümmt.

Fig. 1
Cryptoderma formosense KÔNO ♀ × 2

Körperlänge: ♂ 10–13 mm, ♀ 13–14 mm (Rüssel excl.)

Dem *C. fortunei* (WATERHOUSE) in Grösse und Form ähnlich, jedoch durch die folgenden Punkten verschieden:

1. Körper etwas dicker.
2. Halsschild an den Seiten stärker abgerundet.
3. Die Skulptur des Halsschildes kräftiger.
4. Die Schrägbinde der Flügeldecken überragt den ersten Punktstreifen und an der Spitze nach hinten gerichtet.

Sechs Exemplare (4 ♂ und 2 ♀) im Entomologischen Museum der Hokkaido Universität in Sapporo.

Fundort: Formosa (Horisha, 1 ♂–Holotypus, 18/V.–VIII., H. KAWAMURA, 1 ♀–Allotypus, 13/V. 1927, K. KIKUCHI, Baibara, 1 ♂ u. 1 ♀, 1/IX. 1924, R. SAITO, Ranrun, 1 ♂, 8/VIII. 1925, H. KÔNO, Tamaho, 1 ♂, 11/VII. 1925, S. ISSIKI u. S. AKASAKA).

J. N.: *Taiwan-shiroobizô*.

ON *EVANIIDAE* AND *GASTERUPTIONIDAE* FROM JAPAN *(HYMENOPTERA)*

BY

CHIHISA WATANABE

(渡 邊 千 尙)

(With 2 Textfigures)

Some of the older authors, as ASHMEAD,[1] KIEFFER,[2] etc., have treated these two groups as the subfamilies, *Evaniinae* and *Gasteruptioninae*, under the family *Evaniidae*, but HANDLIRSCH[3] has raised them to the rank of families. On account of difference in the morphological and biological characters, the writer is inclined to agree with HANDLIRSCH.

In this paper one Evaniid and four Gasteruptionids including three new species are recorded from Japan. All the type-specimens dealt with in this paper are deposited in the Entomological Museum of the Hokkaido Imperial University.

The writer desires here to express a debt of gratitude to Professor SHONEN MATSUMURA for his kind direction.

Family ***Evaniidae***

Evaniinae P. CAMERON, Biol. Entr.-Amer. Hymen., I, p. 422 (1887); ASHMEAD, Proc. U. S. Nat. Mus., xxiii, p. 7 (1900); KIEFFER, Tierreich, p. 6 (1912).

Evaniidae HANDLIRSCH, Hand. Entom., III, p. 751 (1924); UCHIDA, Trans. Sapporo Nat. Hist. Soc. xii, p. 190 (1932).

This family is distinguished from *Gasteruptionidae* by the very short truncated pronotum, the short, strongly compressed, hatchet-shaped abdomen, and the short, subexserted ovipositor. The habits of the former are quite different from those of the latter; the former is parasitic in the egg-cases of *Blattidae*.

According to ENDERLEIN[4] 10 species of this family are known from Formosa, but in Japan only a single species is known.

(1) Proc. U. S. Nat. Mus., xxiii, p. 6 (1900)

(2) Das Tierreich, *Evaniidae* (1912)

(3) Hand. Entomolog. (Hymen. in Bd. III, pp. 751–752, 1924)

(4) Zool. Anz., xlii, p. 318 (1913)

Genus *Evania* FABRICIUS

Evania FABRICIUS, Syst. Ent., p. 345 (1775); KIEFFER, Tierreich, p. 65 (1912).
Evaniella BARDLEY, Cand. Ent., xxxvii, p. 63 (1905).
Szepligetella BRADLEY, Trans. Amer. entom. Soc., xxxiv, p. 34 (1908).
Acanthinevania BRADLEY, Trans. Amer. entom. Soc., xxxiv., p. 172 (1908).
Genotype—*Ichneumon appendigaster* LINNÉ

1. *Evania appendigaster* (LINNÉ)

Ichneumon appendigaster LINNÉ, Syst. nat. Ed. 10 I, p. 566 (1758).
Evania appendigaster FABRICIUS, Syst. entom., p. 345 (1775); DALLA TORRE, Cat. Hymen., III, p. 1076 (1902); KIEFFER, Gen. Insect., II, p. 3 (1902); MATSUMURA, Nippon-ekichu-mokuroku, p. 101 (1908); ENDERLEIN, Stett. entom. Zeit., p. 254 (1909); id., Entom. Mitteil., I, p. 264 (1912); KIEFFER, Tierreich, p. 83 (1912); ENDERLEIN, Zool. Anz., xlii, p. 319 (1913); ISHII, Nip. Kon. Zukan, p. 373, fig. 727 (1932).
Ichneumon niger GÖZE, Degger: Abh. Gesh. Insect. III, p. 385 (1780).
Evania laevigata OLIVIER, Encycl. method. Insect, vi, p. 453 (1791).
Evania fuscipes ILLIGER, Rossi: Fauna Etusca Ed. 2, II, p. 83 (1807).
Evania unicolor SAY, Keating's Narrat. Exped. II. p. 320 (1824).
Dvania cubae EICHWALD, Zool. spec. II, p. 214 (1830).
Evania desjardinsii BLANCHARD, Hist. Nat. Int. Insect. III, p. 299 (1840).
Evania affinis GUILLON, Ann, Soc. Entom. France, x, p. 311 (1841).
Evania brachystyla MATSUMURA, Thous. Ins. Jap., Suppl. IV, p. 166 Pl. LII, fig. 14 (1912); id., Ill. Thous. Ins. Jap., II, p. 150, Pl. XV, fig. 14 (1930).
Evania brachygaster MATSUMURA, Konchu-bunruigaku, vol. II, p. 272 (1915); id., 6000 Ill. Insects Japan-Empire, p. 72, fig. 396 (1931).

This species is widely distributed nearly in all parts of the world, and it parasitizes in the egg-cases of *Blattidae*, as *Periplaneta orientalis* LINNÉ and *Periplaneta americana* LINNÉ.

Loc. Distr.—Honshu (Shimauchi, 1 ♀, 27/VII, 1924, H. KÔNO; Echigo, 1 ♂, 1926, NAKAMURA; Tokio, 1 ♂, VII, 1927, S. MATSUMURA; Hachijoshima, 1 ♂, 21/V, 1909, ARAKAWA)—Okinawa (2 ♀ ♀, 3 ♂ ♂, non-data, S. SAKAGUCHI)—Ishigaki-shima (3 ♂ ♂, VIII, 1922, S. HIRAYAMA)—Ogasawara (1 ♀, VIII, 1905)—Formosa (Kosempo, Anping, Yentenpo, Takao, after ENDERLEIN; Taihoku, 1 ♂, V. 1922, NAGASAWA; 1 ♂, 24/VI, 1926, T. YOSHIDA; Gyochi, 1 ♂, 20/VIII, 1908, S. MATSUMURA; Tainan, 1 ♀, 21/IX, 1908, M. ISHIDA)—Polynesia (Ponape, 1 ♂, 25/VII, 1931, S. UCHIYAMA).

Gen. Distr.—Cosmopolitan.

J. N.: *Marugata-yasebachi.*

Family *Gasteruptionidae*

Gasteruptioninae ASHMEAD, Proc. U. S. Nat. Mus., xxiii, p. 7 (1900); KIEFFER, Tierreich, p. 188 (1912).

Foeninae KIEFFER, Gen. Insect., II, p. 6 (1902).
Gasteruptionidae HANDLIRSCH, Hand. Entom., III, p. 752 (1924); UCHIDA, Trans. Sapporo Nat. Hist. Soc., xii, p. 190 (1932).

This family is at once separated from *Evaniidae* by the prothorax with a long conical neck ventrally, the narrow, strongly compressed abdomen, and the long, exserted ovipositor. The species belonging to this group attack the nests of various Sphegids, Vespids and Apids, but the species which inhabit Japan are totally unknown to the writer in their life-history.

As far as the writer's studies are concerned, two genera containing four species are known as existing in Japan. Further in Formosa five species of *Gasteruption* are recorded by ENDERLEIN(1).

Key to the Genera

Eyes naked. ... ... *Gasteruption* LATREILLE
Eyes pubescent. ... ... *Trichofoenus* KIEFFER

Genus *Gasteruption* LATREILLE

Gasteruption LATREILLE, Préc. Caract., p. 113 (1796); KIEFFER, Tierreich, p. 226 (1912).
Foenus FABRICIUS, Ent. Syst. Suppl., p. 210 (1798).
Genotype—*Gasteruption affectator* (LINNÉ)

Key to the Species

1. ♀♀ 2
– ♂♂ 4
2. Pronotum with no tooth at the anterior margin; mesonotum closely, transversely striate-rugose; 4 anterior legs except the coxae reddish yellow; hind metatarsi on the apical three fourths and the preceding two joints yellowish white; 1st discoidal cell a little longer than the 2nd. ... ... *ogasawarensis* nov. sp.
– Pronotum with a tooth at each side of the anterior margin; mesonotum striate-rugose, with scattered punctures; only the hind metatarsi on the apical three fourths yellowish white; 1st discoidal cell one third longer than the 2nd. 3
3. Occiput with three foveae anteriorly; mesonotum strongly, transversely striate-rugose, scattering a few punctures. ... ... *oshimensis* nov. sp.
– Occiput with no fovea anteriorly; mesonotum finely, transversely striate-rugose, sometimes entirely obsolete, scattering strong punctures. ... ... *thomsoni* SCHLETTERER
4. Antennae entirely black; pronotum with a tooth at the anterior margin; mesonotum finely, transversely striate with scattered punctures; occiput sharply raised, with no fovea anteriorly; 4 anterior legs dark brown; hind tarsi brown or the apical three fourths of the hind metatarsi yellowish white; 1st discoidal cell about one third longer than the 2nd. ... ... *thomsoni* SCHLETTERER
– Antennae black, with some apical joints yellowish white; pronotum with no tooth at each side of the anterior margin; mesonotum closely, transversely striate-rugose, with no puncture;

(1) Zool. Ang., xlii, pp. 322—326 (1913)

occiput slightly raised, with a fovea anteriorly at the middle; 4 legs except the coxae yellowish red; hind metatarsi on the apical three fourths and the preceding two joints yellowish white; 1st discoidal cell a little longer than the 2nd. ... ... *ogasawarensis* nov. sp.

1. *Gasteruption thomsoni* SCHLETTERER

Gasteruption thomsoni SCHLETTERER, Verh. zool. bot. Ges. Wien, xxxv, p. 285, ♀ (1885); DALLA TORRE, Cat. Hymen., III, p. 1073 (1902); KIEFFER, Gen. Insect., p. 10 (1902); id., Tierreich, p. 254, ♀ ♂, fig. 61-62 (1912); SCHMIEDKNECHT, Hymen. Nord- und Mittel-Europe, p. 377 (1930).

Gasteruption japonicum MATSUMURA, Thous. Ins. Jap. Suppl. IV, p. 164, Pl. LII, fig. 12, ♀ (1912); id., Konchu-bunruigaku, Vol. II, p. 271, ♀ (1915); id., Ill. thous. Ins. Jap. Vol. II, p. 149, Pl. XV, fig. 12, ♀ (1930); id., 6000 Ill. Ins. Japan-Empire, p. 72, fig. 397, ♀ (1931); ISHII, Nip. Kon. Zukan, p. 370, fig. 728, ♀ (1931).

Gasteruption vegapunctatum MATSUMURA, Com. Ill. Insect. Jap., p. 83, Pl. VIII, fig. 20, ♀ (1931).

This species is known as a parasite of *Osmia tridentata* DUF. et PERR., *Eriades truncorum* L., and *Trypoxylon figulus* L. in Europe.

Loc. Distr.—Honshu (Shimauchi, 1 ♀, 9/VIII, 1925, H. KÔNO; Kibune, 1 ♀, 13/VI, 1930, K. TAKEUCHI; Ikaho, 3 ♀ ♀, 1 ♂, 19/VII, 1927; K. TAKEUCHI; Iwate, 1 ♂, 15/VII, 1910, OGASAWARA; Aomori, 1 ♀, 29/VI, 1904, S. MATSUMURA)—Hokkaido (Sapporo, 1 ♀, 27/VII, 1923, T. UCHIDA, 1 ♀, 17/VIII, 1923, M. YAMANAKA, 1 ♀, 30/VI, 1930, C. WATANABE; Jôzankei, 1 ♀, 31/VIII, 1907, S. MATSUMURA, 2 ♀ ♀, 1/VIII, 1917, S. MATSUMURA, 1 ♂, 7/VII, 1924, K. TAMANUKI; Mt. Daisetsu, 2 ♀ ♀, 1 ♂, 4-10/VIII, 1926, T. UCHIDA; Akan, 1 ♀, 12/VII, 1928, H. KÔNO)—Saghalien (Furumaki, 1 ♀, 20/VII, 1924, S. MATSUMURA; Kiminai, 1 ♀, 27/VII, 1924, S. MATSUMURA; Ichinosawa, 1 ♀, 25/VII, 1924, S. MATSUMURA; Konuma, 3 ♀, 27/VII, 1928, K. TAMANUKI).

Gen. Distr.—Europe, Japan.

J. N.: *Ô-kombô-yasebachi.*

2. *Gasteruption oshimensis* nov. sp.

♀. Black; mandibles and palpi yellowish brown; basal 4 abdominal segments at each apex reddish yellow; legs dark brown, a broad ring at the base of the hind tibia and the basal three fourths of the hind metatarsus yellowish white; wings hyaline, the stigma and the veins black; ovipositor reddish yellow, the sheath black, with the apex broadly white.

Head dull, with silvery pubescence on the face; occiput sharply raised, with 3 deep foveae anteriorly; distance between the hind ocelli a little longer than the length of the 3rd antennal joint; 2nd joint of the antennae as long as a half length of the 3rd, and the 4th joint as long as the 1st and 2nd joints taken together. Neck short, transversely striate; pronotum with a sharp tooth at each side of the anterior margin; mesonotum and scutellum transversely striate-rugose, scattered fine punctures, the parapsidal furrows deep, crenulate; meso- and metapleurae reticulate-rugose; propodeum reticulate, the reticulation coarser than that of the metapleurae. First discoidal cell about one third longer than the 2nd. Hind coxae transversely striate-rugose; hind metatarsi a little longer than the remaining joints united. Abdomen finely coriaceous; ovipositor a little longer than the body.

Body-length 14 mm., Abdomen-length 8 mm., Ovipositor-length 14.5 mm.

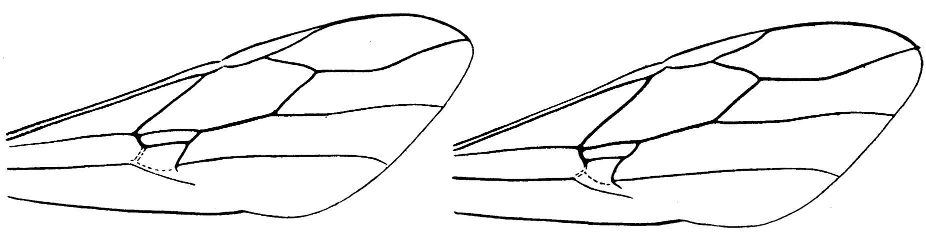
♂. Unknown.

Habitat—Honshu (Oshima).

Cotype: 2♀♀, 19/V, 1929, M. YAMANAKA.

J. N.: *Oshima-kombôyasebachi.*

Gasteruption terrestre TOURNIER (Ann. Soc. ent. Belgique, p. 20, 1877) is closely allied to this species, but differs from the latter in having the parapsidal furrows very fine, and the hind metatarsi entirely black.



a b

Fig. 1

a. Fore wing of *Gasteruption ogasawarensis* nov. sp. (♂)
b. Fore wing of *Gasteruption oshimensis* nov. sp. (♀)

3. *Gasteruption ogasawarensis* MATSUMURA et WATANABE (nov. sp.)

♂. Black; mouth-parts, some apical joints of the antennae, and 4 anterior legs except the coxae yellow; hind legs dark brown, the tibiae basally, and the hind metatarsi on the apical three fourths and the preceding two joints yellowish white; wings hyaline, the stigma and the veins black. Four anterior abdominal segments at each apex yellowish red.

Head dull, with silvery pubescence on the face; occiput slightly raised, with a fovea anteriorly at the middle; distance between the hind ocelli a little longer than the 2nd and 3rd antennal joints taken together; 3rd joint of the antennae as long as the 2nd, the 4th stout, just longer than the 3 basal joints united. Neck short, transversely striate; pronotum and scutellum closely, transversely striate-rugose, the parapsidal furrows deep, crenulate; meso- und metapleurae rugose with silvery pubescence; propodeum rugosely reticulate; 1st discoidal cell a little longer than the 2nd; hind coxae closely striate-rugose; hind metatarsi longer than the remaining joints taken together; abdomen slender, the petiole as long as the remaining segments united.

Body-length 12 mm., Abdomen-length 7 mm.

♀. In one female specimen its head is broken off, but it closely resembles the male in general structure and colour: ovipositor reddish yellow, as long as the thorax and abdomen taken together, and the sheath black, with the apex broadly white.

Abdomen-length 10 mm., Ovipositor-length 14 mm.

Habitat—Ogasawara (Bonin Is.)

Holotype: ♂, 20/VII, 1905, S. MATSUMURA.

Allotype: ♀, 1911, S. MATSUMURA.

Paratype: ♂, 20/VII, 1905, S. MATSUMURA.

J. N.: *Ogasawara-kombôyasebachi.*

This species may easily be distinguished from the others by some apical joints of the antennae, which are yellowish white, and the pronotum with no tooth at each side of the anterior margin.

Species of *Gasteruption* unknown to the writer

Gasteruption japonicum CAMERON

Gasteruption japonicum CAMERON, Proc. Manchest. Philos. Soc., xxvi, p. 133, ♀ (1888); DALLA TORRE, Cat. Hymen., III, p. 1068 (1902); KIEFFER Tierreich, p. 252 ♀ (1912).

This may be the same species with *Gasteruption thomsoni* SCHETTERER, but according to the original description it differs from the latter in the following points:

1) A broad ring at the base of the femora yellowish white.
2) Third joint of the antennae about one fourth longer than the 2nd.
3) Pro- and mesothorax aciculated.

Loc. Distr.—Kobe, Japan.

Genus ***Trichofoenus*** KIEFFER

Trichofoenus KIEFFER, Ann. Soc. ent. France, vol. 79, p. 77 (1910); id., Tierreich, p. 213 (1912).

Genotype—*Trichofoenus merceti* (KIEFFER).

This genus much resembles *Gasteruption* LATREILLE in general structure, but the eyes pubescent.

1. ***Trichofoenus breviterebrae*** nov. sp.

♀. Black; 2nd–4th abdominal segments at each apex yellowish red; legs black, the lower trochanters, the femora apically, and the 4 anterior tarsi fuscous; a broad ring of the hind tibiae at the base yellowish white; wings slightly infuscated, the stigma and the veins black; ovipositor-sheath entirely black.

Head closely rugose; eyes pubescent; occiput slightly raised, lacking the fovea anteriorly; distance between the hind ocelli as long as the length of the 2nd and 3rd antennal joints united; antennae 14-jointed, the 3rd joint about twice as long as the 2nd, and the 4th a little longer than the 3rd; neck very short; pronotum with a short tooth at each side of the anterior margin; mesonotum and scutellum closely striate-rugose; meso- and metapleurae rugosely reticulate; propodeum coarsely reticulate-rugose; 1st discoidal cell one third longer than the 2nd; hind coxae rugose; hind metatarsi longer than the remaining joints taken together. Abdomen long and slender, dull; ovipositor as long as the 1st abdominal segment.

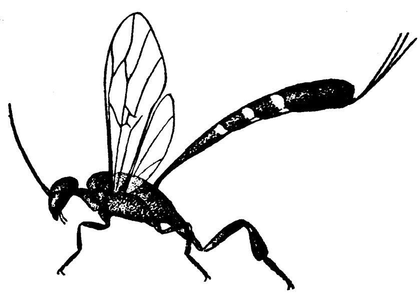


Fig. 2

Trichofoenus breviterebrae nov. sp. (♀)

Body-length 11–13 mm., Abdomen-length 6-8 mm., Ovipositor-length 1.7–3 mm.

♂. Closely allied to the female in general structure and colour, but it differs from the latter in having the antennae 13-jointed, the 3rd joint 1½ times longer than the 2nd, and the 4th as long as the 2nd and 3rd joints united.

Body-length 9–10 mm., Abdomen-length 5-6 mm.

Habitat—Honshu, Hokkaido, Saghalien.

Holotype: ♀, Konuma (Saghalien), 23/VI, 1931, K. TAMAMUKI.

Allotype: ♂, Nagahama (Saghalien), 28/VII, 1929, K. TAMANUKI.

Paratype: 1 ♂, Tarantomari (Saghalien), 13/VII, 1927, H. KÔNO; 1 ♀, Shisuka (Saghalien), 8/VIII, 1914, S. ISSIKI; 1 ♀, Jôzankei (Hokkaido), 3/X, 1929, T. UCHIDA; 3 ♀♀, Ikaho (Honshu), 19/VII, 1927, K. TAKEUCHI.

J. N.: *Hime-kombôyasebachi.*

This species resembles *Trichofoenus pyrenaicus* (GUÉRIN) (Iconogr. végn. anim. VII. Insect., p. 406, 1845), but differs from the latter in having the occiput slightly raised, and the ovipositor shorter than the abdomen.

A LIST OF BIRDS' SKIN BELONGING TO THE ORDER OF ACCIPITRES KEPT IN THE UNIVERSITY MUSEUM OF NATURAL HISTORY IN SAPPORO

BY

MARQUIS YOSHIMARO YAMASHINA AND KÔZÔ MUKASA

(侯爵 山階芳麿・武笠耕三)

Preface

Since the publication of a list of birds in Hokkaido by Dr. S. HATTA and his assistant Mr. MURATA in 1905 based on the specimens in the University Museum, there have been added many birds' skin to the collection gathered chiefly by themselves. Some of the American specimens were donated by the U. S. National Museum. The large collection which numbers at present almost ten thousand, including BLAKISTON's collection are now being put in order.

This is to report first on the birds belonging to the order of Accipitres, thanks to the kind assistance freely offered by Marquis YAMASHINA.

T. INUKAI

The Chief Curator of the Museum.

The birds' skin belonging to this order consist of 125 individuals mostly from Hokkaido, covering 2 families and 26 forms. Most of them were identified already at the time of collection. They have been kept in good condition. In the following list, however, the specific names which are now current are used. At the end of the list the names of the contributed specimens are given.

Family FALCONIDÆ.

Genus ***Falco*** LINNÆUS (1758).

1. ***Falco peregrinus pealei*** RIDGWAY, 1873.

English name: Peale's Peregrine Falcon.
Japanese name: *Ôhayabusa.*

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
10047	♀?	Ad	Hokkaido	? III 1896	370	177	24	55
10070	♂	Imm?	"	?	354	186	22	51

2. *Falco peregrinus calidus* LATHAM, 1790.

English name: Siberian Peregrine Falcon.
Japanese name: *Hayabusa.*

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
3970	♂	Imm	Hokkaido (Kitami)	? IV 1906	309	146	18	48

3. *Falco rusticolus candicans* GMELIN, 1788.

English name: Greenland Falcon.
Japanese name: *Shirohayabusa.*

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
225	♂	Ad	Hokkaido (Otaru)	16 I 1894	356	202	23	63
3161	♀?	Ad	" (Nemuro)	? IV 1892	395	227	25	65
10071	♀?	Imm	? Kurile (Shumushu)	? 1907 ?	407	222	24	65

4. *Falco subbuteo subbuteo* LINNÆUS 1758.

English name: Hobby.
Japanese name: *Chigohayabusa.*

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
216	♂?	Imm	Hokkoido (Sapporo)	? X 1890	263	141	13	37
1131	♂	Ad	" (Okadama)	2 IX 1889	264	137.	13	35
1136	♂?	Imm	" (Shimamatsu)	? IX 1879	257	129	13	34

5. *Falco columbarius insignis* (CLARK), 1907.

English name: Asiatic Merlin.
Japanese name: *Kochôgenbô.*

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
270	♀	Imm	Hokkaido (Sapporo)	9 XII 1896	220	133	14	39
2812	♀	Imm?	Sakhalin (Dariné)	2 X 1910	225	139	14	40
3854	♂?	Imm?	Hokkaido (Sapporo)	? II 1920	208	122	12	39
10052	♀	Imm?	" ?	?	220	135	14	39

(***Cerchneis*** BOIE, 1826).

6. *Falco tinnunculus japonensis* TICEHURST, 1929.

English name: Japanese Kestrel.
Japanese name: *Chôgenbô.*

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
2811	♀	Ad?	Hokkaido ?	? 1887	249	160	16	41
10050	♂	Ad?	Formosa (Shûshû)	10 I 1908	232	156	15	42
10051	♀	Ad?	Hokkaido (Sapporo)	10 II 1917	249	160	14	41

Genus ***Aquila*** BRISSON, (1760).

7. ***Aquila chrysaëtos japonica*** SEVERTZOW, 1888.

English name: Japanese Golden Eagle.
Japanese name: *Inuwashi.*

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
3164	♂	Ad?	Korea	10 XII 1907	583	327	39	105

Genus ***Buteo*** LACÉPÈDE (1799).

(***Buteo*** LACÉPÈDE, 1799).

8. ***Buteo ferox hemilasius*** TEMMINCK & SCHLEGEL, 1844.

English name: Upland Buzzard.
Japanese name: *Ônosuri.*

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
10034	♂ ?	Imm?	?	?	445	231	25	85

9. ***Buteo buteo burmanicus*** HUME, 1875.

English name: Japanese Buzzard, Japanese Desert-Buzzard.
Japanese name: *Nosuri.*

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
156	♀	Imm?	Hokkaido (Sapporo)	? IX 1910	363	222	24	71
3146	♂	Ad?	" (Taiheizan)	20 IX 1906	391	223	24	75
3155	♀	Imm?	" (Sapporo)	25 III 1896	374	224	24	71
3158	♂ ?	Ad?	" ?	? 1887	365	227	21	73
3222	♂	Imm?	Sakhalin (Ikusagawa)	7 IX 1911	354	221	—	73
3224	♂	Ad?	" (")	15 IX 1911	367	228	23	72
3944	♀	Ad?	Hokkaido (Sapporo)	7 IV 1892	370	216	25	70
10024	♀	Imm?	" (")	14 VIII 1913	376	202	25	75
10025	♀	Ad?	" (Hanakawa)	8 IV 1911	379	220	24	75
10026	♂ ?	Ad?	" ?	?	364	216	22	71
10027	♂ ?	Ad?	" ?	?	371	213	22	74
10028	♀	Imm?	" (Sapporo)	9 X 1913	375	224	22	67
10029	♀	Ad?	" (")	10 IX 1907	387	222	24	75
10030	♂	Imm?	Sakhalin	? XII 1908	361	218	21	69
10031	♀	Imm?	Hokkaido (Sapporo)	? 1910	354	215	20	61
10032	♂ ?	Imm?	" ?	?	355?	220	23	69
10033	♂ ?	Ad?	" ?	?	374	222	24	78
10035	♂ ?	Ad?	" ?	?	381	227	25	72

(***Triorchis*** KAUP, 1829).

10. *Buteo lagopus pallidus* (MENZBIER), 1888.

English name: Siberian Rough-legged Buzzard.

Japanese name: *Keashinosuri.*

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
265	♀	Imm?	Hokkaido (Kotoni)	28 III 1896	446	233	23	69

Genus ***Nisaetus*** HODGSON (1836).

11. *Nisaetus nipalensis orientalis* (TEMMINCK & SCHLEGEL), 1844.

English name: Japanese Hawk-Eagle.

Japanese name: *Kumataka.*

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
215	♀	Ad	Hokkaido (Kuriyama)	16 XII 1891	507	364	33	109
3142	♀	Ad	" (Uennai)	? I 1877	504	331	36	107
3151	♀	Ad	" (Sapporo)	3 III 1911	509	342	35	110
3156	♂	Ad	" ?	?	485	334	32	111
3160	♂	Ad	" (Sapporo)	? 1912?	489	314	32	109
10020	♂?	Imm?	" (")	?	472	338	33	97
10021	♂	Ad	" ?	10 VI 1875	485	329	38	97
10022	♀	Ad	" (Nopporo)	? II 1910?	523	362	36	103
10023	♂	Ad?	" ?	?	467	319	31	98

Genus ***Circus*** LACÉPÈDE (1806).

12. *Circus aeruginosus aeruginosus* (LINNÆUS), 1758.

English name: Marsh Harrier.

Japanese name: *Chûhi.*

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
267	♂?	Ad?	Hokkaido (Shiroishi)	? X 1902	413	267	23	93
3147	♀?	Ad?	" (")	12 X 1902	419	260	24	96
10000	♂?	Imm?	" ?	?	397	234	21	92
10001	♀?	Ad?	" ?	?	412	250	22	88

13. *Circus cyaneus cyaneus* (LINNÆUS), 1766.

English name: Hen Harrier.

Japanese name: *Haiirochûhi.*

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
10002	♂	Ad?	Hokkaido (Sapporo)	28 III ?	345	226	16	73
10049	♀	Ad?	" ?	?	381	252	—	79

Genus *Accipiter* BRISSON (1760).

(*Astur* LACÉPÈDE, 1799).

14. *Accipiter gentilis schvedowi* (MENZBIER), 1882.

English name: Siberian Goshawk.
Japanese name: *Ôtaka.*

No.	Sex	Age	Locality		Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
272	♀	Ad	Hokkaido	(Sapporo)	? X 1884	332	236	23	82
3981	♀?	Ad	"	?	?	337	251	24	86
10005	♂	Imm	"	(Sapporo)	2 XI 1915	—	—	24	82
10006	♂?	Ad	"	?	? 1885	298	194	19	74
10007	♀?	Imm	"	?	?	325	249	23	80
10008	♀?	Ad	"	?	?	340	249	26	85
10048	♂?	Imm	"	(Ishikari)	5 V 1906	294	228	20	74
10072	♀	Ad	"	(Bannaguro)	3 XI 1914	330	234	26	81

(*Accipiter* BRISSON, 1760).

15. *Accipiter nisus nisosimilis* (TICKEL), 1833.

English name: Asiatic Sparrow-Hawk.
Japanese name: *Konori* (♂), *Haitaka* (♀).

No.	Sex	Age	Locality		Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
1132	♂?	Imm	Hokkaido	?	? XI 1887	212	156	11	54
2808	♂?	Ad	"	(Sapporo)	20 VI 1894	218	164	12	55
2814	♀?	Ad	"	(Sapporo)	6 IX 1907	250	190	14	62
3159	♀?	Ad	"	(Sapporo)	5 IV 1898	248	187	14	63
3289	♀?	Ad?	"	(Shakotan)	16 IX ?	236	182	—	62
3290	♂?	Imm	Sakhalin	(Ikusagawa)	27 IX ?	205	159	12	56
3853	♀?	Imm	Hokkaido	(Sapporo)	1 IX 1919	243	181	13	62
3960	♀?	Ad	"	?	?	251	190	14	61
3978	♀?	Ad	"	(Sapporo)	16 II 1914	248	202	14	65
10061	♀?	Ad	"	?	?	242	184	14	61
10062	♀?	Ad?	"	?	?	259	198	14	65
10064	♂?	Imm?	"	?	?	204	—	11	55
10065	♂?	Imm	Hondo	(Chichibu)	? II 1912	208	163	—	56
10066	♂?	Ad	Hokkaido	(Sapporo)	2 VII 1916	213	154	12	56

16. *Accipiter virgatus gularis* (TEMMINCK & SCHLEGEL), 1844.

English name: Japanese Sparrow-Hawk.
Japanese name: *Essai* (♂), *Tsumi* (♀).

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
1129	♀?	Imm?	Hokkaido (Sapporo)	? X 1896	186	136	12	53
1133	♀?	Imm?	" (")	17 X 1909	181	132	12	52
1135	♀?	Imm?	" (")	5 X 1909	190	137	12	54
2809	♀?	Imm?	" (")	22 X 1909	199	146	12	52
2810	♂?	Imm?	" (")	5 X 1905	168	126	10	49
2813	♀?	Imm?	" (Muroran)	? IX 1879	188	144	11	51
2939	♂?	Imm?	" ?	8 X 1898	164	119	11	49
3291	♀?	Imm?	" (Shakotan)	16 IX ?	192	142	11	53
3921	♂?	Ad?	" (Sapporo)	2 XI 1913	166	115	10	48
10067	♀?	Imm?	" (")	10 X 1915	187	136	12	52
10068	♂?	Imm?	" (")	1 IX 1914	—	113	11	49
10074	♀?	Imm?	" (")	18 IX 1915	189	136	12	52

17. ***Accipiter virgatus affinis*** HODGSON, 1844.

English name: Larger Besra Sparrow-Hawk.
Japanese name: *Taiwantsumitaka.*

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
10069	♀?	Ad?	Formosa (Horisha)	? IV 1909	202	151	14	61

Genus ***Milvus*** LACÉPÈDE (1799).

18. ***Milvus migrans lineatus*** (GRAY), 1831.

English name: Black-eared Kite.
Japanese name: *Tobi.*

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
3144	♀	Ad?	Hokkaido (Otaru)	? X 1901	502	318	30	62
3145	♂?	Imm?	" (Sapporo)	10 IX 1878	476	288	29	62
3150	♂?	Ad?	" (Nishitappu)	12 XI 1901	480	306	29	62
3152	♀	Ad?	" (Tomakomai)	10 XI 1901	483	305	30	62
3157	♂?	Imm?	" (Sapporo)	2 IX 1885	472	296	—	62
3162	♂?	Imm?	" ?	?	470	278	27	60
10076	♀?	Ad?	" (Eniwa)	1 VI 1932	490	305	31	63
10077	♂?	Imm?	" (Sapporo)	? IX 1879	469	291	28	61
10078	♂?	Imm?	" (Kuroiwa)	10 VIII 1881	472	294	30	61
10079	♂	Imm?	Kurile (Rubetsu)	10 IX 1910	475	302	30	61

19. ***Milvus migrans formosanus*** KURODA, 1920.

English name: Formosan Black-eared Kite.
Japanese name: *Himetobi.*

No.	Sex	Age	Locality		Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
10042	♂	Ad?	Formosa	(Shûshû)	4 II 1908	449	264	30	59
10043	♂	Ad?	"	(")	4 II 1908	433	243	29	60
10044	♂	Ad?	"	(")	7 II 1908	455	267	30	62
10045	♀	Ad?	"	(")	9 II 1908	455	285	30	61
10046	?	Ad?	"		?	446	266	30	61
10080	♂	Ad?	"	(Suikatô)	30 VIII 1907	472	283	32	63
10081	♂	Ad?	"	(Shûshû)	1 II 1908	440	257	29	59
10082	♂	Ad?	"	(")	1 II 1908	443	258	30	60

Genus ***Haliaeetus*** SAVIGNY (1809).

20. ***Haliaeetus albicilla albicilla*** (LINNÆUS), 1758.

English name: White-tailed Sea-Eagle.

Japanese name: *Ojirowashi.*

No.	Sex	Age	Locality		Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
226	♀	Imm?	Hokkaido	(Sapporo)	? XII 1879	598	293	53	99
3154	♂?	Ad	"	(Tokachi)	? IX 1881	575	272	52	95
3163	♀?	Imm?	"	(Sapporo)	? IV 1879	605	298	49	96
10014	♂?	Imm?	"	(")	? I 1878	577	266	52	98
10015	♂?	Imm	"	(")	? II 1879	559	281	49	90
10016	♀	Imm	"	?	? I 1911	597	304	61	102

21. ***Haliaeetus pelagicus pelagicus*** (PALLAS) 1827.

English name: Steller's Sea-Eagle.

Japanese name: *Ôwashi.*

No.	Sex	Age	Locality		Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
266	♂?	Imm?	Hokkaido	(Chitose)	29 I 1884	551	341	63	102
3165	♀?	Imm?	"	(Ebetsu)	30 XI 1912?	630	369	70	108
3363	?	Imm	"		4 VI ?	—	—	32	90
10017	♀	Ad	"		? 1932	605	340	73	113
10018	♂	Ad	"		? 1932	554	299	65	108
10019	♀?	Imm?	"	?	?	644	370	69	105
10073	♂?	Ad	"	?	?	603	341	75	102

Genus ***Pernis*** CUVIER (1817).

22. ***Pernis apivorus japonicus*** KURODA, 1925.

English name: Japanese Honey Buzzard.

Japanese name: *Hachikuma.*

No.	Sex	Age	Locality		Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
3037	♂	Ad	Hondo	(Adusamura)	2 X 1911	428	251	24	60
3365	♂	Ad	"	(Shinano)	?	423	241	24	60

Genus ***Butastur*** HODGSON (1843).

23. ***Butastur indicus*** (GMELIN), 1788.

English name: Eastern Buzzard-Hawk, Grey-faced Buzzard-Eagle.
Japanese name: *Sashiba.*

						Length in mm.		
No.	Sex	Age	Locality	Date	Wing	Tail	Exp. Culmen	Tarsus
3036	♂	Ad	Hondo (Chichibu)	15 XI 1905	311	184	19	60
3959	♀	Ad	" (Kyôto)	17 XII 1905	330	185	—	60

Genus ***Haematornis*** GOULD (1831).

24. ***Haematornis cheela hoya*** (SWINHOE), 1866.

English name: Formosan Serpent-Eagle.
Japanese name: *Ôkammuriwashi.*

						Length in mm.		
No.	Sex	Age	Locality	Date	Wing	Tail	Exp. Culmen	Tarsus
3098	♂?	Ad	Formosa	? III 1870?	494	298	35	106

Family PANDIONIDÆ.

Genus ***Pandion*** SAVIGNY (1809).

25. ***Pandion haliaetus haliaetus*** (LINNÆUS), 1758.

English name: Osprey.
Japanese name: *Misago.*

						Length in mm.		
No.	Sex	Age	Locality	Date	Wing	Tail	Exp. Culmen	Tarsus
260	♂?	Imm	Hokkaido (Sapporo)	17 X 1890	488	228	34	64

A specimen probably from Siberia.

Family FALCONIDÆ.

Genus ***Falco*** LINNÆUS (1758).

(***Falco*** L., 1758).

1. ***Falco rusticolus rusticolus*** LINNÆUS, 1758.

English name: Gyr-Falcon.

						Length in mm.		
No.	Sex	Age	Locality	Date	Wing	Tail	Exp. Culmen	Tarsus
3112	♂	Imm?	Saarikrsk?	12 I 1912?	355	215	23	55

The specimens contributed by the U. S. National Museum.

Family FALCONIDÆ.

Genus *Falco* LINNÆUS (1758).

(*Falco* L., 1758).

1. *Falco mexicanus* SCHLEGEL, 1850. ?[1]

English name: Prairie Falcon.

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
10057	?	Ad	Texas	?	347	189	21	55

2. *Falco columbarius columbarius* LINNÆUS, 1758.

English name: Eastern Pigeon Hawk.

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
10056	♂	Ad	New York (Long Island)	?	190	113	12	34

(*Cerchneis* BOIE, 1826).

3. *Falco sparverius phalaena* (LESSON), 1845.

English name: Desert Sparrow Hawk.

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
10053	♀	Ad?	?	?	195	132	13	33
10054	♂	Ad	California	14 IX 1890	185	119	11	35
10055	♂	Ad	Arizona (Fort Verde)	9 II 1885	192	123	11	35
10075	♀	Ad	Mexico (Sonora)	14 XI 1890	189	125	13	36

Genus *Asturina* VIEILLOT, 1816.

4. *Asturina plagiata plagiata* SCHLEGEL, 1862.

English name: Mexican Goshawk.

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
10060	♂	?	Mexico (Tampico)	30 V 1888	256	154	22	72

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1) The authors could not refer to the original description (Abh. Geb. Zool., Heft III) and the year of publication is different according to literatures as 1841 (A. O. U. Check-List, 2nd. Ed., 1895), 1844 (SWANN's Syn. Accip., 1922), 1843 (PETER's Check-List of Birds, 1931) and 1850 (A. O. U. Check-List, 4th. Ed., 1931).

Genus ***Buteo*** LACÈPÈDE, (1799).

(***Buteo*** LACÉPÈDE, 1799).

5. ***Buteo magnirostris griseocauda*** (RIDGWAY), 1873.

English name: Mexican Large-billed Hawk.

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
10059	?	?	Mexico	?	245	168	20	71

6. ***Buteo platypterus platypterus*** (VIEILLOT), 1823.

English name: Broad-winged Hawk.

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
10036	♂	?	Venezuella (Valle)	20 XII 1902	274	162	18	64
10037	♂	?	New Jersey (Paterson)	27 IV 1901	268	153	18	63

7. ***Buteo lineatus lineatus*** (GMELIN), 1788.

English name: Northern Red-shouldered Hawk.

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
10039	?	Ad	Pennsylvania	?	330	206	22	89

8. ***Buteo borealis borealis*** (GMELIN), 1788.

English name: Eastern Red-shouldered Hawk.

No.	Sex	Age	Locality	Date	wing	Length in mm. Tail	Exp. Clumen	Tarsus
10040	?	Ad	Eastern North America	?	362	202	24	80

9. ***Buteo borealis calurus*** CASSIN, 1855.

English name: Western Red-tailed Hawk.

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
10041	♂	Ad	Western North America	?	388	216	25	82

(***Tachytriorchis*** KAUP, 1844).

10. ***Buteo albicaudatus hypospodius*** GURNEY, 1876.

English name: Sennett's White-tailed Buzzard.

No.	Sex	Age	Locality	Date	Wing	Length in mm. Tail	Exp. Culmen	Tarsus
10038	?	?	Texas (Corpus Christi)	?	404	182	—	89

Genus ***Circus*** LACÉPÈDE (1806).

11. ***Circus cyaneus hudsonius*** (LINNÆUS), 1766.

English name: American Marsh Hawk.

No.	Sex	Age	Locality	Date	Wing	Tail	Exp. Culmen	Tarsus
					Length in mm.			
10003	♂	Imm	California (San Francisco)	?	325	218	17	75
10004	♂	?	?	?	337	218	17	77

Genus ***Accipiter*** BRISSON (1760).

12. ***Accipiter velox velox*** (WILSON), 1812.

English name: Sharp-shinned Hawk.

No.	Sex	Age	Locality	Date	Wing	Tail	Exp. Culmen	Tarsus
					Length in mm.			
10012	♂	Ad	Pennsylvania	?	205	162	12	56
10013	♀	Imm	North America	?	201	158	12	54

13. ***Accipiter cooperi*** (BONAPARTE), 1828.

English name: Cooper's Hawk.

No.	Sex	Age	Locality	Date	Wing	Tail	Exp. Culmen	Tarsus
					Length in mm.			
10009	♂	Ad	New Jersey	?	232	190	15	57
10010	♀	Ad	Pennsylvania	?	264	209	19	70
10011	?	Imm	California	?	248	211	17	68

Genus ***Elanoides*** VIEILLOT, 1818.

14. ***Elanoides forficatus yetapa*** (VIEILLOT), 1818.

English name: Swallow-tailed Kite.

No.	Sex	Age	Locality	Date	Wing	Tail	Exp. Culmen	Tarsus
					Length in mm.			
10058	?	Ad	?	?	406	268	19	—

PLANKTON OF THE LAKES OF THE ISLAND OF ETOROFU (ITURUP)*

BY

MASUZO UÉNO

(上 野 益 三)

(With six text-figures)

The present paper deals with the plankton collected during the two limnological expeditions in the lakes of the Island of Etorofu, one of the South Kuriles. The materials were obtained in the first expedition of July-August, 1932, by Dr. D. MIYADI in twenty lakes, and in the second of July-September, 1933, by Viscount A. TANAKA and Mr. R. HOSINO in six lakes, three of which left unexplored in the preceding year. On the Cladocera of the first collection a short report was already published by the present writer (UÉNO 1933). I am much obliged to Dr. D. MIYADI and Viscount A. TANAKA, who allowed me to undertake this work. My thanks are also due to Prof. K. AKATSUKA for the identification of some species of algae.

1. Remarks on the Localities

It is not necessary to describe the lakes in detail, as a full account of them was already given by MIYADI (1933). Except the four volcanic lakes: Shibetoro-ko, Urumobetsu-ko Kimonma-numa and Kimonma-pontô, all lakes seem to be a marine relic (sand-dammed type), their water surface lying usually not higher than 10 m above sea level.

Owing to low atmospheric temperature, weak sunshine and also to very heavy winds, the water temperatures of the lakes were low, forming only incomplete stratifications. The stagnation period of the water in these lakes seems to be markedly shortened. The lakes of volcanic origin have the neutral or weakly acid water, while the surface water of the coast-lakes show rather pronounced alkaline reaction, their pH-values being mostly higher than 8.0. The large amounts of total residues were obtained in the coast-lakes, but in the water of volcanic lakes the relatively small amounts of inorganic substances were etstimated. N and P were read mostly oligo- or mesotype. Some shallow lakes

* Contribution from the Ôtsu Hydrobiological Station, Kyoto Imperial University.

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

Table I. Lakes of Etorofu[1] (After A. TANAKA and R. HOSINO)

Mame of lake	Altitude (m)	Area (sq. m)	Maximum depth (m)	Date*	Temp. °C (surface)	pH**
Shibetoro-ko	173	2,691,000	4.0	3. VIII .33	21.3	7.5 (7.3)
Tôro-numa	c. 3	1,358,000	21.0	17. VII .32	12.1	6.8 (6.9)
Seseki-numa	10	365,750	5.8	20. VII .32	14.8	6.7 (6.5)
Shana-numa	10	993,000	3.0	23. VII .32	17.2	8.1 (7.1)
Rausu-numa	c. 5	2,081,000	12.5	26. VII .32	15.4	8.2 (8.2)
Rubetsu-numa...	c. 4	280,000	3.5	27. VII .32	14.6	8.4 (7.2)
Kimonma-numa	9	1,907,500	2.0	9. VIII .32	14.0	6.4 (6.3)
"				29. VIII .33	23.6	6.8 (6.8)
Kimonma-pontô	c. 9	12,750	1.1	30. VIII .33	22.5	6.0 (6.0)
Kamoikotan-numa	c. 4	26,500	50 cm	30. VIII .33	22.5	9.0 (9.0)
Naibo-numa	6	2,636,500	1.2	10. VIII .32	18.4	8.4 (8.4)
Toshimoé-ko	c. 4	4,065,000	15.7	30. VII .32	14.4	7.0 (6.7)
Kimon-numa	c. 8	570,000	5.0	1. VIII .32	14.4	8.2 (8.2)
Yanké-numa	c. 2	200,000	1.8	31. VII .32	14.2	6.5 (6.5)
"				25. VIII .33	20.1	6.5 (6.4)
Rébun-numa	c. 2	610,000	2.0	31. VII .32	13.7	7.3 (7.3)
"				25. VIII .33	19.0	7.2 (6.9)
Urumobetsu-ko	83	5,818,000	48.0	5. VIII .32	11.5	7.0 (6.3)

* Dates indicate the days on which the samples were collected.

** Figures in parenthesis are the values obtained from the bottom-water.

such as Tôro-numa and Seseki-numa, however, preserve a good content of phosphorus. The chemical analyses show that the water of most lakes consumed rather large amounts of $KMnO_4$, but there are found no dystrophic lakes in true sense (MIYADI 1933). It is clear that such large quantities of oxygen consumed are not correlated with the humic substances or vegetable extractives in the water. Most of the lakes are the harmonic type and some shallow ones are often in a pronounced eutrophic condition.

1) In the subsequent tables the following abbreviations are used to indicate the lakes.

Si.	Shibetoro-ko.	Tr.	Tôro-numa.	Se.	Seseki-numa.
Sa.	Shana-numa.	Ru.	Rubetsu-numa.	Ra.	Rausu-numa.
Kk.	Kamoikotan-numa.	Ka.	Kimonma-numa.	Kp.	Kimonma-pontô.
Na.	Naibo-numa.	Ts.	Toshimoé-ko.	Km.	Kimon-numa.
Ya.	Yanké-numa.	Ré.	Rébun-numa.	Ur.	Urumobetsu-ko.

2. Short Account of the Plankton

1. Shibetoro-ko. Although the plankton-production of this caldera lake was poor, there were found many littoral forms of rotifers and cladocerans, among which was *Notholca striata acuminata* recorded for the first time from the Kuriles. A water-bloom consisting of *Melosira*, *Anabaena* and *Dinobryon* was very slightly developed.

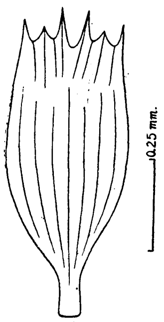


Fig. 1. *Notholca striata acuminata* EHRENBERG. Dorsal view. Shibetoro-ko (Aug. 3, 1933).

2. Tôro-numa. The plankton is scarcely produced; the collection contained a small number of a calanoid *Eurytemora affinis*, a young form of *Cyclops* and three species of rotifers, but a massive water-bloom of *Anabaena circinalis*.

3. Seseki-numa. A special feature of the plankton in this lake is the occurrence of a large number of *Conochilus unicornis* und *Eurytemora affinis*. Cladocera is represented by a dwarf race of *Bosmina coregoni*. The chief element of the phytoplankton is the floating diatoms of several species, though they are not so abundant as to form a distinct water-bloom.

4. Shana-numa. The plankton-production of this shallow lake is very small, young forms of *Cyclops* and a rotifer *Anuraea cochlearis* being the main components. Two species of Cladocera, *Alona guttata* and *A. costata* were also common. No phytoplankton was found at all in the samples.

5. Rubetsu-numa. The samples contained a large amount of a blue-green alga *Oscillatoria lacustris*. As the zooplankter was secured a young form of *Diaptomus* only.

6. Rausu-numa. The samples were whitish-blue in colour, owing to the floating contorted filaments of *Anabaena circinalis* which was so abundant as to cause a massive water-bloom. Another feature of the plankton is seen in the enormous quantity of *Vorticella campanulata*. This lake is also rich in rotifers and entomostrans.

Fig. 2. Plankton of Rausu-numa. (July 26, 1932) Water-bloom of *Anabaena circinalis*; *Eurytemora affinis*.

7. Kimonma-numa. The plankton of this maar obtained in 1932 was represented by only three species of Entomostraca, namely: *Acanthodiaptomus pacificus yamanacensis*, *Bosmina coregoni* and *Daphnia*

longispina, the first of which was in a large number. The other components were *Anuraea cochlearis* and *Ceratium hirundinella* both in a small quantity. The former rotifer was met with abundantly in the samples of 1933 too, among which a cladoceran *Monospilus dispar* was found for the first time from the Kuriles.

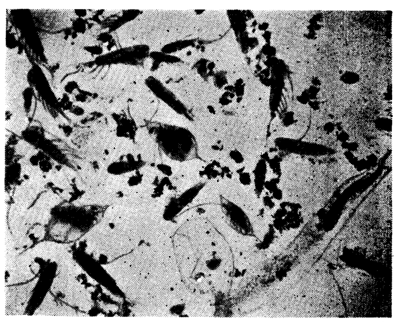
8. Kimonma-pontô. This small lake lies close to the west of Kimonma-numa with a maximum depth of 1.1 m. The plankton-production is rather large, consisting of chiefly a calanoid copepod and a rotifer *Anuraea*, the latter of which is very large in individual numbers (85 % of composition).

9. Kamoikotan-numa. This is a small and very shallow lake (50 cm in maximum depth) fed by cold springs. The plankton is scarcely produced. *Anuraea cochlearis* is the dominant zooplankter. Neverthless the samples contained a good amount of some bentheic species of a diatom genus *Fragilaria*.

10. Naibo-numa. The samples contained rather small quantities of organisms which consisted of six species, among which *Basmina coregoni* and *Euchlanis dilatata* were the commonest. Of the phytoplankters, a blue-green alga *Coelosphaerium Kützingianum*, a diatom *Fragilaria crotonensis* and many other green algae were common.

11. Toshimoé-ko. In spite of that this lake receives water of Kimon-numa at the southern corner, it differs markedly in the property of the plankton from the latter. The samples were yellowish green, owing to the fertility of plankton-diatoms consisting of chiefly *Melosira granulata*, with profusions of *Asterionella* and *Cyclotella*. The occurrence of some species of Isokontae was also noticed. Of the zooplankters, *Conochilus*, *Asplanchna* and *Anuraea* were present in rather large quantities; a small number of *Polyarthra* and *Ploesoma* were also met with. The Entomostraca, consisted of merely a small number of *Bosmina* and *Cyclops*.

12. Kimon-numa. Kimon-numa is the most interesting among the lakes, as far as the feature of the plankton is concerned. The principal constituents of the zooplankton were *Bosmina coregoni*, *Sinocalanus tenellus*, *Eurytemora affinis* and *Euchlanis dilatata*. This lake is also characterized by the appearance of a race of *Daphnia longispina* with a pointed helmet (UÉNO 1933). The phytoplankton scarcely yielded, only a small quantity of *Anabaena* having been detected.



Fgi. 3. Plankton of Kimon-numa (Aug. 1, 1932).

Daphnia longispina (*galeata*), *Leptodora kindtii*, *Bosmina coregoni*, *Sinocalanus tenellus*, *Eurytemora affinis*, *Conochilus unicornis*.

13–14. Yanke-numa and Rebun-numa. Yanke-numa is separated from Rebun-numa by a narrow sandy bar of the River Opépon. The total quantity of the plankton of Yanke-numa is considerably small, containing only five species of organisms in the catches of both years. There occurred two rotifers, *Anuraea cochlearis* and *Ploesoma truncatum*, and a calanoid copepod *Eurytemora affinis*, among which the first two species were relatively common. The plankton of Rebun-numa has a somewhat different appearance from that of Yanke-numa collected on the same day. There were found only a few numbers of *Sinocalanus tenellus* and *Eurytemora affinis* mingling with a large amount of vegetable débris and decayed crustacean shells. A large discoidal marine diatom *Arachnoidiscus Ehrenbergi* was also found in the samples.

Fig. 4. Plankton of Urumobetsu-ko (Aug. 5, 1932).

Daphnia longispina (primitiva), Acanthodiaptomus pacificus yamanacensis, Copepodid of *Cyclops* sp.

15. Urumobetsu-ko. As the phytoplankter of this large and deep caldera lake, *Ceratium hirundinella* was only found. The constituents of the zooplankton were principally Crustacea, among which *Daphnia longispina* with a short head and very short spine (UÉNO 1933) was the most abundant; *Acanthodiaptoms*, *Cyclops* and *Bosmina* were also common. It is of a great ecological interest that the first-named calanoid is deep carrot-red owing to the carotinoid pigments in the body, as was the case with the same species living in Kimonma-numa. This is a common phenomenon to this species living in Japanese volcanic lakes of weakly acid water.

3. General Considerations

1. The Composition of the Plankton. The plankton-organisms found in the collections are listed in Tables IV and V. (Appendix).

Of the 30 species of zooplankters (excepting copepodid), the rotifers are the richest in species (c. 43 %), the Cladocera coming to the next (c. 37 %). None of the eulimnetic forms of Protozoa, especially Rhizopoda were found in the samples. Among the phytoplankton, diatoms are the richest, occurring more than 20 speceis. Isokontae are also represented by many species, while Myxophyceae have only four eulimnetic representatives. It is also remembered that no species of *Dinobryon* occurred in the lakes examined, excepting Shibetoro-ko, and that there were seen very few desmids. The percentage composition of the zooplankton of the lakes is given in Table II.

Table II. Percentage Composition of Zooplankton*

	Si.	Tr.	Se.	Sa.	Ru.	Ra.	Kk.	Ka.	Kp.	Na.	Ts.	Km.	Ya.	Ré.	Ur.
Protozoa	0	0	0	0	0	*75.0*	0	0	0	0	3.8	0	0	0	0
Rotatoria	(28.1)	18.9	*64.8*	5.7	0	15.9	(*99.6*)	0.4 (73.5)	(*78.4*)	*72.7*	*65.5*	35.5	*68.5* (*97.0*)	0 (*100*)	17.3
Cladocera	(1.6)	0	4.1	2.5	0	4.1	0	13.9 (0.7)	(2.7)	6.0	19.8	*38.0*	0 (1.3)	0	*69.3*
Copepoda	(*41.7*)	*81.0*	31.2	*92.7*	*100*	4.8	0	*85.4* (3.7)	(19.0)	19.6	11.0	26.5	32.8 (1.9)	*100*	12.6
Ceratium	(25.8)						(0.6)	0.4 (22.1)							0.8

* Including *Ceratium hirundinella*. Bracketed figures show the frequency in 1933.

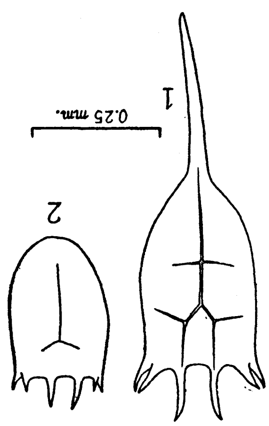


Fig. 5. *Anuraea cochlearis* GOSSE. Dorsal view.

1. Kimonma-numa; Aug. 29, 1933.
2. Shana-numa; July 23, 1933.

The typical form of this species with a long hind spine is most widely distributed in the lakes of Etorofu.

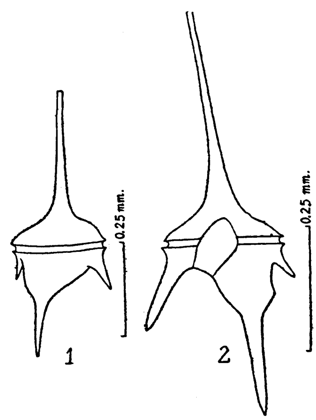


Fig. 6. *Ceratium hirundinella* O. F. MÜLLER.

1. Urumobetsu-ko (Aug. 1932). 2. Shibetoro-ko (Aug. 1933).

Ceratium hirundinella occurring in the lakes of Etorofu belongs to this form (*Austriacum*-form).

2. Biogeography. The plankton fauna and flora of the Islannd of Etorofu are much more allied to those in Hokkaido than in the North Kuriles, as the writer has already pointed out in the Cladocera-fauna (UÉNO 1933; cf. also UÉNO 1934). With regard to the copepodean fauna this is also true. Three species of Calanoida recorded from Etorofu are common in Hokkaido and Honshu (KIKUCHI 1927 and 1933, KOKUBO 1932), but three species: *Hetero-cope borealis*, *Diaptomus occidentalis* and *D. angustilobus* found in the North Kuriles were not collected in the lakes of Etorofu. *Acanthodiaptomus pacificus yamanacensis* is the only exception, being distributed thoroughout Japan, from Kyushu to Paramushir as far north as Kamtchatka (KIKUCHI 1927, SMIRNOV 1929).

All rotifers are cosmopolitan species which are distributed in the waters of the Japanese Islands south of Etorofu. There is to be found no biogeo-graphical peculiarity in the phytoplankton; it is represented by wide-spread species in the Northern Hemisphere.

It is noteworthy that a marine relic copepod *Sinocalanus tenellus* (KIKUCHI) inhabits in three lakes of relic nature, such as Tôro-numa, Rausu-numa and Kimon-numa, the waters of which contain similarly richer amounts of chloride than in the other lakes. None of such peculiar boreal elements as discussed by MIYADI (1933) in the macroscopic fauna were not detected in the planktic animals and plants of the lakes of Etorofu.

3. The Stratification ('Biozone'). In the lakes of Etorofu the zooplankters appear to live chiefly in the upper layers, not merely in deeper lakes but in shallower ones also, the richest species in the largest individual numbers being always found in the surface catches. In the deepest lake, Urumobetsu-ko, judging by a series of samples obtained by vertical hauls of a closing-net, the number of plankters is the greatest in the surface layer. The individual numbers of each species at the layer of 10-20 m is about half as many as those at the layer of 0-10 m, and none of them are found at all in the stratum below 17 m. The occurrence of *Bosmina* and *Acanthodiaptomus* is limited to the surface layer only. The latter calanoid is, in Honshu and Hokkaido, always found in either deep lakes with hypolimnion in summer or cold alpine lakes and ponds, while in Etorofu it lives in a shollow lakes Kimon-ma-numa and in the surface layer of a deep lake Urumobetsu-ko. In Para-mushir of the North Kuriles, it was obtained even in small bog-pools situated in the sea-coast (UÉNO 1934).

4. Associations and Productivity. The composition of the plankton is highly variable in the different lakes. Of the fifteen lakes, the three of volcanic origin are characterized by the rich production of crustacean plankton

consisting of chiefly *Daphnia, Acanthodiaptomus* and *Anuraea*. In such lakes the phytoplankton is quite scarce, *Ceratium hirundinella* only occurring in a very small quantity. Among the volcanic lakes, Shibetoro-ko is only exceptional, having many littoral animals and a visible amount of phytoplankton. This must be due chiefly to the shallowness of its basin compared with its large area. On the contrary, most of the lakes situated near the sea coast, the phytoplankton was often observed in immense numbers. Such lakes may conveniently be divided into the following three types:

	Zooplankton	Lake
1. Myxophyceae-Type	Rotifers abundant; *Sinocalanus tenellus* dominant (exp. Ru.)	Tôro, Rubetsu, Rausu, Kimon
2. *Melosira-Pediastrum*-Type...	Rotifers abundant	Toshimoé
3. *Melosira-Coelastrum*-Type...	Rotifers abundant	Seseki

While *Anabaena* appeared sufficiently to cause a massive water-bloom in both Rausu-numa and Tôro-numa, in the other two lakes the same blue-green alga was restricted to such an extent that either gives only 'vegetable colouration' to the water or only scarcely grows in water-bloom (Kimon-numa). Seseki-numa and Toshimoé-ko are also in contrast. The water of the former lake was only coloured with the phytoplankton, but in the latter lake *Melosira granulata* multiplied to a vast quantity as to cause a water-bloom. Such various grades of quantities of phytoplankton in these lakes are, I think, due to the individual characters of the basins and some meteorological factors (low temperature, weak insolation, heavy winds) rather than to the amounts of nutritive substances (N, P, Ca, & c) dissolved in lake-water. The eutrophic condition in such shallow lakes is often in pronounced progress, as MIYADI (1933) suggests (cf. also NATHANSSON 1906 and MÜNSTER-STRÖM 1933), owing to some organic matter in solution derived from the bottom-mud, which would be stirred up by heavy winds. On the other hand, however, in some of these lakes the turbulance by winds seems to be too heavy to yield sufficient quantities of plankton, especially phytoplankton.

In Table III are given a series of figures obtained by Mr. HOSINO from surface water of the lakes, together with a rough indication of the nature of the plankton.

Table III. Chemical Analyses of Lake Waters* and Characteristic Plankton

Lake	N	P	SiO_2	Ca	Cl	Cons. of $KMnO_4$	Phytoplankton	Zooplankton
Tr.	0.06	0.19	110.8	0.95	16.7	56.0	*Anabaena*, ccc.	*Sinocalanus*
Se.	0.04	0.44	38.4	1.00	13.1	54.4	*Coelosphaerium*, cc.	
Sa.	0.06	0.07	53.4	0.2	13.1	34.4	nil.	
Ru.	0.06	0.04	52.4	1.3	16.0	48.0	*Oscillatoria*, c.	
Ra.	0.09	0.09	54.3	2.3	26.9	184.0	*Anabaena*, ccc.	*Sinocalanus*
Ka.	0.07	0.04	28.3	2.1	—	72.0	*Ceratium*	*Daphnia*
Na.	0.08	0.06	39.1	1.0	13.1	80.0		
Ts.	0.07	0.095	22.0	0.2	13.1	12.0	Diatoms, ccc.	
Km.	0.05	0.02	51.6	1.8	24.8	64.0	*Anabaena*, c.	*Sinocalanus* & *Daphnia*
Ya.	0.05	0.02	3.1	2.1	11.4	72.0	nil.	
Ré.	0.05	0.05	37.9	1.0	8.9	12.0		
Ur.	0.10	0.005	56.3	0.6	—	32.0	*Ceratium*	*Daphnia*

* mg per litre.

There is seen an interesting correlation between the two partial productions, the planktic (especially phytoplanktic) and bentheic. In ten coast-lakes, in which the larva of *Chironomus plumosus* was a characteristic bottom inhabitant (MIYADI 1933), the phytoplankton usually appeared and was often observed as a vigorous water-bloom. Shana-numa and Naibo-numa are exceptional, though they are of the *plumosus*-type. None of the eulimnetic phytoplankters were found in these lakes, the water of the latter lake being quite clear. This is chiefly due to the effect of heavy winds, since their basins are considerably shallow in most parts compared with their large area. Shallowness as well as the sandyness of the bottom give the similar result to Yanke-numa and Rebun-numa, both of which are the poorest in productions among the lakes of Etorofu, not only plankton but in bottom inhabitants.

(March 10, 1934) (Ôtsu Hydrobiological Station)

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Appendix

Table IV. Zooplankton of the Lakes of Etorofu (Iturup)

	Si.	Tr.	Se.	Sa.	Ru.	Ra.	Kk.	Ka.	Kp.	Na.	Ts.	Km.	Ya.	Ré.	Ur.	
PROTOZOA																
1. *Vorticella campanulata* EHRENBERG	...	...	...	...	...	+	...	...	...	...	+	...	...	...	...	2
ROTATORIA																
2. *Conochilus unicornis* ROUSSELET	...	...	+	+	...	+	...	...	...	...	+	+	...	...	+	6
3. *Asplanchna priodonta* GOSSE	(+)	...	+	...	...	+	...	...	...	...	+	+	...	...	...	5
4. *Pedalia mira* (HUDSON)	(+)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
5. *Synchaeta stylata* WIERZEJSKI	...	+	+	...	...	+	...	...	...	+	+	...	...	...	...	5
6. *Euchlanis dilatata* EHRENBERG	...	...	...	+	...	+	...	...	...	+	+	+	...	...	...	5
7. *Polyarthra platyptera* EHRENBERG	(+)	+	+	+	...	+	...	...	...	+	+	+	...	...	...	8
8. *Triarthra longiseta* EHRENBERG	(+)	...	...	...	...	+	...	...	...	...	...	+	...	...	+	4
9. *Monostyla lunaris* EHRENBERG	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1
10. *Brachionus bakeri brevispina* EHR.	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	1
11. *Notholca striata acuminata* EHR.	(+)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
12. *Anuraea cochlearis* GOSSE	(+)	+	+	+	...	+	(+)	+ (+)	(+)	...	+	+	+ (+)	(+)	...	12
13. *Ploesoma truncatum* LEVANDER	...	..	...	...	...	...	...	...	...	...	+	...	+ (+)	...	...	2
CLADOCERA																
14. *Daphnia longispina* O. F. MÜLLER	(+)	...	...	...	...	...	...	+	(+)	...	...	+	...	...	+	5
15. *Bosmina coregoni* BAIRD	(+)	...	+	...	...	+	...	+	(+)	+	+	+	+	...	+	10
16. *Alona guttata* G. O. SARS	...	...	...	+	...	...	...	...	...	+	...	...	...	...	...	2
17. *A. costata* G. O. SARS	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	1

18. *A. quadrangularis affinis* (LEYDIG)	...	...	...	...	...	...	...	(+)	...	...	...	(+)	...	...	...	2
19. *A. rectangula* G. O. SARS	(+)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
20. *Chydorus sphaericus* (O. F. MÜLLER)	(+)	...	...	...	...	...	...	(+)	...	...	...	...	...	...	...	2
21. *Ch. gibbus* LILLJEBORG	(+)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
22. *Monospilus dispar* G. O. SARS	...	...	...	...	...	...	...	(+)	...	...	...	...	...	...	...	1
23. *Polyphemus pediculus* (LINNÉ)	...	...	...	...	...	...	...	...	(+)	...	...	...	...	...	...	1
24. *Leptodora kindtii* (FOCKE)	...	...	...	...	...	...	...	...	...	...	+	+	...	...	...	2
COPEPODA																
25. *Sinocalanus tenellus* (KIKUCHI)	...	+	...	...	...	+	...	...	...	...	...	+	...	...	...	3
26. *Eurytemora affinis* (POPPE)	...	+	+	...	...	+	...	...	...	...	...	+	+	+	...	6
27. *Acanthodiaptomus pacificus yamanacensis* BREHM	...	...	...	...	...	...	(+)	+	(+)	...	...	...	...	...	+	4
28. *Diaptomus* sp. (Copopedid)	(+)	...	...	...	+	...	...	...	...	...	...	...	...	...	...	2
29. *Ergasilus* sp. (Copepodid)	...	...	...	...	...	...	...	...	(+)	...	...	...	...	...	...	1
30. *Cyclops (Diacyclops) crassicaudis* G. O. SARS.	(+)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
31. *C. (Diacyclops) languidus* G. O. SARS.	...	...	...	...	...	...	...	(+)	...	...	...	...	...	...	...	1
32. *Cyclops* sp. (Copepodid)	...	+	...	+	...	...	...	+	...	+	+	...	+	...	+	(7)
Total	13	6	7	8	1	11	2	8 (1)	6	7	11	12	5	2	6	

N. B. Bracketed letters show the occurrence in the samples of 1933.

Table V. Phytoplankton of the Lakes of Etorofu (Iturup)

	Si.	Tr.	Se.	Sa.	Ru.	Ra.	Kk.	Ka.	Kp.	Na.	Ts.	Km.	Ya.	Ré.	Ur.	
BACILLARIOPHYTA																
*1. *Melosira varians* A. C. AGARDH	...	...	+	...	...	...	...	...	...	...	...	...	...	+	...	2
*2. *M. granulata* (EHRB.) RALFS	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	1
*3. *Cyclotella comta* (EHRB.) KÜTZ.	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	1
*4. *C.* sp.	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	1
*5. *Coscinodiscus lacustris* GRUN	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	1
6. *Arachnoidiscus Ehrenbergi*	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	1
*7. *Atheya Zacchariasi* J. BRUN	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	1
*8. *Tabellaria fenestrata* (LYNGBYE) KÜTZ.	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	1
9. *Diatoma* sp.	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	1
*10. *D. elongatum* AGARDH	(+)	...	+	...	...	...	...	...	...	...	...	...	...	...	...	2
*11. *Fragilaria crotonensis* KITTON	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1
*12. *F. capucina* DESMAZIÈRES	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1
*13. *Asterionella formosa gracillima* (HANTSCH) HEIBERG	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	1
14. *Synedra ulna* EHRENBERG	...	...	+	...	...	...	...	...	...	+	...	...	...	...	...	2
15. *S. acus* KÜTZ.	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1
16. *S.* sp.	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1
17. *Navicula* sp.	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1
18. *Cymbella (Cocconema)* sp.	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1

19. *Cymbella tumida* (BRÉBISSON) VAN HEURICK	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	1
20. *Gomphonema* sp.	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1
21. *Epithemia turgida* (EHRB.) KÜTZ.	...	...	...	...	...	...	...	...	...	+	...	...	...	+	...	2
22. *Rhopalodia gibba* (EHRB.) MÜLLER	...	...	...	...	...	...	...	...	...	+	...	...	...	+	...	2
PERIDINEAE																
*23. *Peridinium* sp.	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	1
*24. *Glenodinium* sp.	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1
*25. *Ceratium hirundinella* (O. F. M.)	...	...	...	...	...	...	...	+	...	...	...	...	...	...	+	2
MYXOPHYCEAE																
*26. *Oscillatoria lacustris* (KLEB.) GEITLER	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	1
*27. *Coelosphaerium Kützingianum* NÄGELI	...	...	+	...	...	...	...	...	...	+	...	...	...	...	...	2
*28. *Anabaena circinalis* (KÜTZ.) RABENHORST	...	+	...	...	...	+	...	...	...	...	...	+	...	...	...	3
*29. *A. flos-aquae* (LYNGBYE)	(+)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
30. *Aphanotheca* sp.	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	1
31. *Tolypothrix* sp.	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	1
ISOCONTAE																
*32. *Ankistrodesmus falcatus* (CORDA) RALFS	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1
*33. *Scenedesmus obliquus* (TURPIN) KÜTZ.	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1
*34. *S. abundans* (KIRCHNER) CHODAT	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1

(Tablle V, continued).

	Si.	Tr.	Se.	Sa.	Ru.	Ra.	Kk.	Ka.	Kp.	Na.	Ts.	Km.	Ya.	Ré.	Ur.	
*35. *Coelastrum microsporum* NÄGELI	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	1
*36. *Pediastrum Boryanum* (TURPIN) MENEGINI	...	...	...	...	...	...	...	...	...	+	+	...	...	...	...	2
*37. *P. duplex* MEYEN	...	...	...	...	...	...	...	...	...	+	+	...	...	...	...	2
*38. *P. d. reticulatum* LAGERHEIM	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	1
39. *Mougeotia* sp.	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	1
40. *Spirogyra* sp.	...	...	...	...	...	...	...	...	...	+	...	...	...	+	...	2
*41. *Staurastrum paradoxum* MEYEN	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1
42. *Cosmarium reniforme* (RALFS) ?	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	1
43. *C. granatum* BRÉB.	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	1
44. *Closterium Dianae* ?	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	1
45. *Gonatozygon Brébissonii* DEBARY	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1
46. *Chodatella quadriseta* LEMMERMANN	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	1
FLAGELLATEAE																
*47. *Dinobryon cylindricum* IMHOF	(+)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Total	3	1	7	0	4	1	0	1	0	20	10	1	0	10	1	

N. B. Species marked with an asterisk * are the planktic forms. Bracketed letters show the occurrence in the samples of 1933.

ON THE PARTIAL ALBINO OF THE JAPANESE MINK FOUND IN HOKKAIDO

BY

TETSUO INUKAI

(犬 飼 哲 夫)

(With four text figures)

The Japanese mink, *Mustela itatsi itatsi* Temminck which abounds in the main island group of Japan including Honshu, Kyushu and Shikoku, was first introduced into Hokkaido quite accidentally about 60 years ago when communication between the island and the main island suddenly became frequent and easy. Before going further a brief history of the animal in Hokkaido may well be given. In the early days of the settlement of Hokkaido, that is around 1880, the animal which was increasing gradually in number was restricted to the southern portion near Hakodate port. In 1899 239 skins of the animal were traded for the first time in Hokkaido and after 4 years, namely in 1902, 847 peltries were collected by a fur trader, Mr. MATSUSHITA in Hakodate. In 1909 this one dealer exported 8,000 peltries to London. At that time the animal occupied about one tenth of the whole area of Hokkaido, that is only the southern peninsular part. By the end of 1921 almost all the southern half of the land had been intruded by the mink and up to the present time, within a total course of 60 years, the animal has covered all Hokkaido except the southeastern end (INUKAI, 1932).

The production of the peltries from Hokkaido has been raised to more than 50,000 in number since 1930. Last season at least 70,000 skins are said to have been obtained in Hokkaido for trade in spite of the protection law acting from December of 1933 to check the wild rats in Kitami province where more than 3,000 peltries of the best quality are expected to be produced in one season. The production of the pelts from all Japan is estimated to be approximately 700,000 in number annually.

As is well known the colour of the animal is usually uniform muddy yellow above and a little paler below but as Bachrach (1931) pointed out the peltries from Hokkaido are the silkiest and palest. It is generally stated,

[Trans. Sapporo Nat. His. Soc. Vol. XIII, Pt. 3, 1934]

however, that the young of the animal sometimes has a white pattern around the neck and an adult is occasionally found which has a white tip of the leg. No other kind of colour variety has ever been reported. It happened that in the spring of 1933 among the furs from the Shiribeshi district in Hokkaido two abnormal kinds (No. 1 and No. 2) were found which show an apparent partial albino. Another fascinating example of the same sort (No. 3) was obtained this year in Yubari.

No. 1 and No. 2 are much the same in colour. In No. 1 the albinism appears on the head, the under side of the face and the neck region being whitish in colour. On the head there is a longitudinal white marking which bifurcates anteriorly at the nose. Two small white patterns are also on the nape. The tips of the four limbs are white. Otherwise the animal makes a quite normal appearance.

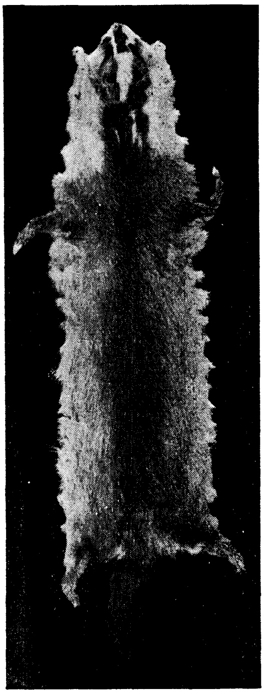

Fig. 1. No. 1. $\times \frac{1}{5}$

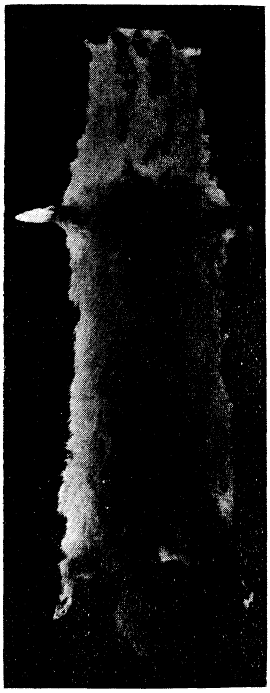

Fig. 2. No. 2. $\times \frac{1}{5}$

Fig. 3. No. 3. $\times \frac{1}{7}$

No. 2 is a sort of a white headed animal. There are only five minute brown markings on the face and head, two symmetrical ones on the cheeks, another pair behind the ears and one on the median line on the nape. Both sides of the chest are also somewhat pale. The tips of the legs are white as in No. 1. The animal is normal in coloration in the posterior body part.

No. 3 proves a higher grade of albinism. The white area of the head extends farther backward covering the side and the belly as far as the hind limbs, leaving on the dorsal only a small portion of brown colour in which many white bristles are found. The nose is somewhat dark in colour and there are two symmetrical longitudinal markings of brown colour extending from the cheek to the nape. Only the posterior-most part including the tail is normally coloured.

Taking into consideration the history of the animal in Hokkaido the patterned animals above mentioned are doubtless albinic mutants which have not been known among the ancestors as far back as 50 generations at least.

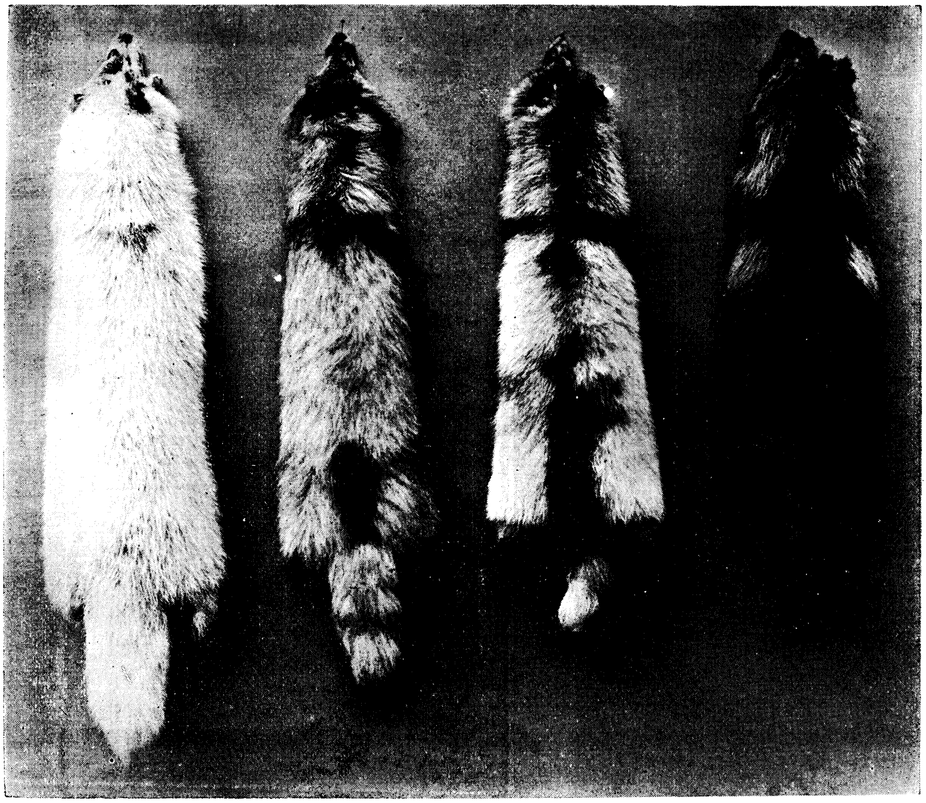

Fig. 4.

Complete and partial albinos of the racoon dog from Hokkaido, kept in the University Museum in Sapporo. $\times \frac{1}{14}$

In this respect it is worth while to note that there are members of the same genus, namely, the ermine, *Mustela ermina* Schrenck and the pigmy weasel, *Mustela rixosa namiyei* Kuroda which inhabit the northern section of Japan including Hokkaido where an abundance of ice and snow is found in winter. These two animals turn white during the colder months. In addition to this complete and partial albinos of the racoon dog (Fig. 4) have been frequently recorded from Hokkaido (MISHIMA, 1932). The scientific name of the latter *Nyctereutes albus* Beard was in reality thus derived from this character.

In view of the above facts, therefore, the occurrence of the albinic mutant in the Japanese mink in Hokkaido is quite remarkable. It is sufficient to call the general attention of the biologist, suggesting some possible influence of the environment upon the animal as in the case of X-ray which caused abnormality in the descendants of other kinds of animals as was shown by some authentic workers (LITTLE and McPHETERS, 1932). Moreover, the possibility of hybridization between the above white species and the Japanese mink is out of the question from the zoological as well as the genetical point of view.

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AN OBSERVATION ON THE SAND PARTICLES IN THE GIZZARD OF SOME SMALL WILD BIRDS

BY

TETSUO INUKAI AND SHINJIRO IKEDA

(犬 飼 哲 夫 • 池 田 眞 次 郎)

The importance of the sand found mixed in the gizzard with food materials to the digestion of the seed eating birds has long been known and explained. Among all the various papers those by JACOBI (1900) and REY (1907) were remarkable reporting studies on the stomach of various kinds of the wild birds. However, in spite of the general understanding of the physiological significance of the sand, exact observation has not been carried out with satisfaction. The writers have undertaken, first of all, the quantitative and qualitative study of the mineral contents in the stomach of some small wild birds for the basis of a more extensive study.

The observation was made mostly with the brambling, *Fringilla montifringilla* L. which was collected in March 1932 in Nagano prefecture. In addition a restricted number of small Japanese green finch, *Chloris sinica minor* (Temm. & Schl.), the Japanese cross-bill, *Loxia curviostra japonica* Ridway and the Japanese meadow bunting, *Emberiza sicides ciopsis* Bonaparte from the same locality were examined for comparison. The gizzards of these birds are almost equal in size.

The selection of the sand from amongst the other organic contents was executed easily by the following methods. First the contents were taken out from the stomach carefully and washed with distilled water in order to eliminate the soluble substances. Next they were dried and centrifuged in a mixture of water and corbon tetrachloride which has a higher specific gravity than water. The mixture excludes the organic food matter with water separating out the minerals which deposit in corbon tetrachloride.

Brambling. 45 individuals were observed. It is noted that there was no marked difference in respect to the sand according to the sex. Table 1 shows the result of the observation. The kinds of the sands are indicated by the abbreviations q, f, m, h, i, a, ho, l, ch, p, cl, s representing respectively quartz, felspar, magnetite, hematite, ilmenite, augite, hornblend, limonite, chromite, pyrrhotin, clayslate and silicate.

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

Table 1. Sands in *Fringilla montifringilla* Linnaeus. Brambling.

	Total Number	Total Weight (gr.)	Total Volume (c. c.)	Size in diameter: larger than ¼ mm.	Size in diameter: ¼ — mm.	Size in diameter: smaller than ¼ mm.	Fine Sand (gr.)	Quality: q	f	m	h	i	a	ho	l	ch	p	cl	s	?
1	125	0.062	0.0367	20	20	85	0.002	112	8						3					2
2	28	0.025	0.0184	8	10	10	×	10	12										2	4
3	3	×	×	×	×	×	×		3											2
4	6	0.002	×	1	2	3	×	4												
5	225	0.150	0.0551	25	70	130	×	99	126											
6	181	0.085	0.0367	16	39	126	×	121	60											
7	63	0.075	0.0367	22	18	23	×	40	21						2					
8	173	0.110	0.0367	17	50	106	×	146	21	1								5		
9	52	0.047	0.0276	11	13	28	×	37	15											
10	11	0.006	0.0073	2	4	5	×		11											
11	5	0.001	×	×	×	×	×		2											3
12	105	0.084	0.0386	32	30	43	×	80	24											1
13	17	0.008	×	1	5	11	×	14	1	1										1
14	116	0.048	0.0367	17	20	79	×	110	6											
15	182	0.068	0.0367	29	43	110	×	50	122	2					1	3	3	1		
16	26	0.030	0.0184	6	14	6	×	12	11				1						2	
17	64	0.047	0.0184	14	11	39	×	18	12									1		33
18	69	0.059	0.0184	14	25	30	×	37	19	3					5	4				1
19	28	0.034	0.0184	13	14	1	×	4	12										3	9
20	74	0.021	0.0184	5	8	61	×	12	12											50
21	75	0.093	0.0441	21	36	18	×	34	40				1							

Table 1 (continued)

22	36	0.025	0.0148	6	12	18	×	8	12						7	5	2			2
23	5	0.027	0.0184	1	2	2	×	1	3											1
24	111	0.082	0.0367	27	43	41	×	100	11											
25	228	0.117	0.0551	26	58	144	×	146	82											
26	183	0.120	0.0367	27	55	101	×	117	30						20	16				
27	100	0.090	0.0625	23	35	42	×	88	12											
28	94	0.073	6.0257	26	21	47	×	25	69											
29	125	0.060	0.0276	20	20	85	×	26	89	3						2	3			2
30	37	0.044	0.0037	31	3	3	×	27	8							2				
31	45	0.048	0.0331	11	24	10	×	39	6											
32	33	0.027	0.0165	10	18	5	×	30	3											
33	26	0.011	0.0367	12	14	0	×	11	14											1
34	25	0.030	0.0184	9	11	5	×	9	14										2	
35	62	0.065	0.0367	26	14	22	×	45	5						12					
36	16	0.024	0.0184	9	4	3	×	13	3											
37	252	0.070	0.0312	14	28	210	×	168	84											
38	97	0.030	0.0386	15	46	36	×	42	50						1					4
39	50	0.009	0.0367	18	12	20	×	3	1	2						2				42
40	104	0.071	0.0276	14	33	57	×	55	46										2	1
41	39	0.023	0.0055	9	16	14	×	18	20								1			
42	80	0.055	0.0367	15	21	44	×	40	35	1	1		1		1	1				
43	26	0.042	0.0009	10	8	8	×	0	24									2		
44	26	0.030	0.0009	7	9	10	×	17	8	1										
45	36	0.053	0.0184	6	6	24	×	8	12						1	1				14
Ave.	76.38	0.0052	0.0276																	

From the table it is clear that the number of pieces of sand differs according to the individual varing from 3 (No. 3) to 252 (No. 37). The haviest showed a weight of 0.15 gr. (No. 5) while the lightest was 0.001 gr. (No. 11). In No. 3, No. 4, No. 11 and No. 13 the volume of sand was less than 0.0009 representing the smallest. The maximum volume is found in No. 27, being 0.0625 c.c. As to the size of sand most of the pieces were smaller than ¼ mm. as is seen in the 5th, 6th and 5th columns.

About 11 different kinds of minerals were identified as shown in the table. Quartz and felspar are almost of constant occurrence and also represent the majority in the number of pieces. Next in order of frequency appeared limonite, then chromite, pyrrhotin, magnetite and so on, but their quantity was extremely limited as compared with that of the former two.

Comparing the range of variability of the number, the weight and the volume with each other one can see that the volume is the least variable of the three, showing a range of 1-34 while the number varies 1-78 and the weight 1-150. Thus it would appear that a certain volume of sand seems necessary for the birds rather than the number and the weight of the pieces. The kind of sand does not seem to make much difference provided that it is of hard quality.

The small Japanese green finch. This bird feeds upon seed and grain by preference and so sometimes affects crops a good deal. Fourteen stomachs were examined as Table 2 shows.

Table 2. Sands in *Chloris sinica minor* (Temminck & Schlegel).
Small Japanese Greenfinch

	Total Number	Total Weight (gr.)	Total Volume (c.c.)	Size in diameter			Fine Sand (gr.)	Quality												
				larger than ¼ mm.	¼ mm.	Smaller than ¼ mm.		q	f	m	h	i	a	ho	l	ch	p	cl	s	?
1	369	0.090	0.0367	17	41	311	×	9	59	1										295
2	263	0.088	0.0184	14	29	220	0.008	24	16	2										113
3	84	0.070	0.0276	9	33	42	×	11	70											3
4	189	0.060	0.0551	8	39	142	×	69	119											1
5	135	0.120	0.0184	21	54	60	×	44				1		2						88
6	183	0.060	0.0184	14	69	100	×	10	62	1		2								108
7	185	0.065	0.0184	14	65	106	×	11	170											4
8	200	0.060	0.0367	12	47	141	×	102	96						1			1		
9	185	0.070	0.0386	40	49	96	0.010	182							1			1	1	
10	138	0.110	0.0276	18	31	89	×	48	72											18
11	192	0.100	0.0364	9	29	154	×	115	75									1		1
12	178	0.100	0.0364	12	31	135	0.030	160	13											5
Ave.	108.42	0.08275	0.0307																	

The largest number of grains of sand was 369 (No. 1) while the smallest was 84 (No. 3), the average being 108,4. The weight averages 0.082 gr. and the volume 0.030 c.c. As in the case of the brambling most of the grains are smaller than 1/4 mm.. They consist mostly of quartz and felspar. Magnetite, ilmenite, hornblend, limonite, clayslate and silicate are much less frequent than the first two named. The large number, the weight and the quantity of pieces of sand in this case as compared with brambling without doubt may be ascribed to feeding habits of the bird. The same observation is apllicable to the case of the cross-bill which is known as an eater of hard coniferous seeds.

The Japanese cross-bill. Only five stomachs were subjected to examination. A high quantitative percentage was obtained as follows:

Table 3. Sands in *Loxia curvirostra japonica* Ridgway.
Japanese Crossbill.

	Total Number	Total Weight (gr.)	Total Volume (c.c.)	Size in diameter			Fine Sand (gr.)	Quality							
				larger than 1/4 mm.	1/4 mm.	smaller than 1/4 mm.		q	f	m	i	a	l	s	?
1	119	0.070	0.0367	26	14	79	×	28	18						63
2	210	0.070	0.0331	18	17	175	×	180		2			1		27
3	183	0.080	0.0367	25	37	121	×	38						9	136
4	150	0.060	0.0367	7	15	128	×	150							
5	140	0.073	0.0367	5	23	112	0.015	58	13	20	17	6			5
Ave.	160.4	0.0706	0.03598												

The average number, weight and volume of grains of sand are the highest of the three, being respectively 160.4, 0.070 gr, and 0.0359 c.c. Most of them are quartz and show a good adaptation to the feeding habits.

The Japanese meadow bunting. This bird is usually recognized as an insectivorous species which very rarely eats seeds. An extremely small amount of the sand has been detected in the stomach as Table 4 shows.

Table 4. Sands in *Emberiza cioides ciopsis* Bonaparte.
Japanese Meadow Bunting

	Total Number	Total Weight (gr.)	Total Volume (c.c.)	Size in diameter			Fine Sand (gr.)
				larger than ¼ mm.	¼ mm.	smaller than ¼ mm.	
1	13	0.025	0.0122	4	3	6	0.005
2	53	0.042	0.0165	10	6	37	0.002
3	9	0.023	0.0184	5	2	2	0.007
4	10	0.029	0.0092	1	0	9	0.019
5	59	0.049	0.0184	10	22	27	×
6	35	0.067	0.0367	9	4	22	0.021
7	44	0.063	0.0184	5	7	32	0.008
8	20	0.050	0.0184	2	5	13	0.016
Ave.	30.375	0.0435	0.0160				

The largest number in this case is merely 59 (No. 5) and accordingly the weight and the volume of the total sand much less than those of the former cases. Quartz and felspar are rarely found. The sand is derived from stone of soft quality.

Summary

It seems highly probable that some amount of sand grains of hard quality is rather necessary than the number and weight of them for the seed eating birds. More sand is required, the harder the food of the birds is. The sand consists mostly of quartz and felspar particles. There are also magnetite, ilmenite, limnite and so on which show high hardness among the ordinary minerals in nature but their number is comparatively small. Subsequently it is clear that to a certain extent, in nature, the birds pick up some hard minerals by preference.

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ON AN OCCURRENCE OF *ASCARIS* IN THE INTESTINE OF A BEAR, *URSUS ARCTOS YESOENSIS* LYD.

BY

TETSUO INUKAI AND JIRO YAMASHITA

(犬飼哲夫・山下次郎)

(With three text-figures)

A careful search for any example of the parasite in the bear, *Ursus arctos yesoensis* which is found abundantly in Hokkaido and proves a delicious food of the aborigines, the Ainu who oftentimes eats the flesh raw, has hitherto proved negative. On January 20 1934 a male bear was examined which had been killed by the Ainu for the bear festival after having been raised in the cage for a year since its birth.* Numerous nematode parasites were found in the intestine. They were all living and quite active. The bear, on the contrary, looked somewhat weak and less active as compared with others under the same care, apparently on account of the infection.

With the kind assistance of Dr. K. ICHIKAWA in the veterinary institute of the university to whose kindness the authors wish to acknowlege their indebtedness, they could identify the species of the worm, referring it to *Ascaris lumbricoides* L.. This is most common and cosmopolitan species which has been known hitherto infesting man (1,3), gorilla (4), monkey (4), pig (3,4), dog (3), sheep (2), cow (3), deer (3), and squirrel (4).

Fig. 1

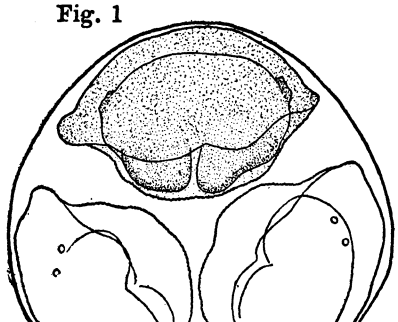
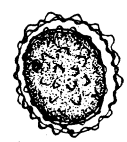


Fig. 3



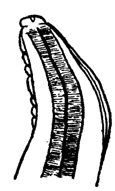


Fig. 2

Fig. 1. Head end from front. ×40. Fig. 2. Anterior body part, ventral view. ×5. Fig. 3. Egg. ×250.

* This was a wild bear which was captured in a den with the mother bear soon after its birth.

The description of the nematode is as follows:

Body white, firm and elastic; head consisting of three prominent lips with dentigerous ridges surrounding the mouth and supplied with pepillae; interlabia absent; cervical alae present but very short and narrow.

Male: tail conical without caudal alae, with numerous preanal and few postanal papillae; two equal spicules; body 190 mm. long and 2.5 mm. in diameter.

Female: vulva at anterior third of the body; vagina directed backwards; two uterine tubes; oviparous, eggs with a thick smooth shell surrounded by an albuminous coat having a coarsely granular surface; body 210 mm. long and 4.5 mm. in diameter.

Remarks. Usually *Ascaris lumbricoides* L.. has no cervical alae but in the present case there are distinct ones as seen in the figure. Such a structure is also found sometimes in *Ascaris lumbricoides* of the pig.

It has become clear that the general hosts of this worm so far investigated are herbivores and omnivores. The bear was fed after the Ainu custom on just the same foods as comprise the human diet.

Literature

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2. GOODEY, T. 1926, On the *Ascaris* from Sheep. Journ. Helminthology, Vol. IV, 1926.
3. SPREHN, C. E. W. 1932, Lehrbuch der Helminthologie. Berlin.
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A SUPPLEMENTARY NOTE ON SPIDERS FROM SOUTHERN SAGHALIEN, WITH DESCRIPTIONS OF TWO NEW SPECIES

BY

SABURO SAITO

(齋 藤 三 郎)

(With ten text-figures)

Since the publication of a preliminary note on the spiders from Southern Saghalien in The Annotationes Zoologicae Japonenses in 1932 a considerable number of specimens has been added to the author's collection being presented by Mr. F. FUJITA from Rakuma and by Mr. M. YOSHIKURA from Shiretori. Moreover the specimens collected by Dr. H. Kôno in his journey to that part in 1932 were kindly placed in the hands of the author for examination. Here the author wishes to acknowledge his great indebtedness to the kindness of the above friends.

Of the seven species formerly recorded by the author, three, *Araneus, ventricosus* (L. KOCH), *Zilla x-notata* CLERCK and *Zilla montana* C. L. KOCH are not found among the present specimens while, the other four, *Araneus marmoreus* CLERCK, *Araneus patagiatus* CLERCK, *Araneus adiantus* WALCKENAER and *Lycosa T-insignita* Bös. et STRAND are referable again. In addition to the latter, twenty three more species are newly identified of which twenty one are known and two are new to science. Hence to the present a total of thirty species of spiders have been discovered inhabiting the island.

Upon considering the species it becomes clear that the spider fauna of Saghalien has much uniformity with that of the northern Eurasiatic continent, there being twenty examples representing the continental form. Five of them even distribute to North America beyond the Bering Strait.

The list of known species and descriptions of the new species are given as follows :—

Family *THOMISIDAE*

Genus ***Misumena*** LATREILLE, 1804

1. ***Misumena vatia*** CLERCK

Misumena vatia, T. THORELL :—Rem. on Syn., Upsala, 1870–1873, pp. 258, 573. ; ———— :—Südrus-

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

sischer Spinnen, St. Petersburg, 1875, p. 57.; E. SIMON:—Arachn. de France, Paris, 1875, Tom. 2, p. 273.; L. KOCH:—Arachn. Sibirien Novaja Semlja, Stockholm, 1879, p. 96.; E. KEYSERLING:—Spinnen Amerikas, Laterigradae, Nürnberg, 1880, p. 101.; F. CAMBRIDGE:—Biol. Centr. Amer., 1900, Vol. 2, p. 141, pl. 9, fig. 33.; J. H. EMERTON:—Common Spiders, London, 1902, p. 27, figs. 76–78.; W. BÖSENBERG:—Zoologica, Stuttgart, Bd. 14, 1903, p. 366, Taf. 34, Fig. 539.; K. KISHIDA:—Zoological Magazine (in Japanese), Tokyo, Vol. 36, 1924, p. 512.

Misumena calycina, W. BÖSENBERG u. E. STRAND: Japanische Spinnen, Stuttgart, 1905, p. 255, Taf. 10, Fig. 164.

Thomisus citreus, J. BLACKWALL:—Spid. Gr. Brit. & Ir., 1864, p. 88, pl. 4, fig. 53.

Thomisus fartus, N. M. HENTZ:—Spiders U. S., Boston, p. 78, pl. 10, fig. 4.

Locality: Three adult and two immature females from Baguntan (H. KÔNO, Aug. 5, 1932), Shirahama (H. KÔNO, Aug. 5, 1932), Kashiho (H. KÔNO, Aug. 3, 1932), Shiretori (M. YOSHIKURA, 1933).

The measurements (in centimeters) are as follows:—

	totol length	abdomen	leg I	leg II	leg III	leg IV
female (Baguntan)	1.20	0 90	1.40	1.25	0.65	0.80
female (Shirahama)	0.85	0.65	1.20	1.10	0.60	0.75
female (Shiretori)	0.90	0.70	1.35	1.25	0 70	0.90

Distribution: U.S.A., Canada, Alaska, Siberia (Krasnojarsk), U.S.S.R., Germany, France, Japan (Kyushu), Northern Saghalien.

Genus ***Philodromus*** WALCKENAER, 1825

2. ***Philodromus rufus*** WALCKENAER

Philodromus rufus, E. SIMON:—Arachn. de France, Paris, 1875, Tom. 2, p. 287, pl. 8, fig. 9.; E. KEYSERLING:—Spinnen Amerikas, Laterigradae, Nürnberg, 1880, p. 217, pl. 5, fig. 119.; W. BÖSENBERG:—Zoologica, Stuttgart, 1903, Bd. 14, p. 333, Taf. 31, Fig. 494.; A. PETRUNKEVITCH:—Bull. Amer. Mus. Nat. Hist., Vol. 29, 1911, p. 421.

Philodromus obscurus, J. BLACKWALL:—Ann. Mag. Nat. Hist., 4ser., 1871, Vol. 8, p. 431.

Philodromus pictus, J. H. EMERTON:—Common Spiders, London, 1902, p. 37, figs. 108–110.

Locality: A matured female from Randomari (H. KÔNO, July 17, 1932).

Distribution: U.S.A., Germany.

Genus ***Tibellus*** SIMON, 1875

3. ***Tibellus tenellus*** (L. KOCH)

(Fig. 1)

Tibellus tenellus, W. BÖSENBERG u. E. STRAND:—Japanische Spinnen, Stuttgart, 1905, p. 271, Taf. 8, Fig. 112, Taf. 10, Fig. 156.

Locality: Three adult females from Sakaehama (H. KÔNO, July 20, 1932), Kiton (Vicinity of Shisuka, H. KÔNO, July 28, 1932), Shiretori (M. YOSHIKURA, 1933).

The measurements (in centimeters) are as follows:—

	total length	abdomen	leg I	leg II	leg III	leg IV
female (Sakaehama)	1.00	0.70	1.10	1.20	0.90	1.00
female (Kiton)	1.00	0.65	1.30	1.50	1.00	1.35
female (Shiretori)	0 80	0 60	1.00	1.20	0.80	1.00

Distribution: Japan (Honshu, Kyushu).

Family *CLUBIONIDAE*

Genus ***Clubiona*** LATREILLE, 1804

4. ***Clubiona coerulescens*** L. KOCH

(Fig. 2)

Clubiona coerulescens, T. THORELL:—Rem. on Syn., Upsala, 1870–1873, p. 224.; L. KOCH:—Arachn. Sibirien Novaja Semlja, Stockholm, 1879, p. 89.; W. BÖSENBERG:—Zoologica, Stuttgart, Bd. 14, 1903, p. 268, Taf. 25, Fig. 388.; R. BREMEN:—Tierwelt Mittleuropas, Leipzig, Bd. 3, Lief. 2, pp. 31, 33, Taf. 5, Fig. 338, Taf. 6, Fig. 355.

Locality: One adult male, three adult and several immature females from Shiretori (M. YOSHIKURA, 1933).

The measurements (in centimeters) are as follows:—

	total length	abdomen	leg I	leg II	leg III	leg IV
male (Shiretori)	0.60	0.45	0.80	0 70	0.60	0.90
female (Shiretori)	0 90	0 50	1.20	1.10	0.90	1.20
female (Shiretori)	0.80	0.50	1.10	1.00	0 70	1.10
female (Shiretori)	0 80	0 50	1.00	0.90	0.80	1 00

Distribution: Europe, Siberia (Krasnojarsk).

5. ***Clubiona lutescens*** WESTRING

(Fig. 3)

Clubiona lutescens, T. THORELL:—Rem. on Syn., Upsala, 1870–1873, p. 225.; ———:—Südrussischer Spinnen, St. Petersburg, 1875, p. 40.; W. BÖSENBERG:—Zoologica, Stuttgart, 1903, Bd. 14, p. 276, Taf. 26, Fig. 405.; W. BÖSENBERG u. E. STRAND:—Japanische Spinnen, Stuttgart, 1905, p. 283, Taf. 16, Fig. 485.; R. BREMEN:—Tierwet Mitteleuropas, Leipzig. Bd. 3, Lief. 2, pp. 32, 33, Taf. 5, Fig. 352, Taf. 6, Fig. 365.

Locality: An adult male from Shiretori (M. YOSHIKURA, 1933).

The measurements (in centimeters) are as follows:— total length 0.50, abdomen 0.35, leg I 1.15, leg II 1.20, leg III 0 90, leg IV 1.00.

Distribution: Germany, U.S.S.R., Japan (Kyushu).

Genus ***Chirakanthium*** C. L. KOCH, 1879

6. ***Chiracanthium lascivum*** KARSCH

(Fig. 4, a, b)

Chiracanthium lascivum, F. KARSCH:—Verhandl. d. N. V., Jahrg. 36, p. 91.; W. BÖSENBERG u. E. STRAND:—Japanische Spinnen, Stuttgart, 1905, p. 287, Taf. 16, Fig. 502.

Locality: An adult male from Shiretori (M. YOSHIKURA, 1933).

Distribution: Japan (Honshu or Kyushu ?).[1]

Family *THERIDIIDAE*

Genus ***Theridion*** WALCKENAER, 1805

7. ***Theridion tepidariorum*** C. L. KOCH

Theridion tepidariorum, J. BLACKWALL:—Spid. Gr. Brit. & Ir., 1864, p. 180, pl. 13, fig. 114,: ———:— Ann. Mag. Nat. Hist., 5ser., Vol. 1, 1878, p. 155.; E. SIMON:—Arachn. de France, Paris, Tom. 5, 1881, p. 93.; T. THORELL:—Descriptive Catalogue of Spiders of Burma, British Mus., 1895, p. 95.; E. SIMON:—Fauna Hawaiiensis, Cambridge, Vol. 2, 1900, p. 449.; J. ALLEN:—Bull. Amer. Mus. Nat. Hist., Vol. 29, 1911, p. 207.; J. H. COMSTOCK:—Spider Book, New York, 1913, pp. 210, 299, 330, 345. 421, figs. 321, 323, 340–343.; R. V. CHAMBERLIN:—Proc. U. S. Nat. Mus., Vol. 63, 1924, p. 5.; ———:—Proc. California Academy Science, 4ser., Vol. 12, 1924, p. 638.; C. R. CROSBY and S. C. BISHOP:— Memoir Cornell Univ. Agr. Exper. Station, Vol. 101, 1926, p. 1042.; R. BREMEN:— Tierwelt Mitteleuropas, Leipzig, Bd. 3, Lief. 2, pp. 57, 59, Taf. 9, Fig. 647, Taf. 10, Fig. 662.; S. YUHARA:—Study of spiders (in Japanese), Tokyo, 1931, pp. 96. 97, figs. 25, 26.; S. SAITO:—Proc. Imper. Academy, Vol. 9, 1933, p. 273.; ———:—Trans. Sapporo Nat. Hist., Vol. 13, 1933, p. 42.

Theridion tepidatorium, E. KEYSERLING:—Spinnen Amerikas, Nürnberg, Theridiidae, 1884, Bd. 1, p. 9, Tab. 1, Fig. 1.

Theridion vulgare, N. M. HENTZ:—Spiders U. S., Boston, 1875, p. 142, pl. 16, fig. 1.

Theridium tepidariorum, T. THORELL:—Rem. on Syn., Upsala, 1870–1873, p. 80.; ———:—Horae Societatis Entomologicae Rossicae, Vol. 11. 1875, p. 29.; O. HERMAN:—Ungarns Spinnen-Fauna, Budapest, Bd. 3, 1879, p. 83.; G. MARX:—Proc. U. S. Nat. Mus., Vol. 10, 1890, p. 520.; C. CHYZER et L. KULCZYNSKI:—Araneae Hungariae, Budapest, Tom. 2, 1894, p. 35.:—T. THORELL:—Estratto dagli Annali del Musco Civico di Storia Naturale di Genova, 2ser., Vol. 19, 1898, p. 45.; ———:—Bihang Till K. Svenska Vet.-Akad. Handlingar, Bd. 25, 1899, p. 25.; T. P. von BAYERN:—Zool. Anz., Bd. 23, 1900, p. 283.; W. BÖSENBERG:—Zoologica, Stuttgart, 1903. Bd. 14, p. 96, Taf. 8, Fig. 115.; J. H. EMERTON:—Common Spiders, Lonon, 1902, p. 111, figs. 255—260.; W. BÖSENBERG u. E. STRAND:—Japanische Spinnen, Stuttgart, 1905, p. 148.; E. STRAND:— Zool. Anz., Bd. 32, 1908, p. 219.; N. BANKS:—Bull. Smithsonian Institution U. S. Nat. Mus., Vol. 72, 1910, p. 20.

Steatoda tepidariorum, O. P. CAMBRIDGE:—Biol. Cent. Amer., Vol. 2, 1897–1905, p. 382, Taf. 36, figs. 1, 2.

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1) The original papers by W. BÖSENBERG, E. STRAND and F. KARSCH do not give the localities.

Locality: An adult female from Rakuma (F. FUJITA, 1932).
Distribution: Cosmopolitan.

8. *Theridion nivalium* n. sp.

Jap. name. (*Yuki-himegumo*)

(Fig. 5, a, b, c)

An adult female was collected by Dr. H. KÔNO at Tarandomari on the west coast of Karafuto, on July 17, 1932. Total length 0.30 cm. Cephalothorax 0.15 cm. long, 0.12 cm. wide between second and third coxae, 0.05 cm. wide in the eye-region, gradually rounded in front. A shallow depression of an indefinite shape in place of the thoracic groove. First row of eyes recurved, second row procurved. Anterior median eyes alone diurnal. Eyes of the first row equidistant, separated by almost their diameter. Eyes of second row slightly larger than those of the first row, equidistant, separated by about 3/4 of their diameter. Lateral eyes of both rows contiguous. Quadrangle wider behind than in front in ratio 5 : 4, more wide than long in ratio 4.5 : 4. Clypeus equal to length of quadrangle. Chelicerae longer than clypeus, slender, parallel, without boss, with a very short, stout fang. Maxillae more long than wide, covered with hairs. Labium triangular, rounded anteriorly, articulated to maxillae with distinct sternal suture. Sternum convex, triangular, with straight anterior edge, as wide as long. First coxae wide apart, fourth coxae separated by their width. Posterior end of sternum pointed. Legs slender and long, their length, I 0.55 cm., II 0.50 cm., III 0.40 cm., IV 0.60 cm. Comb poorly developed, composed of eleven serrated bristles. Abdomen 0.20 cm. long, elliptic, without hairs. Spinnerets six, first pair close together. Colulus wanting.

Colour in alcohol: Cephalothorax grabrous, except a few bristles, and perfectly lemon yellow. Sternum brownish yellow. Chelicerae, maxillae and labium slightly darker than the cephalothorax. Palpi and legs slightly paler than the cephalothorax but ends of the fourth femora almost black. Abdomen snowy white. Belly and spinnerets dark yellowish brown.

The male of this species has not been examined.

Remarks: The species is closely allied to *Theridion fordum* KEYSERLING which inhabits America, but it is distinguished from the American species by the form of epigynum.

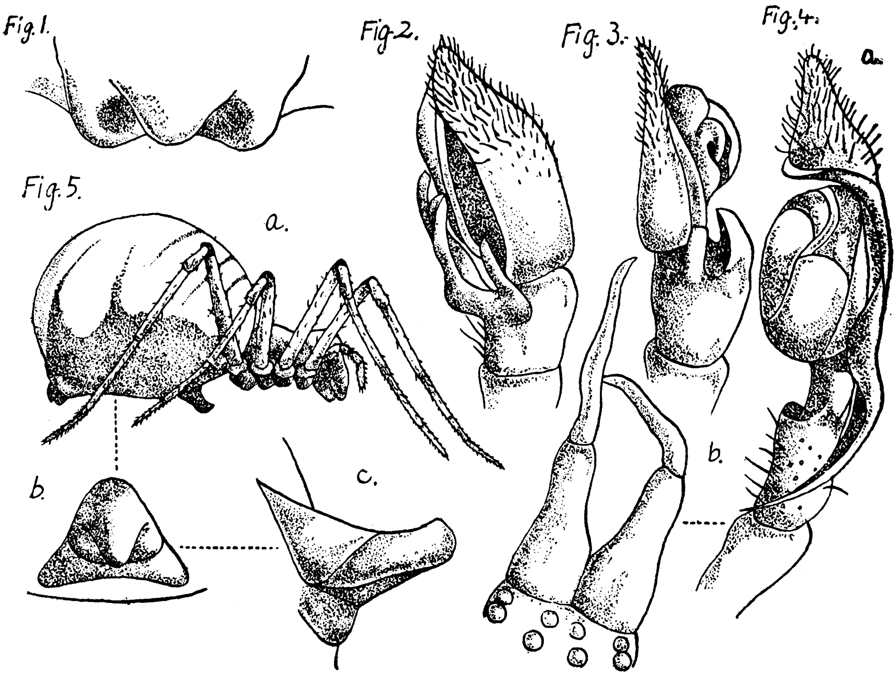

Fig. 1. *Tibellus tenellus* (L. KOCH); Epigynum.
Fig. 2. *Clubiona coerulescens* L. KOCH; Palpus of male.
Fig. 3. *Culbiona lutescens* WESTRING; Palpus of male.
Fig. 4. *Chiracanthium lascivum* KARSCH; a, Palpus of male, b, Chelicerae of male.
Fig. 5. *Theridion nivalium* n. sp.; a, Sideview of female, b, Epigynum from above, c, Sideview of epigynum.

Family *ARGIOPIDAE*

Genus ***Meta*** C. L. KOCH, 1836

9. ***Meta yunohamaensis*** BÖS. et STRAND

Mata yunohamaensis, W. BÖSENBERG u. E. STRAND:—Japanische Spinnen, Stuttgart, 1905, p. 180, Taf. 11, Figg. 225, 229.; T. KAMBE:—Jour. Chosen Nat. Hist. (in Japanese), No. 15, 1933, p. 44.; S. SAITO:—Transact. Sapporo Nat. Hist., Vol. 13, 1933, p. 48, pl. 3, fig. 12.; ———— :—Proc. Imper. Academy, Vol. 9, 1933, p. 237.

Locality: An adult female from Shiretori (M. YOSHIKURA, 1933).

The measurements (in centimeters) are as follows:—tatal length 0.80, abdomen 0.50, leg I 1.90, leg. II 1.50, leg III 0.90, leg IV 1.30.

Distribution: Japan (Kyushu, Formosa, Korea, Hokkaido).

Genus ***Argiope*** AUDOIN, 1825

10. ***Argiope sachalinensis*** n. sp.

Jap. name. (*Karafuto-Koganegumo*)

(Fig. 6, a, b, c, d)

One female was captured by Dr. H. KÔNO at Kashiho on the east coast on August 3, 1932. Total length 0 85 cm. Cephalothorax 0.40 cm. long, 0.25 cm. wide between second and third coxae, 0.15 cm. wide in the eye-region, furnished with white hairs. Viewed from above, both rows of eyes slightly recurved, first row more so than the second, slightly shorter. Anterior median eyes separated from each other by their diameter, and from anterior lateral eyes by 1.5 times their diameter. Posterior median eyes separated from each other by 2/3 of their diameter, from posterior lateral eyes by 2 times their diameter. Lateral eyes of both rows contiguous. Quadrangle as wide behind as in front, slightly more wide then long. Clypeus equal to the diameter of anterior median eyes. Chelicerae strong, with boss, furnished with three teeth at lower margin. Labium triangular, more wide than long. Maxillae longer than wide at end in ratio 1.5 : 1. Sternum convex, shield-shaped, as wide as long, pointed between hind coxae. Length of legs, I 1.00 cm., II 0.90 cm., III 0.50 cm., IV 0.80 cm. Abdomen 0.60 cm. long, somewhat pressed, without shoulder tubercles.

Colour in alcohol: Cephalothorax dull yellow with brownish black lines at radial and cervical grooves. Chelicerae brownish yellow slightly dusky, with brown fang. Labium and maxillae black with white ends. Sternum black uniformly. Legs pale yellow, annulated with deep black and furnished with black hairs and bristles. Abdomen white above, mottled with black. Venter yellow with black at the median field and with a pair of white spots at postero-lateral angles of black field. Spinnerets black.

Remarks: This species is peculiar in the form of epigynum differing from the other species of *Argiope*.

Genus ***Araneus*** LINNAEUS, 1759

11. ***Araneus inconspicua*** SIMON

Aranea inconspicua, R. BREMEN :—Tierwelt Mitteleuropas, Leipzig, Bd. 3, Lief. 2, pp. 112, 115, Taf. 23, Fig. 1263, Taf. 24, Fig. 1293.

Epeira inconspicua, E. SIMON :—Arachn. de France, Paris, Tom. 1, 1874, p. 84.; C. CHYZER et L. KULCZYNSKI :—Araneae Hungariae, Budapest, 1892, Tom. 1, p. 131.; W. BÖSENBERG :—Zoologica, Stuttgart, Bd. 14, 1903, p. 29, Taf. 1, Fig. 12.

Locality: Two females from Shiretori (M. YOSHIKURA, 1933), Randomari (H. KÔNO, July 17, 1932).

The measurements (in centimeters) are as follows:—

	total length	abdomen	leg I	leg II	leg III	leg IV
female (Shiretori)	0.70	0.60	0.90	0.70	0.60	0.80
female (Randomari)	0.70	0.50	0.70	0.60	0.50	0.65

Distribution: Germany, Hungary, France.

12. *Araneus omoeda* THORELL

Aranea omoeda, R. BREMEN:—Tierwelt Mitteleuropas, Leipzig, Bd. 3, Lief. 2, pp. 111, 114, Taf. 23, Fig. 1255, Taf. 24, Fig. 1281.

Epeira omoeda, E. SIMON:—Arachn. de France, Paris, Tom. 1, 1974, p. 66.; C. CHYZER et L. KULCZYNSKI:—Araneae Hungariae, Budapest, Tom. 1, 1892, p. 129.; W. BÖSENBERG:—Zoologica, Stuttgart, 19c5, Bd. 14, p. 27, Taf. 1, Fig. 9.

Epeira bicornis, T. THORELL:—Rem. on Syn., Upsala, 1870-1873, p. 19.

Locality: One female and one male from Shiretori (M. YOSHIKURA, 1933), vicinity of Shisuka (H. KÔNO, July 27, 1932).

The measurements (in centimeters) are as follows:—

	total length	abdomen	leg I	leg II	leg III	leg IV
female (Shiretori)	1.00	0.80	1.50	1.20	0.80	1.20
male (Shisuka)	0.70	0.40	1.40	1.20	0.70	1.20

Distribution: Sweden, Hungary, Germany, France.

13. *Araneus nordmanni* THORELL

(Fig. 7)

Araneus nordmanni, A. PETRUNKEVITCH:—Bull. Amer. Nat. Hist., Vol. 29, 1911, p. 307.; C. R. CROSBY and S. C. BISHOP:—Memoir Cornell Univ. Agr. Exper. Station, 1926, p. 1053.

Aranea nordmanni, R. BREMEN:—Tierwelt Mitteleuropas, Leipzig, Bd. 3, Lief. 2, pp. 110, 114, Taf. 24, Fig. 1280.

Epeira nordmanni, T. THORELL:—Rem. on Syn., Upsala, 1870–1873, p. 3.; E. SIMON:—Arachn. de France, Paris, Tom. 1, 1874, p. 55.; C. CHYZER et L. KULCZYNSKI:—Araneae Hungariae, Budapest, Tom. 1, 1892, p. 128.; J. H. EMERTON:—Common Spiders, London, 1902, p. 163, figs. 387, 388.; W. BÖSENBERG:—Zoologica, Stuttgart, Bd. 14, 1903, p. 27, Taf. 1, Fig. 8.

Epeira angulata, J. BLACKWALL:—Spid. Gr. Brit. & Ir., 1864, p. 47, pl. 2, fig. 2.

Locality: One female and an immature male from Shiretori (M. YOSHIKURA, 1933), vicinity of Shisuka (H. KÔNO, July 26, 1932).

The measurements (in centimeters) of the female are as follows:—total length 1.00, abdomen 0.80, leg I 1.50, leg II 0.75, leg III 1.50, leg IV 1.30.

Distribution: U.S.A., Canada, France, Germany, Hungary.

14. *Araneus patagiatus* CLERCK

Araneus patagiatus, A. PETRUNKEVITCH :—Bull. Amer. Nat. Hist., Vol. 29, 1911, p. 808.; W. RABELER:—Zeitschr. f. Morph. u. Oekol. d. Tiere, Bd. 21, 1931, p. 198.

Aranea patagiata, L. KOCH :—Arachn. Sibirien Novaja Semlja, Stockholm, 1879, p. 7.; W. BÖSENBERG :—Zoologica, Stuttgart, 1903, Bd. 14, p. 36, Taf. 2, Fig. 22.; T. THORELL :—Rem. on Syn., Upsala, 1870–1873, p. 16.; C. R. CROSBY and S. C. BISHOP :—Memoir Cornell Univ. Agr. Exper. Station, 1926, p. 1053.; S. SAITO :—Ann. Zool. Jap., Vol. 13, 1932, p. 380, fig. 2.; M. L. PEELLE and S. SAITO :—Jour. Science Hokkaido Imper. Univ., 6ser., Vol. 2, 1932, p. 92; S. SAITO :—Pro. Imper. Academy, Vol. 9. 1933, p. 273.

Epeira patagiata, J. BLACKWALL :—Spid. Gr. Brit. & Ir., 1864, p. 329, pl. 24, fig. 229.; E. SIMON :—Arachn. de France, Paris, Tom. 1, 1874, p. 110.; T. THORELL :—Südrussischer Spinnen, St. Petersburg, 1875, p. 16.; C. CHYZER et L. KULCZYNSKI :—Araneae Hungariae, Budapest, Tom. 1, 1892, p. 113, Taf. 5, fig. 10.; J. H. EMERTON :—Common Spiders, London, 1902, p. 160, fig. 384.

Locality: One female and one male from Sakaehama (H. KÔNO, July 20, 1932).

The measurements (in centimeters) are as follows :—

	total length	abdomen	leg I	leg II	leg III	leg IV
female (Sakaehama)	0.85	0.50	1.30	1.10	0.85	1.10
male (Sakaehama)	0.70	0.50	1.50	1.30	0.90	1.10

Distribution :—Siberia (Krasnojarsk), Germany, Hungary, France, U.S.S.R., U.S.A., Alaska, Japan (Iterup, Hokkaido).

15. *Araneus cornutus* CLERCK

Araneus cornutus, A. PETRUNKEVITCH :—Bull. Amer. Mus. Nat. Hist., Vol. 29, 1911, p. 742.

Araneus frondosa, J. H. COMSTOCK :—Spider Book, New York, 1913, p. 489.

Araneus foliatus, S. SAITO :—Proc. Imper. Academy, Vol. 9, 1933, p. 273.

Aranea cornuta, W. BÖSENBERG u. E. STRAND[1] :—Japaniche Spinnen, Stuttgart, 1905, p. 236.

Aranea foliata, R. BREMEN :—Tierwelt Mitteleuropas, Leipzig, Bd. 3, Lief. 2, pp. 111, 115, Taf. 23, Fig. 1253. Taf. 24, Fig. 1299.

Epeira cornuta, T. THORELL :—Rem. on Syn., Upsala, 1870–1873, p. 15.; E. SIMON :—Arachn. de France, Paris, Tom. 1, 1874, p. 108.; T. THORELL :—Südrussischer Spinnen, 1875, p. 16. L. KOCH :—Arachn. Sibirien Novaja Semlja, Stockholm, 1879, p. 5.; O. HERMAN :—Ungarns Spinnen-Fauna, Budapest, 1879, Bd. 3, p. 17.; C. CHYZER et L. KULCZYNSKI :—Araneae Hungariae, Budapest, Tom. 1, 1891, p. 133, Taf. 5, fig. 9.

Epeira strix, N. M. HENTZ :—Spiders U.S., Boston, 1875, p. 112, pl. 13, fig. 5.; J. H. EMERTON :—Common Spiders, London, 1902, p. 160, fig. 385.

Epeira affinis, J. BLACKWALL :—Spid. Gr. Brit. & Ir., 1864, p. 325, pl. 23, fig. 237.

Locality: An adult male and three immature females from Shiretori (M. YOSHIKURA, 1933), vicinity of Shisuka (H. KÔNO, July 26, 1932), Sakaehama (H. KÔNO, July 20, 1932),

1) They failed in the collection of this species and their description depends upon a report by F. KARSCH.

The measurements (in centimeters) of the male are as follows:—total length 0.85, abdomen 0.65 leg I 1.30, leg II 1.00, leg III 0.70, leg IV 0.95.

Distribution: U.S.A., Canada, Germany, Hungary, France, U.S.S.R., Siberia, Japan (Hokkaido).

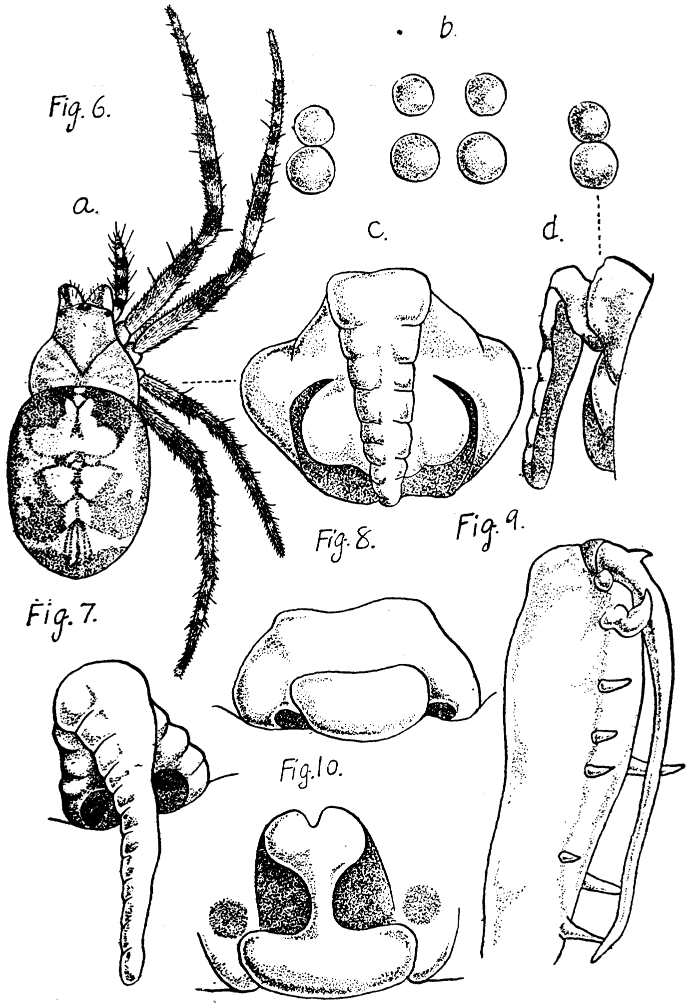

Fig. 6. *Argiope sachalinensis* n. sp.; a, Dorsal view of female, b, Eye-group, c, Epigynum from above, d, Sideview of epigynum.

Fig. 7. *Araneus nordmanni* THORELL; Epigynum.

Fig. 8. *Zilla atrica* L. KOCH; Epigynum.

Fig. 9. *Tetragnatha squamata* KARSCH; Chelicera of male.

Fig. 10. *Trochosa terricola* THORELL; Epigynum.

16. *Araneus marmoreus* CLERCK

Araneus marmoreus, O. HERMAN :—Ungarns Spinnen-Fauna, Budapest, Bd. 3, 1879, p. 15,; A. PETRUNKEVITCH :—Bull. Amer. Mus. Nat. Hist., Vol. 29, 1911, p. 301.; W. RABELER :—Zeitschr. f. Morph. u. Oekol. d. Tiere, Bd. 21, 1931, p. 198.

Araneus marmorea, C. R. CROSBY and S. C. BISHOP :—Memori Cornell Univ. Agr. Exper. Station, 1926, p. 1053.; S. Saito :—Annot. Zool. Jap., Vol. 13, 1932, p. 379, fig. 1.

Aranea marmorea, J. C. FABRICIUS :—Ent. Syst., Tom. 2, 1793, p. 415.

Aranea marmorea (Aranea Rajii), T. THORELL :—Rem. on Syn., Upsala, 1870–1873, p. 9.

Aranea Radii, W. BÖSENBERG u. E. STRAND[1) :—Japanische Sp'nnen, Stuttgart, 1905, p. 236.

Epeira marmorea, E. SIMON :—Arachn. de. France, Paris, Tom. 1, 1874, p. 76.; L. KOCH :—Arachn. Sibirien Novaja Semlja, Stockholm, 1879 p. 5.; C. CHYZER et L. KULCZYNSKI :—Araneae Hungariae, Budapest, Tom. 1, 1892, p. 130, Taf. 5, fig. 15.; J. H. EMERTON :—Common Spiders, London, 1902, p. 169, figs. 398, 399.; W. BÖSENBERG :—Zoologica, Stuttgart, Bd. 14, 1903, p. 24, Taf. 1, Fig. 4.

Epeira scalaris, J. BLACKWALL :—Spid. Gr. Brit. & Ir., 1864, p. 331, pl. 24, fig. 240.

Epeira insularis, E. KEYSERLING :—Spinnen Amerikas, Epeiridae, 1892, p. 170, pl. 8, fig. 126.; N. M. HENTZ :—Spiders U.S., Boston, 1875, p. 109.

Epeira Radii, T. THORELL :—Südrussischer Spinnen, St. Petersburg, 1875, p. 15.

Locality: Four females and two males from Shiretori (M. YOSHIKURA, 1933), Sakaehama (H. KÔNO, July 20, 1932), Baguntan (H. KÔNO, Aug. 5, 1932), Kashiho (H. KÔNO, Aug. 3, 1932).

Distribution: U.S.A., Canada, Siberia, U.S.S.R., Germany, France, Hungary, Japan (Hokkaido).

17. *Araneus triguttatus* FABRICIUS

Aranea triguttata, J. C. FABRICIUS :—Ent. Syst., Tom. 2, 1793, p. 416.

Aranea guttata, R. BREMEN :—Tierwelt Mitteleuropas, Leipzig, Bd. 3, Lief. 2, pp. 113, 114, Taf. 23, Fig. 1270, Taf. 24, Fig. 1285.

Epeira triguttata, E. SIMON :—Arachn. de France, Paris, Tom. 1, 1874, p. 83.; C. CHYZER et L. KULCZYNSKI :—Araneae Hungariae, Budapest, Tom. 1, 1892, p. 131, Taf. 5, Fig. 6.; W. BÖSENBERG :—Zoologica, Stuttgart, Bd. 14, 1903, p. 38, Taf. 2, Fig. 25.

Epeira triguttata var. *agalena*, T. THORELL :—Südrussischer Spinnen, St. Petersburg, 1875, p. 16.

Locality: Four females from Kiton (H. KÔNO, July 28, 1932) and Tarandomari (H. KÔNO, July 17, 1932).

The measurements (in centimeters) are as follows:—

	total length	abdomen	leg I	leg II	leg III	leg IV
female (Kiton)	0.50	0.40	0.70	0.60	0.45	0.55
female (Kiton)	0.60	9.45	0.75	0.65	0.50	0.65
female (Tarandomari)	0.70	0.50	0.80	0.60	0.45	0.65
female (Tarandomari)	0.50	0.40	0.70	0.65	0.50	0.65

Distribution: Germany, France, Hungary, U.S.S.R.

1) They did not have the species from Japan.

18. ***Araneus adiantus*** WALCKENAER

Araneus adiantus, W. RABELER:—Zeitsch. f. Morph. u. Oekol. d. Tiere, Bd. **21**, **1931**, p. **198**.

Araneus adianta, S. SAITO:—Annot, Zool. Jap., Vol. **13**, **1932**, p. **381**, fig. **3**.

Aranea adianta, T. THORELL:—Rem. on Syn., Upsala, 1870–1873, p. 23.; R. BREMEN:—Tierwelt Mitteleuropas, Leipzig, Bd. 3, Lief. **2**, pp. 112, 115, Taf. 23, Fig. 1265, Taf. 24, Fig. 1291.

Epeira adianta, J. BLACKWALL:—Spid. Gr. Brit. & Ir., 1864, p. 348, pl. 25, fig. 251.; E. SIMON:—Arachn. de France, Paris, Tom. 1, 1874, p. 111.; T. THORELL:—Südrussischer Spinnen, St. Petersburg, 1875, p. 18.; C. P. CAMBRIDGE:—Ann. Mag. Nat. Hist., Vol. 1, 1878, p. 120.; L. KOCH:—Arachn. Sibirien Novaja Semlja, Stockholm, 1879, p. 7.; C. CHYZER et L. KULCZYNSKI:—Araneae Hungariae, Budapest, Tom. 1, 1892, p. 133.

Locality: An adult female from Shiretori (M. YOSHIKURA, 1933).

Distribution: Siberia, Hungary, France, Germany, U.S.S.R.

19. ***Araneus diadematus*** CLERCK

Araneus diadematus, O. HERMAN:—Ungarns Spinnen-Fauna, Budapest, Bd. 3, 1879, p. 13.; A. PETRUNKEVITCH:—Bull. Amer. Mus. Nat. Hist., Vol. 29, 1911, p. 289.

Aranea diadema, R. BREMEN:—Tierwelt Mitteleuropas, Leipzig, Bd. 3, Lief. 2, pp. 110, 114, Taf. 23, Fig. 1243, Taf. 24, Fig. 1287.

Epeira diademata, E. SIMON:—Arachn. de France, Paris, Tom. 1, 1874, p. 72.; T. THORELL:—Rem. on Syn., Upsala, 1870–1873, p. 8.; ———:— Südrussischer Spinnen, St. Petersburg, 1875, p. 15.; C. CHYZER et L. KULCZYNSKI:—Araneae Hungariae, Budapest, Tom. 1, 1897, p. 129, Taf. 5, fig. 14.; W. BÖSENBERG:—Zoologica, Stuttgart, Bd. 14, 1903, p. 24, Taf. 1, Fig. 2.

Epeira diadema, J. BLACKWALL:—Spid. Gr. Brit. & Ir., 1864, p. 358, pl. 24, fig. 258.

Locality: An adult female from Shiretori (M. YOSHIKURA, 1933).

The measurements (in centimeters) of the female are as follows:—total length 1.40, abdomen 1.20, leg I 2.00, leg II 1.70, leg III 1.10, leg IV 1.80.

Distribution: U.S.A., Chile, Hungary, France, Germany, U.S.S.R.

20. ***Araneus qudratus*** CLERCK

Araneus quadratus, O. HERMAN:—Ungarns Spinnen-Fauna, Budapest, Bd. 3, 1879, p. 16.; A. PETRUNKEVITCH:—Bull. Amer. Mus. Nat. Hist., Vol. 29, 1911, p. 311.

Epeira qudrata, E. SIMON:—Arachn. de France, Paris, Tom. 1, 1874, p. 80; J. BLACKWALL:—Spid. Gr. Brit. & Ir., 1864, p. 324, pl. 23, fig. 236.; C. CHYZER et L. KULCZYNSKI:—Araneae Hungariae, Budapest, Tom. 1, 1892, p. 130, Taf. 5, fig. 12.; W. BÖSENBERG:—Zoologica, Stuttgart, Bd. 14, 1903, p. 23, Taf. 1, Fig. 3.

Lacality: Two adult females from Shiretori (M. YOSHIKURA, 1933).

The measurements (in centimeters) are as follows:—

	total length	abdomen	leg I	leg II	leg III	leg IV
female (Shiretori)	1.80	1.50	2.20	1.80	1.30	2.00
female (Shiretori)	1.80	1.20	2.10	2.10	1.40	2.30

Distribution: Greenland, Hungary, Germany, France.

Genus *Zilla* L. KOCH, 1834

21. *Zilla atrica* L. KOCH

(Fig. 8)

Zilla atrica, T. THORELL:—Rem. on Syn., Upsala, 1870–1873, p. 31.; E. SIMON:—Arachn. de France, Paris, Tom. 1, 1892, p. 138.; C. CHYZER. et L. KULCZYNSKI:—Araneae Hungariae, Budapest, Tom. 1, 1892, p. 137, Taf. 5, fig. 34.; J. H. Emerton:—Common Spiders, London, 1902, p. 185, figs. 432–434.: W. BÖSENBERG:—Zoologica, Stuttgart, Bd. 14, 1903, p. 46, Taf. 3, Fig. 36.

Araneus atricus, A. PETRUNKEVITCH:—Bull. Amer. Nat. Hist., Vol. 29, 1911, p. 28.

Aranea atrica, R. BREMEN:—Tierwelt Mitteleuropas, Leipzig, Bd. 3, Lief. 2, pp. 116, 117, Taf. 25, Fig. 1311, Taf. 24, Fig. 1319.

Epeira calophylla, J. BLACKWALL:—Spid. Gr. Brit. & Ir., 1864, p. 338, pl. 25, fig. 245.

Locality: One female from Shiretori (M. YOSHIKURA, 1933).

The measurements (in centimeters) are as follows:—total length 0.65, abdomen 0.40, leg I 0.85, leg II 0.65, leg III 0.50, leg IV 0.75.

Distribution: U.S.A., Germany, France, Hungary.

Family *TETRAGNATHIDAE*

Genus *Tetragnatha* LATREILLE, 1804

22. *Tetragnatha squamata* KARSCH

(Fig. 9)

Tetragnatha squamata, F. KARSCH:—Verhandl. d. N. V., Jahrg. 36, 1879, p. 65, Taf. 1, Fig. 3.; W. BÖSENBERG u. E. STRAND:—Japanische Spinnen, Stuttgart, 1905, p. 176, Taf. 3, Fig. 5, Taf. 15, Fig. 405.

Locality: Two adult and one immature females and an adult male from Tarandomari (H. KÔNO, July 17, 1932), Sakaehama (H. KÔNO, July 20, 1932), vicinity of Shisuka (H. KÔNO, July 26, 1932), Kashiho (H. KÔNO, Aug. 3, 1932).

The measurements (in centimeters) are as follows:—

	total length	abdomen	leg I	leg II	leg III	leg IV
male (Tarandomari)	0.65	0.40	1.50	1.20	0.70	1.00
female (Sakaehama)	0.60	0.40	1.40	1.00	0.60	0.90
female (Shisuka)	0.70	0.50	1.10	0.75	0.50	0.80

Distribution: Japan (Kyushu, Hokkaido).

23. *Tetragnatha Solandrii* (SCOPOLI)

Tetragnatha Solandrii, C. CHYZER et L. KULCZYNSKI:—Araneae Hungariae, Budapest, Tom. 1, 1892, p. 145, Taf. 6, fig. 9.; R. BREMEN:—Tierwelt Mitteleuropas, Leipzig, Bd. 3, Lief. 2, p. 118, Taf. 25, Fig. 1329.

Tetragnatha Solandri, L. KOCH:—Arachn. Sibirien Novaja Semlja, Stockholm, 1879, p. 7.

Tetragnatha montana, E. SIMON:—Arachn. de France, Paris, Tom. 1, 1874, p. 157.; W. BÖSENBERG:—Zoologica, Stuttgart, Bd. 14, 1903, p. 58, Taf. 4, Fig. 54.

Locality: Three adult females and two immature males from the vicinity of Shisuka (H. KÔNO, July 26, 1932).

The measurements (in centimeters) are as follows:—

	total length	abdomen	leg I	leg II	leg III	leg IV
female (Shisuka)	1.00	0.60	1.90	1.30	0.70	1.15
female (Shisuka)	0.90	0.65	1.60	1.00	0.70	1.15
female (Shisuka)	0.80	0.50	1.40	0.85	0.50	0.90

Distribution: Germany, France, Hungary, Siberia.

24. *Tetragnatha extensa* LINNAEUS

Tetragnatha extensa, R. BREMEN:—Tierwelt Mitteleuropas, Leipzig, Bd. 3, Lief. 2, p. 118, Taf. 25, Fig. 1332.; T. THORELL:—Oefver. af K. Vet.-Akad. Förh. Bd. 17, 1858, p. 174.; J. BLACKWALL:—Spid. Gr. Brit. & Ir., 1864, p. 337, pl. 28, fig. 265.; ———:—Ann. Mag. Nat. Hist., Vol. 5, 1870, p. 404.; T. THORELL:—Rem. on Syn., Upsala, 1870–1873, p. 40.; E. SIMON:—Arachn. de France, Paris, Tom. 1, 1874, p. 115.; T. THORELL:—Südrussischer Spinnen, St. Petersburg, 1875, p. 20.; O. HERMAN:—Ungarns Spinnen-Fauna, Budapest, Bd. 3, 1879, p. 46.; L. KOCH:—Arachn. Sibirien Novaja Semlja, Stockholm, 1879, p. 7.; H. LUDWIG:—Tierkunde, Bd. 2, 1886, p. 588.; G. MARX:—Proc. Nat. Mus., Washington, 1889, Vol. 12, p. 552.; J. H. EMERTON:—Common Spiders, London, 1902, p. 201, figs. 462, 466.; W. BÖSENBERG:—Zoologica, Stuttgart, Bd. 14, 1903, p. 59, Taf. 4, 5, Fig. 55.; N. BANKS:—Proc. Nat. Mus., Vol. 25, 1903, p. 215.; ———:—Bull. U. S. Nat. Mus., Vol. 72, 1910, p. 37.; A. PETRUNKEVITCH:—Bull. Amer. Mus. Nat. Hist., Vol. 29, 1911, p. 390.; J. H. COMSTOCK:—Spider Book, New York, 1913, p. 411.; C. R. CROSBY and S. C. BISHOP:—Memoir Cornell Univ. Agr. Exper. Station, 1926, p. 1057.; M. L. PEELLE and S. SAITO:—Jour. Faculty Science Hokkaido Imper. Univ., 6ser., Vol. 2, 1932, p. 95, fig. 8.

Aranea extensa, J. C. FABRICIUS:—Ent. Sys., Tom. 2, 1793, p. 407.

Locality: An adult male from Kashiho (H. KÔNO, Aug. 3, 1932).

The measurements (in centimeters) are as follows:—total length 0.80, abdomen 0.50, leg I 1.80, leg II 1.40, leg III 0.70, leg IV 1.50.

Distribution: Tropical, temperate and subarctic countries; Europe, Siberia, U.S.A., Canada, Alaska.

Family *LYCOSIDAE*

Genus *Trochosa* C. L. KOCH, 1846

25. *Trochosa terricola* THORELL

(Fig. 10)

Trochosa terricola, O. HERMAN:—Ungarns Spinnen-Fauna, Budapest, 1879, p. 279.; C. CHYZER et L. KULCZYNSKI:—Araneae Hungariae, Budapest, 1892, p. 73, Taf. 3, fig. 6.; W. BÖSEN-

BERG:—Zoologica, Stuttgart, Bd. 14, 1903, p. 399, Taf. 37, Fig. 587.; R. BREMEN:—Tierwelt Mitteleuropas, Leipzig, Bd. 3, Lief. 2, p. 130, Taf. 27, Figs. 1466, 1469.

Lycosa terricola, T. THORELL:—Rem. on Syn., Upsala, 1870–1873, p. 339.

Lycosa agretyca, J. BLACKWALL:—Spid. Gr. Brit. & Ir., 1864, p. 17, pl. 1, fig. 2.

Locality: Two females from Shiretori (M. YOSHIKURA, 1933), Kiton (H. HÔNO, July 18, 1932).

The measurements (in centimeters) are as follows:—

	total length	abdomen	leg I	leg II	leg III	leg IV
female (Shiretori)	1.00	0.70	1.00	0.80	0.90	1.20
female (Kiton)	0.90	0.60	1.30	1.00	1.00	1.20

Distribution: Germany, Hungary.

Genus ***Lycosa*** LATREILLE, 1804

26. ***Lycosa T-insignita*** Bös. et STRAND

Lycosa T-insignita, W. BÖSENBERG u. E. STRAND:—Japanische Spinnen, Stuttgart, 1905, p. 324, Taf. 8, Fig. 109, Taf. 13, Figg. 337, 344.; S. SAITO:—Trans. Sapporo Nat. Hist., Vol. 11, 1930, p. 149.; ———:—Annot. Zool. Jap., Vol. 13, 1932, p. 385.

Locality: Two females from Shiretori (M. YOSHIKURA, 1933).

The measurements (in centimeters) are as follows:—

	total length	abdomen	leg I	leg II	leg III	leg IV
female (Shiretori)	0.80	0.50	1.10	1.20	1.10	1.50
female (Shiretori)	0.70	0.50	1.15	1.10	1.00	1.40

Distribution: Japan (Kyushu, Honshu, Hokkaido).

27. ***Lycosa Doenitzi*** Bös. et STRAND

Lycosa Doenitzi, W. BÖSENBERG u. E. STRAND:—Japanische Spinnen, Stuttgart, 1905, p. 325, Taf, 13, Fig. 345.

Locality: Three females from Shiretori (M. YOSHIKURA, 1933).

The measurements (in centimeters) are as follows:—

	total length	abdomen	leg I	leg II	leg III	leg IV
female (Shiretori)	0.70	0.40	1.10	1.00	0.70	1.30
female (Shiretori)	0.70	0.50	0.90	0.80	0.70	1.10
female (Shiretori)	0.80	0.50	1.10	1.00	0.80	1.20

Distribution: Japan (Kyushu).

Zoological Institute, Agricultural Faculty,
Hokkaido Imperial University, Sapporo, Japan.

SOBOLIPHYME SAHALINENSE, N. SP., (NEMATODES) FROM MARTES ZIBELLINA SAHALINENSIS OGNEV

BY

KYOJIRO SHIMAKURA AND KOICHI ODAJIMA

(島倉亨次郎 • 小田島幸一)

(With two text-figures and plate X)

The genus *Soboliphyme* was established in 1930 by PETROW on the basis of an ample collection of material from Kamchatka and Siberia. This genus, including the single species *Soboliphyme baturini* PETROW, 1930, has been the sole representative of the family Soboliphymidae PETROW, 1930, which was ranked together with the family Dioctophymidae under the suborder Dioctophymeata SKRJABIN, 1927. Later the definition of the suborder Dioctophymeata and also that of the family Soboliphymidae were emended by RAUTHER (1930), who then renamed the former the suborder Dioctophymoidea[1] RAUTHER, 1930, to rank it together with the suborder Trichuroidea under the first order Hologonia RAUTHER, 1930, of the class Nematodes.

The writers have recently obtained three mature individuals, two males and one female, of a nematode probably belonging to the genus *Soboliphyme*, but with peculiarities possibly characterizing a new species, which they wish to designate under the name of *Soboliphyme sahalinense*, n. sp.

Occurrence

Two of the specimens, a couple of male and female, were found in the stomach of a female Saghalien sable, *Martes zibellina sahalinensis* OGNEV, 1925, captured about a month before she was beaten to death by an accident. About thirty-four hours after her death the sable was dissected by one (ODAJIMA) of the writers on March 15, 1932. With more or less compact physique the sable, about four years old, was in well nourished condition and possessed a fur of superior quality; she always had a good appetite for her food, except for the first two days after the capture. When her abdominal cavity was dissected,

1) In remembrance of, perhaps, the superfamily Dioctophymoidea RAILLIET, 1916.

the stomach was found moderately dilated with no unusual appearances externally. It was filled with pieces of horse-flesh masticated shortly before and the stomach mucous membrane appeared more or less congested and catarrhal due probably to the cause of her death. The male nematode was found attached with its large acetabular buccal capsule to the mucous membrane of the minor curvature and the female individual also, a little nearer to the pyloric part. The nematodes together with the stomach contents were carefully removed and three small rounded slight ulcerations were observed where apparently the nematodes adhered to on the mucous membrane. However, hardly any trace of the occurrence of bleeding could be seen here. The two nematodes lived about fifty-two hours in artificial gastric juice in a glass vessel kept at room temperature. Attached to the wall of the vessel with their buccal capsule, which then seemed to contract more or less, they were actively moving at even as low a temperature as 15°C. and especially the male was often observed to approach the body of the female with its copulatory bursa.

Besides the above mentioned female sable two males and four females were beaten to death at the same time and dissected; however, no *Soboliphyme* nematodes were obtained from these.

The third male nematode was obtained from another female Saghalien sable that had been captured about fourteen months before she was worried to death by her mate. The

Fig. 1. *Soboliphyme sahalinense*, n. sp., male (left) and female; preserved in 75 p. c. alcohol and photographed by reflected light; × 4. The body of the male was fixed twisted around its longitudinal axis through an angle of about 80°, and that of the female about 100°. Two brown spots are found on the cuticle of the male, one at the *niveau* of about 2/7 the entire body length from its anterior end and the other in the middle region (cf. Fig. 1, Pl. X); now they seem to be impossible of easy removal.

sable, about three years old, having good physique, and being in well nourished condition, was dissected on November 2, 1932, about seventy-one hours after her death. The nematode was found still alive in the coagulated cow's milk within her stomach, detached already from the fundus wall where it had evidently adhered until not very long before; two slight ulcerations were observed on the mucous membrane similar to those in the first animal. Regrettably this third specimen was deformed and partly broken by an accident during transportation from one (ODAJIMA) of the writers to the other. The measurements have, therefore, been executed on the former two intact specimens (preserved in lactophenol) and the third male specimen, though incomplete and not well fixed, has been cut into serial sections for anatomical examination.

Description of *Soboliphyme sahalinense*, n. sp.

This medium sized nematode, cylindrical in shape and slightly attenuated anteriorly and a little more posteriorly, is semitransparent and almost colourless in its living condition, except for the wall of the anterior greater half of the male's mid-gut, which is deeply bluish green, and the mass of eggs, which is dull orange, in the uterus of the female; when fixed with alcohol, the muscular tissues especially become white and semiopaque (Text-fig. 1; Figs, 2, 3, 5, Pl. X). The cuticle is thin, transparent, and coarsely striated transversely (except on the surface of the buccal capsule, see below), without spines or elevations. The musculature of the body wall is typically polymyerial. Excretory organs are absent. The anterior end of the body is developed into a large thick-walled buccal capsule turned anteroventrad, whose wall is more developed dorsally than ventrally (Text-fig. 1; Fig. 1, Pl. X). The outer cuticle of the buccal capsule is minutely striated meridionally (Fig. 2) and provided with no spines. Surrounding the oral opening six small cone-shaped papillae are present, dorsolateral, lateral, and ventrolateral in position on each side (Fig. 2) arranged in a circle. The wall of the buccal capsule, which apparently serves as an acetabulum, is richly furnished with radial muscles (Text-fig. 2), these viewed from the end sometimes giving a false appearance of the "brickwork-like" cuticle. The inner surface of the capsule is generally smooth. The anterior tip of the oesophagus is visible as a relatively small rounded slight elevation surrounded by a circular groove at the bottom of the buccal capsule (Fig. 3). An equilateral triangle inscribed in the circle forms the oesophageal opening, one of its apices lying medioventral. Each side of the triangle is often slightly protruded inward at its center and here opens, as a small V-shaped slit with its apex turned inward (Fig. 3), the duct of the corresponding sectoral

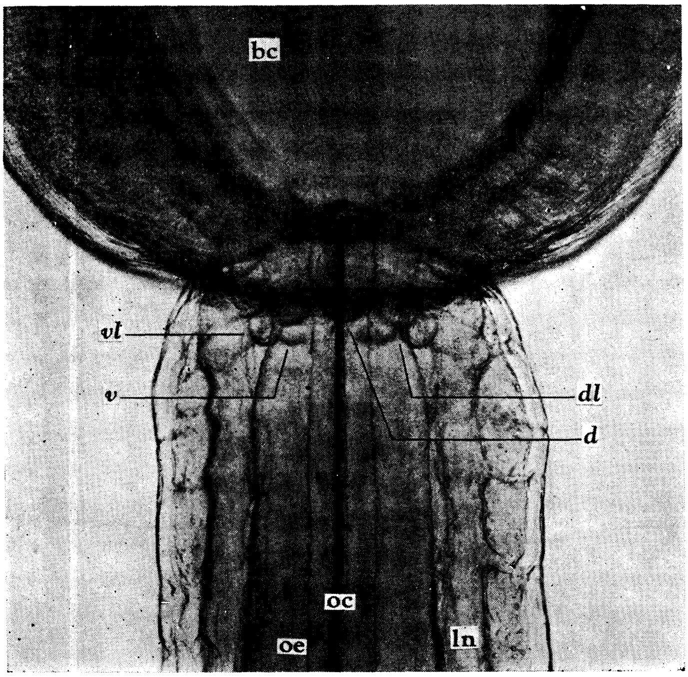

Fig. 2. Cervical region of the female, in slightly oblique dorsal view; cleared in lactophenol and photographed by reflected light; × 36. **bc**, buccal capsule; ***d***, dorsal cervical sac; ***dl***, dorsolateral c. s.; **ln**, lateral longitudinal nerve trunk; **oc**, triradiate oesophageal cavity; **oe**, oesophagus; ***v***, ventral *cervical sac*; ***vl***, ventrolateral c. s.

group of the oesophageal glands (cf. p. 345). The circumoesophageal nerve ring is situated near the anterior end of the oesophagus and just beneath the bottom of the buccal capsule. From the nerve ring arise the ventral main and a pair of lateral longitudinal nerve trunks, the latter (Text-fig. 2) supplying nerve fibers to the corresponding series of sensory papillae (Text-fig. 2; Figs. 6, 7, Pl. X), which constitute lateral lines along the entire body length. About forty-one papillae are found in each lateral line and they are more densely arranged in the anterior and posterior terminal portions, excepting the buccal capsule where only a single very small papilla is found. The dorsal longitudinal nerve trunk seems to faint out anteriorly not attaining to the nerve ring. Immediately posterior to and in close contact with the nerve ring there are seven spheroid bodies (as observed superficially) of at least two distinct grades in size, arranged in a circle surrounding the oesophagus (Text-fig. 2). One is mediodorsal in position, two dorsolateral (one on each side), and another two ventrolateral, these five being more or less equal in size and relatively large. The remaining two, which are smaller, lie one on each side of the anterior end of the ventral nerve trunk. The oesophagus is slightly constricted where it is surrounded by these spheroid bodies (Text-fig. 2) and the latter in turn are more or less flattened between he former and the body wall. Examined in sections, these spheroid bodies have proved to be sacs rather thick-walled and containing mucous or "plasma-like" substance. They are unknown in function, however, they may be temporarily referred to as "cervical sacs"[1]. The oesophagus is muscular, relatively thick, long and almost cylindrical in shape, slightly dilated posteriorly, without a bulb, and it has a slight constriction near its anterior end (see above). The well developed oesophageal glands are distributed in three sectors partitioned by the triradiate oesophageal cavity, each comprizing a number of syncytial, polynucleated glandular portions provided with a central canal. The mid-gut is straight, thin-walled, and flattened without constrictions (Fig. 1). The hind-gut is more or less thick-walled with muscle fibers, rather long in the male, while shorter and distally flattened dorsoventrally in the female (Figs. 6, 7, Pl. X). The alimentary canal is suspended by mesenteries and some transverse muscular bands to the lateral body walls. The anus of the female opens subterminally on the ventral surface as a transverse slit (Fig. 8, Pl. X), whose posterior lip is thick and more or less protruded ventrally (Fig. 7). The caudal end of the female is rather more pointed than rounded off (Text-fig. 1; Figs. 1, 6, 7). The gonad is single for both sexes and hologonial. The testis is a thick tubule running anteriad with deep alternating one-sided constrictions or windings (Fig. 1). The vas deferens (Fig. 1) is coiled and convoluted back and forth several times, but as a whole runs posteriad. The ejaculatory duct is long and thick-walled with longitudinal external and circular internal muscle layers, its lumen being lined with two or three cell layered glandular epithelium; it runs straight posteriad (Fig. 1), except for a loop in its distal portion. The caudal end of the male, where the cloaca opens, is surrounded by a large muscular modified bell-shaped copulatory bursa, whose margin is more or less trapezoidal in face view (cf. Fig. 5), turned posteroventrad (Text-fig. 1; Figs. 1, 5), without rays. The bursal wall is more developed dorsally than ventrally and its internal surface is provided with a pair of ridge-like lateral longitudinal thickenings (Fig. 5) running parallel to and opposite the lateral lines (cf. p. 344) on the external surface. The spicule (Fig. 5) is single, setiform, and canaliculated. No gubernaculum. The vulva (Fig. 1) of the female is situated medioventrally at the *niveau* of about 2/5 the length of the

1) Whether or not these are comparable to the "cervical sacs" of Gnathostomidae (cf. RAUTHER, 1930, p. (4) 270) is also a question at present.

oesophagus from the anterior end of the latter. The vagina is relatively long, thick-walled tubular, and slightly winding (Fig. 1). The single uterus is considerably dilated at its anterior (distal) end and gradually attenuated posteriorly (Fig. 1); it is filled with eggs (Fig. 4), the mass of which is dull orange in colour. The ovarium is a very long tubule, gradually thickened distally, running forth and back through the body cavity with involved coilings and windings (Text-fig. 1; Fig. 1)

Deposited eggs were collected by one (ODAJIMA) of the writers, but the preparation of them was very regrettably lost prior to closer observation. An egg in the uterus or the vagina appears almost colourless under the magnification of 100 times or more. It is thick-shelled and, in shape, a prolate spheroid with peculiar plug-like modifications at both poles; the outer surface of the shell appears almost smooth when observed through the walls of the body and of the uterus or the vagina.

The male measures 28.60 mm. in length (L) and 1.511 mm. in maximum diameter of the body (D) in its middle region; the diameter of the body in the neighbourhood[1] of the base of the buccal capsule is 1.222 mm. and in the neighbourhood of the base of the bursa 1.111 mm. The diameter of the oral opening is 1.156 mm., the maximum external diameter of the buccal capsule (C) is 2.600 mm., and the depth of the capsule along its axis is 1.556 mm. The oesophagus is 4.889 mm. in length and 0.822 mm. in maximum diameter at the *niveau* of about 1/3 its length from its posterior end. The maximum external diameters of the copulatory bursa are 2.133 mm. transversely (Bt) and 2.489 mm. dorsoventrally (Bd); its maximum depth is 1.156 mm. The spicule is 4.556 mm. in length, 0.0852 mm. in the greatest diameter at its proximal end, and 0.0355 mm. in its middle region.

The female measures 34.63 mm. in length (L) and 1.746 mm. in maximum diameter of the body (D) in its middle region; the body diameter in the neighbourhood[1] of the base of the buccal capsule is 1.400 mm., at the *niveau* of the vulva 1.378 mm., and at the *niveau* of the anus 0.678 mm. The diameter of the oral opening is 1.489 mm., the maximum external diameter of the buccal capsule (C) is 3.000 mm., and the depth of the capsule along its axis is 1.667 mm. The oesophagus is 6.000 mm. in length and 0.889 mm. in maximum diameter in its posterior portion corresponding to about 1/3 of its entire length. The vulva is situated 3.933 mm. distant along the body axis from the anterior end (oral opening) of the nematode. The average external diameter of the vagina,

1) At the base of the buccal capsule there is a constriction (Text-figs. 1, 2; Fig. 1), where the body diameter is 1.089 mm. in the male and 1.045 mm. in the female.

in its middle region, is 0.311 mm. The anus is situated 0.573 mm. distant along the body axis from the caudal end.

The eggs in the uterus measure roundly 0.09048 mm. in length and 0.04126 mm. in maximum diameter.

Systematic Considerations

The characteristics of the nematode described in the preceding section conform to those of the order Hologonia RAUTHER, 1930, the suborder Dioctophymoidea RAUTHER, 1930, and the family Dioctophymidae PETROW, 1930, emended by RAUTHER (1930). They are also in general conformity to the characteristics of the genus *Soboliphyme* PETROW, 1930, except that the caudal end of the female is rather more pointed than rounded off and that numerous minute depressions are not traceable with certainty on the surfaces of the eggs in the uterus or the vagina. However, these two points of discrimination, of which one, in reality, may be a matter of very slight distinction and the other not quite certain at present, can hardly justify establishing a separate new genus to include the nematode in question. The writers may thus probably be allowed to consider the new nematode as another representative of the genus *Soboliphyme* and incidentally to modify slightly the definition of the genus in respect to the points in question, as will be later stated (p. 349).

The new nematode differs, on the other hand, from *Soboliphyme baturini* PETROW, 1930, in the following points.

(1) It is obviously larger, but relatively more slender. The male individual (cf. p. 343) is 2.2396–1.6677 times as long as the male of *Soboliphyme baturini* and the female individual 2,0613–1.8131 times as long as the female of *Soboliphyme baturini*. The value of the ratio L/D[1] is 18.928 for the male and 19.834 for the female in the case of the new nematode, while it is 11.963–12.098[2] for the male and 13.151–12.840[2] for the female in the case of *Soboliphyme baturini*.

(2) The copulatory bursa of the new nematode seems to be relatively larger than that of *Soboliphyme baturini*. The ratio B/D[1] is 0.8525–0.8642[2] for the latter, while Bt/D is 1.4117 and Bd/D 1.6473 for the former. The ratio B/L is 0.071260–0.071430[2] for *Soboliphyme baturini*, while Bt/L is 0.074580 and Bd/L 0.087026 for the new nematode.

1) As to the meanings of the symbols, L, D, B, etc., cf. p. 346.

2) The smallest and the largest body lengths (of more than 100 individuals) have been compared respectively with the smallest and the largest maximum diameters of the body, utilizing the data given by PETROW (1930); the same applies to similar treatment of figures in various other cases.

(3) The caudal end of the female is more or less rounded off in *Soboliphyme baturini*, while it is rather pointed in the new nematode.

(4) The egg-shell surface is provided with numerous minute depressions in *Soboliphyme baturini*, but possibly not in the new nematode.

(5) The "papillae" surrounding the anterior end of the oesophagus of *Soboliphyme baturini* may be, in all probability, identified with the "cervical sacs" described in the present paper (p. 345); then their numbers, reported to be six for the former and seven for the latter, are in striking discrepancy with each other.

On these accounts the new nematode should probably be regarded as constituting a new species, which the present writers wish to call *Soboliphyme sahalinense*, n. sp.

The vulval opening of *Soboliphyme baturini* has been recorded by PETROW (1930) to lie 0.4915–0.6475 mm. distant "vom Kopfende," but these figures seem hardly reasonable to the present writers, taking into account all the possibilities which may arise from his rather ambiguous expression. PETROW'S Fig. 2 clearly shows, on the contrary, that the opening is situated at the *niveau* of about 2/5 the length of the oesophagus from the anterior end of the latter, a condition entirely similar to the case of *Soboliphyme sahalinense*, n. sp. (cf. pp. 345 and 346).

RAUTHER (1930), who ranked the family Soboliphymidae PETROW, 1930, emended by RAUTHER (1930), which included at that time the single genus and species *Soboliphyme baturini* PETROW, 1930, under the suborder Dioctophymoidea RAUTHER, 1930, must probably have ascertained the presence of "6, 12, or 18 papillae in one or two circles" surrounding the oral opening of *Soboliphyme baturini*. PETROW did not note such papillae in his original paper (1930), though he described the presence of six "papillae" (see above) surrouding the anterior end of the oesophagus, accordingly present in the body cavity and not to be confounded with the "papillae" under consideration. Though small and rather inconspicuous (Fig. 2), six papillae are present in one circle surrouding the oral opening of *Soboliphyme sahalinense*, n. sp.

Meridional striations (cf. p. 343) are present in the outer cutilcle of the buccal capsule of *Soboliphyme sahalinense*, n. sp., and similar striations (possibly more numerous and minute) are very clearly traceable in PETROW'S Fig. 3, though, notwithstanding that, he says in his text, "Oberfläche der Mundkapsel mit einer dichten, feinen, ziegelartig gebauten Kutikula überzogen." The writers found that the optical transverse sections of the radial muscles constituting the wall of the buccal capsule appear brickwork-like (p. 343). The wall of the buccal capsule is more developed dorsally than ventrally in *Soboliphyme sahalinense*

(p. 343) and such appears also to be traceable, though it may be less in degree, in PETROW's Figs. 1 and 2 of *Soboliphyme baturini.*

By reason of all the above facts and considerations an emended definition of the genus *Soboliphyme* may be stated as follows.

Genus ***Soboliphyme*** PETROW, 1930.

Definition. A representative of the family Soboliphymidae PETROW, 1930, emended by RAUTHER (1930): anterior end of the body developed into a large buccal capsule, more or less turned anteroventrad, and its wall more developed dorsally than ventrally; the cuticle of the capsule minutely striated meridionally, without spines; (at least) a circle of six small papillae surrounding the oral opening; cuticle of the body (excepting the buccal capsule) coarsely striated transversely, without spines or elevations; (in some at least) a pair of lateral lines of sensory papillae present. Oesophagus cylindrical, slightly dilated posteriorly, without a bulb; a circle of six or seven cervical sacs is found immediately posterior to the nerve ring, which is situated near the anterior end of the oesophagus. Male: caudal end, where cloaca opens, is surrounded by a large muscular modified bell-shaped copulatory bursa turned posteroventrad; bursal wall more developed dorsally than ventrally, without rays, but with a pair of ridge-like lateral thickenings on its internal surface. Spicule long and setiform. Gubernaculum absent. Female: vulva in the oesophageal region; caudal end more or less rounded off or sometimes rather pointed; anus subterminal, on the ventral surface. Egg: thick-shelled and, in shape, a prolate spheroid with plug-like modifications at both poles and with (or without) minute depressions on its external surface except the poles.

Adult: parasite in the alimentary canals of carnivorous mammals.

Type species: *Soboliphyme baturini* PETROW, 1930.

At present including two species, *Soboliphyme baturini* PETROW, 1930, and *Soboliphyme sahalinense*, n. sp., the former distributed in Kamchatka and Siberia and the latter in Saghalien.

Key to the Determination of Species.

The ratio L/D (cf. p. 347) is approximately
12 for the male and 13 for the female .... *Soboliphyme baturini.*
The ratio L/D is approximately
19 for the male and 20 for the female .... *Soboliphyme sahalinense.*

The writers wish here to express their sincere gratitude to Prof. TETSUO

INUKAI for his kind help and encouragement during the course of the present work. Acknowledgements are also due to Prof. TOICHI UCHIDA for helpful guidance of the writers in the way of systematics.

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Explanation of Plate X

Fig. 1. *Soboliphyme sahalinense*, n. sp., male (left) and female; cleared in lactophenol and photographed by transmitted light; ×5.4. The body of the male is twisted around its longitudinal axis through an angle of about 40° and that of the female about 100°; **e**, the circular muscle layer of the ejaculatory duct; **g**, mid-gut; **oe**, oesophagus; **ov**, ovarium; **t**, testis; **u**, uterus; **v**, vulva; **vd**, vas deferens; **vg**, vagina.

Fig. 2. Buccal capsule of the female in slightly oblique face view; preserved in alcohol and photographed by reflected light; ×24. The arrows show the positions of the six papillae arranged in one circle surrounding the oral opening.

Fig. 3. Ditto, showing oesophageal opening at the bottom.

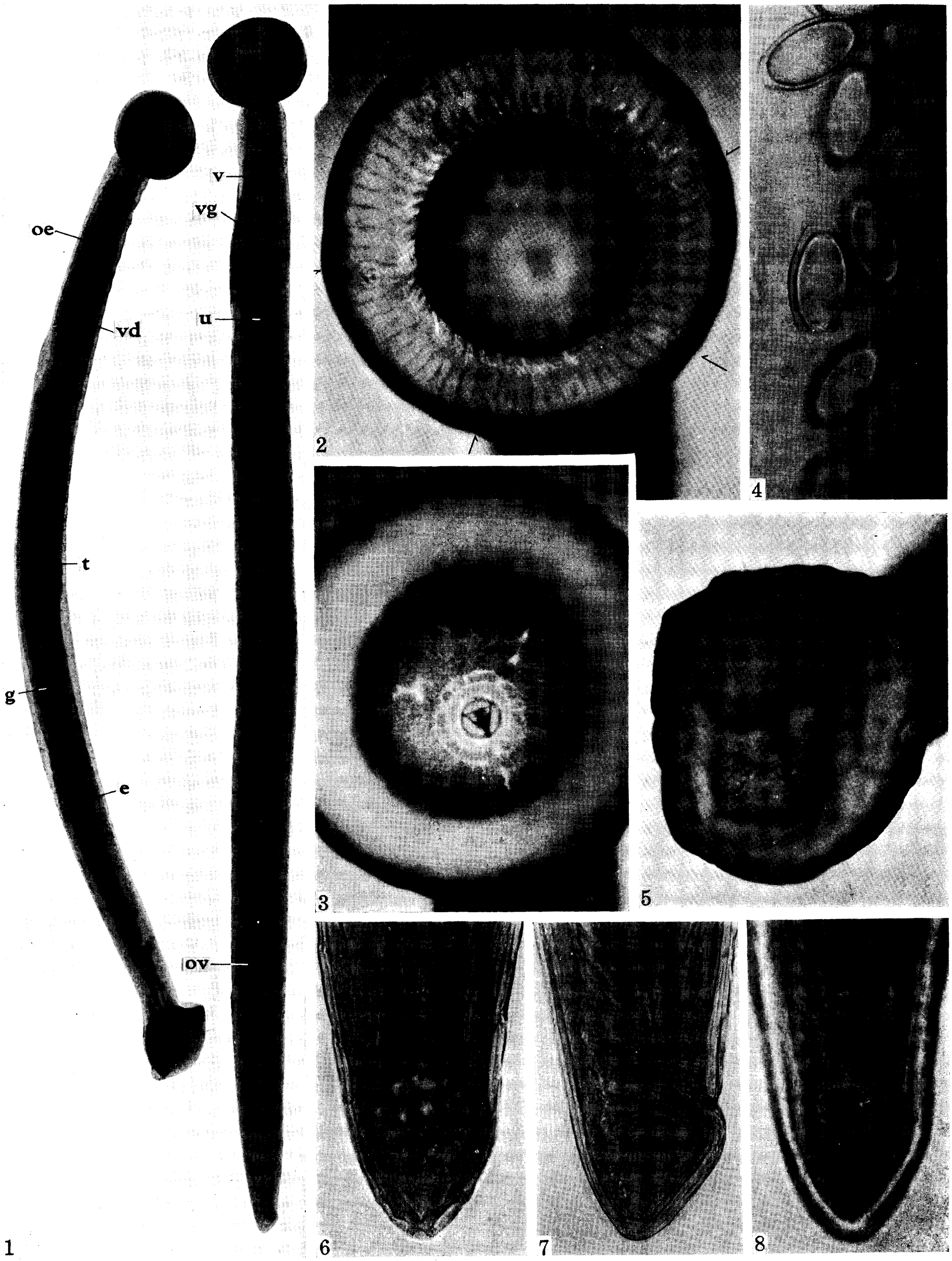
Fig. 4. Eggs in the uterus; cleared in lactophenol and photographed by transmitted light; ×240.

Fig. 5. Copulatory bursa, in oblique posterior view; preserved in alcohol and photographed by reflected light; ×24.

Fig. 6. Posterior extremity of the female, in facial optical section through the lateral lines; cleared in lactophenol and photographed by transmitted light; ×36.

Fig. 7. Ditto, in median longitudinal optical section.

Fig. 8. Ditto, showing anus, in ventral view.



SHIMAKURA and ODAJIMA Photo.

THE CHROMOSOMES OF *HYNOBIUS LEECHII* AND *H. NEBULOSUS*[1]

BY

SAJIRO MAKINO

(牧 野 佐 二 郎)

(With 2 figures in text)

In previous papers (MAKINO, '32; INUKAI and MAKINO, '33) the author dealt with the chromosomes of hynobiid salamanders, making a comparative survey of five species: *Hynobius retardatus*, *H. lichenatus*, *H. tokyoensis*, *H. nigrescens* and *Salamandrella keyserlingii*. Recently the author has had the opportunity to study the chromosomes of two other species, *H. leechii* from Korea and *H. nebulosus* from Tottori and Nagasaki, the results obtained from which are given in the present paper[2].

It is a pleasure to the author to express here his hearty thanks to Professor OGUMA, under whose kind direction the work was carried out. Thanks are also due to Prof. T. INUKAI, through whose kindness the present material was supplied.

Hynobius leechii BOULENGER (Fig. 1)

The present species is the only representative of *Hynobius* living in Korea. The specimens employed in the study were collected in the vicinity of Keijo (Seoul), Korea, in May 1933, by Prof. K. SUZUKI of the Medical College, Keijo University, to whom the author wishes to express his sincere gratitude. They were brought to the laboratory alive and reared with scrupulous care for several months with the purpose of obtaining adequate material for the chromosome study.

The animals were killed at several different times during the interval from May to September. Those obtained in May proved to be favourable for the

1) Contribution No. 66 from the Zoological Institute, Faculty of Science, Hokkaido Imperial University.

The essential points of the present work were reported at the 9th Annual Meeting of the Zoological Society of Japan at Hiroshima, October, 1933.

2) The general method for preparing sections was given in the author's previous paper ('32).

study of the spermatogonial chromosomes, while those in the latter half of July good for the spermatocyte chromosomes. As fixatives, BENDA's mixture and FLEMMING's strong solution without glacial acetic acid were applied, the former being chiefly employed for the preservation of the spermatogonial chromosomes.

As shown in Fig. 1, *a*, the spermatogonium contains fifty-six chromosomes. They arrange in a rosette form as usual in the equatorial plate; the larger ones take their position in the peripheral part of the spindle, surrounding those of smaller size in the central space.

The chromosomes can be classified into two main groups in respect to their shape. The one is a group of large V-shaped chromosomes and consists generally of ten homologous pairs varying in size and form. And they are confined to the periphery of the spindle directing their apices towards the center. The other group is composed of eighteen pairs of rod-shaped chromosomes of rather small size, most of which are scattered in the central space of the spindle, showing a gradatory difference of size. Thus the spermatogonial chromosome reveals a similar feature to that already reported in *H. tokyoensis* and *H. nigrescens* (MAKINO. '32), not only in number but also in morphological structure.

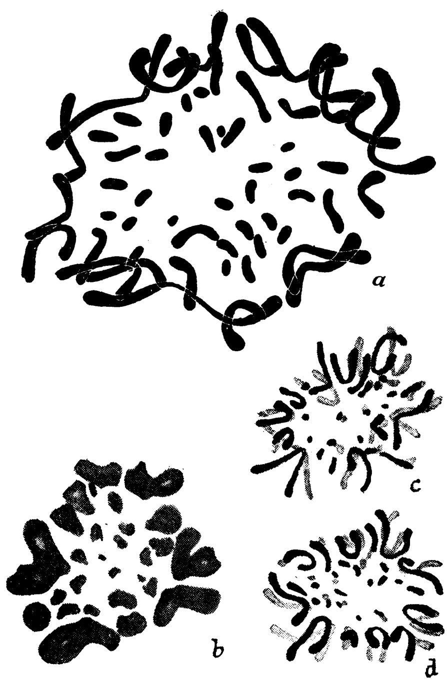


Fig. 1. *Hynobius leechii.* ×2500.
a, spermatogonial metaphase, 56 chromosomes.
b, primary spermatocyte metaphase, 23 tetrads.
c–d, secondary spermatocyte metaphase, 28 dyads; the paler chromosome denoting the identical monad with the deep black one.

As readily expected from the chromosome constitution of the spermatogonium, the metaphase of the primary spermatocyte shows, without any conflict, twenty-eight tetrads, of which ten or eleven larger ones usually take the peripheral position of the spindle, enclosing the remaining smaller ones at the central space (Fig. 1, *b*). They can hardly be divided into mega- and micro-tetrads as was done in *Megalobatrachus* (IRIKI, '32), since they present gradatory change in magnitude. Some larger tetrads disposed at the periphery take the form of a V, of which both arms represent a structure of ring-tetrad. They are probably derived from the large V-shaped chromosomes of the spermatogonium and seem to be of a similar structure to those found in some other urodeles (*Diemyctylus* and *Megalobatrachus*, IRIKI, '32; SATO, '32) and some reptiles (NAKAMURA, '28; MATTHEY '31, '33).

In the equatorial plate of the secondary spermatocyte twenty-eight chromosomes are counted without exception (Fig. 1, *c-d*). As a whole, they consist of ten V-shaped and eighteen long and short rod-shaped dyads, showing a complete half set of spermatogonial chromosomes. They arrange in quite the same way as the latter. Every dyad appears as two identical monads superimposed horizontally on the equatorial plate.

Hynobius nebulosus (SCHLEGEL) (Fig. 2)[1]

Hynobius nebulosus is one of the common species and distributes widely through Honshu to Kyushu. The material for the study were secured in April, 1933 in Tottori (Southwestern Honshu)[2] and Nagasaki (Kyushu).[3] They were sent by mail to the laboratory alive and then the testes were fixed. For preservation of chromosomes FLEMMING's strong solution without glacial acetic acid was applied.

Fig. 2. *Hynobius nebulosus*. ×2500. *a*, *b*, spermatogonial metaphase, 56 chromosomes.

Fig. 2, *a* and *b*, shows the metaphase polar views of the spermatogonia, *a* being drawn from the material obtained from Nagasaki and *b* from Tottori. In both equatorial plates, there are contained fifty-six chromosomes, of which twenty represent V-shape and the remaining thirty-six are rod-shaped, arranged in a fairly rosette form. Most of the chromosomes exhibit longitudinal splits for provision of the ensuing division.

In the number, arrangement and general morphological characters of individual chromosomes, on the whole, one can hardly find any remarkable difference between the present species and *H. tokyoensis*, *H. nigrescens* and *H. leechii*.

1) Identification was done by Mr. I. SATO of Hiroshima University, to whom the author wishes to express his hearty thanks.

2) 3), For collection of the specimens the author is greatly indebted to Messrs. K. KAWADA and D. NAKAMURA.

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(March, 1934)

Zool. Inst. Hokkaido Imp. Univ. Sapporo

ÜBER DEN GASWECHSEL UND WÄRMEREGULATION BEI EINEM KLEINEN SINGVOGEL*

VON

GENTARO GOTO

(後藤源太郎)

Bekanntlich zeigt die Wärmebildung bei den grösseren Vogelarten z. B. Gans, Ente, Huhn usw. wenn man sie auf die Einheit der Körperoberfläche berechnet, fast gleiche Werte wie bei den Säugetieren, während sich dagegen bei den kleineren Vogelarten wesentlich höhere Umsatzzahlen pro Flächeneinheit ergeben. GROEBBELS (1919) war der erste, der mit kleinen Vögeln sich beschäftigt hat, doch hat er nur kurz davon einen Begriff gegeben. Um weiter genaueres darüber zu finden, habe ich einen Versuch ausgeführt, der die Menge des Gaswechsels bei einem kleinen japanischen Vogel, Jûshimatsu (*Uroloncha domestica* FLOWER) bestimmen sollte. Jedoch ist der Grundumsatz, besonders bei einem kleinen Vogel im allgemeinen sehr schwer festzustellen, da dieser sich sowohl im Hungerzustand als auch in der Muskelruhe schwer halten lässt. Zum Glück aber blieben die Vögel in diesem Fall verhältnismässig ruhig, ohne zu fliegen oder zu singen.

Der Respirationsapparat wurde nach demselben Prinzip konstruiert wie derjenige, der von mir (1934) für den Versuch beim Salamander verwendet wurde. Der Hauptteil des Apparats besteht aus einem Atmungskabinett und damit sich verbindenem Ventil, deren Volumina jedes für sich 3340,8 bzw. 39,2 ccm sind. Das Atmungskabinett wird in einen Wasserthermostat versenkt und die Luft des Ventils wird vor und nach dem Experiment mit dem Haldane-Gasanalysenapparat analysiert. Die Versuchszeitdauer betrug meistens 30 Minuten. Das Volumen des Versuchstieres war empirisch als 1,27 × Tiergewicht (g) bestimmt.

Gaswechsel im Ruhezustand. In der Tabelle I werden die Ergebnisse der Experimente gegeben, indem die aus der Gaswechselmenge nach der ZUNTZschen Tabelle über kalorischen Wert berechneten Werte der Wärmeproduktion hinzufügt werden.

* Contribution No. 71 from the Zool. Inst. Fac. Sci. Hokkaido Imp. Univ.

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

Tabelle 1. Gaswechsel und Energieumsatz von Jûshimatsu bei 20,5°C. O_2 Verbrauch und CO_2-Abgabe in ccm, Wärmeproduktion in Kal. pro 24 Stunden.

Geschl.	Gew. (gr.)	Gasmenge pro Tier u. 30 Min.		Gasmenge pro Kg. u. St.		R.Q.	Wärmeproduktion	
		O_2	CO_2	O_2	CO_2		pro Kg.	pro qm.
♂	14.0	65.56	48.75	9365.5	6964.1	0.74	1062	2451
♀	13.4	78.35	52.13	11695.2	7777.7	0.66	1299	2954
♂	13.2	63.93	50.47	9687.1	7647.7	0.79	1113	2517
♂	14.1	80.68	60.51	11444.0	8584.0	0.75	1301	3009
♂	14.6	68.24	61.52	9348.0	8427.0	0.90	1105	2584
durchschn.	13.8	71.35	54.67	10307.9	7880.1	0.77	1176	2703

Also nimmt ein Vogel von 13,8 gr. Körpergewicht in 30 Minuten 71,35 ccm Sauerstoff auf und gibt 54,67 ccm Kohlendioxyd ab. Der so erworbene Wert, umberechnet in Kalorienwert pro Kilogramm und 24 Stunden ergibt sich als 1176. Daraus folgt die Quantität der Energieproduktion pro Quadratmeter Körperoberfläche und 24 Stunden als 2703 Kal.[1)]

Einfluss der Umgebungstemperatur. Wie bekannt, reagierten die Homoiothermen gegen sinkende Aussentemperatur mit ansteigendem Gaswechsel, um die Körpertemperatur konstant zu halten, und zwar wird nach GROEBBELS (1919) diese Regulation bei kleinen Vögeln ausgezeichnet ausgeübt. Die Resultate bei verschiedenen Temperaturen wurden in der Tabelle 2 gegeben und wieder in der Abb. 1 graphisch dargestellt.

Tabelle 2. Einfluss der Aussentemperatur. ♂, 11,5 gr.

Temp. in °C	pro Tier u. 30 Min.		pro Kg. u. St.		R.Q.
	O_2	CO_2	O_2	CO_2	
11.5	57.22	50.49	9951.3	8782.5	0.88
16.0	48.81	43.76	8488.0	7610.0	0.89
20.0	37.03	37.03	6439.3	6439.3	1.00
24.0	34.33	34.33	5971.0	5971.0	1.00
29.0	30.39	37.03	5286.0	6439.3	1.22
35.0	23.56	33.66	4098.0	5854.0	1.43

1) Fur die Berechnung der Oberfläche (O) aus dem Gewicht (g) benutzt man die Formel: $O = K \sqrt[3]{g^2}$. Die Konstante K für den Vogel ist 10,45.

Aus den Zahlen in dieser Tabelle ergeben sich die folgenden Tatsachen: erstens dass der O_2-Verbrauch beim Abstieg der Temperatur bis 11,5°C beträchtlich zunimmt; in dem Temperatur-Intervall von 11,5°C bis 20°C vermindert sich der O_2-Verbrauch um 40 Proz. pro 10°C, indessen von 20°C bis 35°C um 24 Proz. pro 10°C. Es ist daher klar, dass die chemische Wärmeregulation bei niedrigen Aussentemperaturen lebhafter ist. Zweitens ist es bedeutend, dass der respiratorische Quotient mit ansteigender Temperatur auffallend zunimmt, indem er bei 29°C 1,22 ist, während er bei 35°C 1,43 beiträgt.

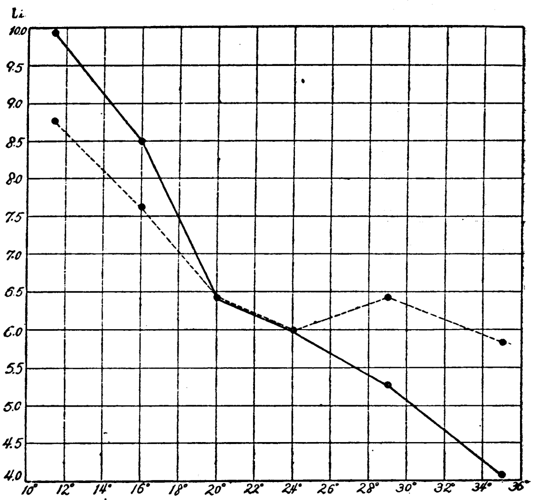

Abb. 1 ——————— Sauerstoff
----------- Kohlendioxyd

Die Körpertemperaturen haben bei kleinen Vögeln besonders grosse Tagesschwankungen, indem sie bei der Ruhe gegen Mitternacht absteigen. Es scheint, dass diese Tagesschwankungen in Zusammenhang mit der Muskelbewegung stehen. Wir können einen sofortigen bedeutenden Abstieg der Körpertemperatur finden, wenn wir diese messen indem wir einen Vogel in der Hand halten. In der Tat sinkt die Körpertemperatur z.B. von 42°C bis 37,7°C in 12 Minuten oder bis 38,5°C in 14 Minuten in Zimmertemperatur von 18,5° C, wie Abb. 2 zeigt.

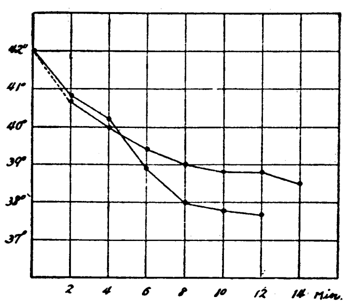

Abb. 2

Schlussbetrachtung. Wie schon von GROEBBELS (1919) gezeigt wird, bilden die kleine Vögel eine Ausnahme von dem RUBNERschen Oberflächengesetz. Eine Hausmaus von 13 gr. produziert 75,4 ccm CO_2 pro Kilogramm und Minute (Loewy 1926), d. i. also ungefähr die Hälfte des von Jûshimatsu produzierten CO_2. Als die Wärmeproduktion für 1 Quadratmeter Körperoberfläche fand VOIT (1901) bei Gans 967 Kal. und bei Huhn 943 Kal., während HÁRI (1917, 1918) bei Gans 682–1038 Kal. und bei Ente 735–935 Kal. erhielt. So ist die von diesen Vögeln produzierten Wärmemenge auf jeden Fall kleiner als die Hälfte der Kalorien von Jûshimatsu. In dieser Beziehung stimmen die von

GROEBBELS gegeben Werte für Buchfink und Kanalienvogel mit meinem Fall völlig überein. Die Körpertemperatur von Gans, Huhn und Ente ist 41,3°, bezw. 42,0°C und 42,1°C (KANITZ, 1926), gleicht also der des Jûshimatsu. Was die Atmungsfrequenz betrifft, so zeigt Jûshimatsu 132-186 pro Minute, während sie bei Huhn 24 und Hausente 16 ist (STÜBEL, 1910). Mit Berücksichtigung der in Abb. 1 und 2 gezeigten Tastsache und der Atemfrequenz, können wir schliessen, dass die grosse Wärmeproduktion des Jûshimatsu zum grössten Teil mit der Muskelbewegung oder dem Muskelzittern, in anderen Worten mit der hoch entwickelten chemischen Wärmeregulation zusammenhängt.

Zum Schluss ist es mir eine angenehme Pflicht, Herrn Prof. Dr. INUKAI für die Leitung und Unterstützung dieser Arbeit meinen aufrichtigsten Dank auszusprechen.

(Aus dem Zoologischen Institut
der Universität zu Sapporo)

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ON THE PARASITISM OF HETERODERA SCHACHTII SCHMIDT ON BEANS

BY

KATSUMASA FUJITA AND OSAMU MIURA

(藤田勝正・三浦修)

In Hokkaido, the injury to beans by *Heterodera schachtii* has recently became serious, occurring in the provinces of Oshima, Iburi, Ishikari, Hidaka, Tokachi and Kushiro, prevailing particularly in the southern part of the island. A field survey conducted chiefly by the senior writer for three years from 1931 shows an infested area amounting to more than ten thousand acres.

The affection appears about two months after sowing. Growth of the affected plants is retarded severly, causing the foliage to turn yellow in color and to fall off early. As the result the plants bear only a few flowers, and a few seeds which are smaller in size and inferior in quality to the normal ones. In many cases, actually, a smaller yield than the seed sown has been harvested.

The occurrence of the nematode in Japan was first recorded by HORI (4) in 1915 who reported an attack on soy bean at Shirakawa, Iwaki Prov., referring the causal nematode to a species closely related to *Heterodera schachtii* according to the identification of S. UCHIDA. Since then, the occurrence of the same kinds of worm has been reported from Echigo Prov. by ISHIKAWA (5), from Hitachi Prov. by TANAKA (10), and from Hokkaido by Katsufuji (7) causing "yellow dwarf" disease which is named after the characteristic symptom of yellowish discoloration of the plant injured. Last year the nematode was found on the roots of soy bean in the provinces of Rikuchu and Mutsu in northern parts of Honshu by Messers KAGEYAMA and TERUI. Detailed symptoms, the geographical distribution, the host plants and the morphology of the nematode together with the remedial measures have been described by ITO (6).

However, in Europe a large number of plants have already been reported as susceptible to the attack of *Heterodera schachtii.* According to GOODEY (3) 92 species of plants in 62 genera covering 21 families have been attacked. Among them, 13 species of legumes are included. The occurrence of biologic strains, in connection with the parasitism, as expected naturally in such cases, has been noted by LIEBSCHER (8), VOIGT (11), GOFFART (1, 2), SCHMIDT (9), etc. Up to present, the following four strains have been studied tolerably in detail, namely: beet strain parasitic on chenopods and crucifers, oat strain on cereals, potato strain on potato and pea strain on legumes. As each strain differs not only in the parasitism but also in the morphological characters to some extent, some of them have been sometimes considered even as a distinct species or variety or subspecies of *Heterodera schachtii*. GOODEY (3) summarized the outstanding investigations along this line up to 1933.

As to the parasitism of the nematode under question only a few facts have been known. KATSUFUJI (7) and ITO (6) reported that adzuki bean and kidney bean as well as soy bean are attacked by the nematode while some other investigators thought soy bean to be the only host plant. In the course of the field survey, the writers have paid special attention to learn the range of the host plants but have not yet found any beyond the above three kinds of bean. It is however very important from the economical as well as the scientific standpoint of view to ascertain experimentally the range of the host plants.

Under these circumstances, the writers have carried out a series of experiments at the Agricultural Experiment Station of the Hokkaido Government. The results so far obtained will be given as the following.

Experimental results

For the inoculation experiments four kinds of soils were used as follows:

No. 1. Soil naturally infested, taken from a soy bean fieid at Yuni-mura, Iburi Prov.

No. 2. Soil naturally infested, taken from a field of wheat planted with soy bean at Date-machi, Iburi Prove., in 1931.

No. 3. Soil naturally infested, taken from a soy bean field at Date-machi, Iburi Prov., in 1932.

No. 4. Soil inoculated with cysts developed on soy bean roots.

The soils were put into porcelain pots or earthenware cylinders, in which various crops were planted, and kept mostly in the green house, but partly out of doors.

Table 1. Results of inoculation experiments with soy bean nematode

Experiment 1. (June 2—July 13, 1931)

Plant			Formation of cyst	Remarks
English mame	Scientific name	Variety		
Soy bean	*Glycine Max* MERR.	Tsuru-no-ko	+++	This experiment was carried out in the green house, using soil No. 1.
Adzuki bean	*Phaseolus angularis* WIGHT	Kensaki	+	
Sugar beet	*Beta vulgaris* L.	Hon-iku No. 48	—	
Cabbage	*Brassica oleracea* L. var. *capitata* L.	Sapporo-kanran	—	
Pe-tsai	*B. pekingnensis* RUPR.	Matsushima-hakusai	—	
Oat	*Avena sativa* L.	Victory No. 1	—	
Barley	*Hordeum vulgare* L.	Marumi No. 15	—	
Potato	*Solanum tuberosum* L.	Danshaku	—	
Soy bean	*Glycine Max* MERR.	Tsuru-no-ko	++	Soil No. 2 was used.
do	do	Shiro-shoryu	++	
Adzuki bean	*Phaseolus angularis* WIGHT	Maruha	+	
Kidney bean	*Phaseolus vulgaris* L.	Uzura	—	
do	do	Kintoki	—	
Pea	*Pisum sativum* L.	Aka-endo	—	
Radish	*Raphanus sativus* L.	Mino-wase	—	
Spinach	*Spinacea oleracea* L.	Long Standing	—	
Oat	*Avena sativa* L.	Victory No. 1	—	
Barley	*Hordeum vulgare* L.	Sapporo-rokkaku	—	
Pea	*Pisum sativum* L.	Sapporo-ao-tenashi	—	Soil No. 4 was used.
Sugar beet	*Beta vulgaris* L.	Hon-iku No. 48	—	
Kohlrabi	*Brassica oleracea* L. var. *caulorapa* PASQ.	White Vienna	—	
Wheat	*Triticum aestivum* L.	Sapporo-harukomugi	—	
Corn	*Zea mays* L.	Yellow Dent Corn	—	
Potato	*Solanum tuberosum* L.	Danshaku	—	

Experiment 2. (June 8—Aug. 3, 1931)

Soy bean	*Glycine Max* MERR.	Tsuru-no-ko	+	This experiment was carried on outdoors, using soil No. 2.
Pea	*Pisum sativum* L.	Sapporo-ao-tenashi	—	
Sugar beet	*Beta vulgaris* L.	Hon-iku No. 48	—	
Cabbage	*Brassica oleracea* L. var. *capitata* L.	Sapporo-kanran	—	

continued

Plant			Formation of cyst	Remarks
English name	Scientific name	Variety		
Kohlrabi	*Brassica oleracea* L. var. *caulorapa* PASQ.	White Vienna	—	
Oat	*Avena sativa* L.	Victory No. 1	—	
Barley	*Hordeum vulgare* L.	Sapporo-rokkaku	—	
Potato	*Solanum tuberosum* L.	Danshaku	—	

Experiment 3. (Aug. 3—Nov. 9, 1932)

Soy bean	*Glycine Max* MERR.	Tsuru-no-ko	+ + +	This experiment was carried on outdoors using soil No. 3.
Adzuki bean	*Phaseolus angularis* WIGHT	Maruha	+	
Kidney bean	*Ph. vulgaris* L.	Beni-kintoki	+	
Pea	*Pisum sativum* L.	Sapporo-ao-tenashi	—	
Sugar beet	*Beta vulgaris* L.	Hon-iku No. 48	—	
Rape	*Brassica Napus* L.	Kabafuto	—	
Oat	*Avena sativa* L.	Victory No. 1	—	
Potato	*Solanum tuberosum* L.	Danshaku	—	

Experiment 4. (July 30—Oct. 4, 1932)

Soy bean	*Glycine Max* MERR.	Nakate-hadaka	+	This experiment was carried out in the green house, using soil mixed together No. 1, 2 and 3.
do	do	Cha-shoryu	+	
Adzuki bean	*Phaseolus angularis* WIGHT	Wase-maruha	+	
Kidney bean	*Ph. vulgaris* L.	Tenashi-nagauzura	+	
Multiflora bean	*Ph. coccineus* L.	Murasaki-hanamame	+	
Lima bean	*Ph. limensis* MACQ.		—	
Pea	*Pisum sativum* L.	Marrow Fat	—	
Broad bean	*Vicia faba* L.	Otafuku	—	
Common vetch	*V. sativa* L.		—	
Peanut	*Arachis hypogea* L.		—	
Cow pea	*Vigna sinensis* ENDL.	Rokushaku-sasage	—	
Red clover	*Trifolium pratense* L.		—	
	Lupinus albus L.		—	
	Lathyrus tingitanus L.		—	

continued

Experiment 5. (July 31—Sept. 21, 1932)

Soy bean	*Glycine Max* MERR.	Rankoshi	+++	This experiment was carried out in the green house, using soil No. 3.
Pea	*Pisum sativum* L.	Sapporo-ao-tenashi	−	
do	do	Aka-endo	−	
do	do	Small Blue	−	
do	do	Ball Pea	−	
do	do	Best Extra Early	−	
do	do	French Canner	−	
do	do	Alaska	−	
do	do	Marrow Fat	−	

As shown in the above table, the soy bean nematode can infect soy bean, adzuki bean, kidney bean and multifora bean, but can not attack the other legumes, chenopods, solanacees, crucifers, and graminees tested. Among the affected plants, soy bean was most severly attacked, while adzuki bean was always slightly attacked. As for kidney bean and mutiflora bean only a trace of affection was secured. It is evident, therefore, that the soy bean nematode is a distinct strain differing from the strains specialized on beet, oat, and potato. It is also clear that the present nematode differs from pea strain which is parasitic mainly on peas.

In addition to the above experiments the following cross inoculation experiments were performed in order to determine whether cysts developed on soy bean, adzuki bean, and kidney bean as well are really equal in respect to the parasitism. Soils sterilized by steam for forty minutes were inoculated (a) with 200 cysts collected from soy bean; (b) with 100 ycsts collected from adzuki bean; (c) with 20 cysts collected from kidney bean. The inocula were all obtained from living plants in fields at Kotoni (Nov. 4, 1933). The experiments were performed twice in the green house, the first of which was carried out during the period Nov. 4, 1933—March 5, 1934, and the second from March 7 to May 8, 1934. The results of these experiments are shown in the following table.

Table 2. Results of cross inoculation experiments with cysts collected from soy bean, adzuki bean and kidney bean

Soil	Plants					
	Soy bean		Adzuki bean		Kidney bean	
	Exp. 1	Exp. 2	Exp. 1	Exp. 2	Exp. 1	Exp. 2
a	+	+	+	+	−	+
b	+	+	+	+	+	+
c	−	+	+	+	+	+

The above table shows that in Exp. 1 soy bean in soil (c) and kidney bean in soil (a) were not affected, but in Exp. 2 they were affected although only a few cysts were found on soy bean roots in soil (c). Apart from some small discrepancies as above it may be safe to infer that almost no differrence exists among the three kinds of cysts tested, if we remember that the activities of the nematode in question are less in winter, when Exp. 1 was carried out, than in summer. Further investigations are going to be undertaken along this line.

Here the writers would like to express their thanks to Dr. S. ITO for his kindness in enabling us to carry out the investigation and in giving many valuable suggestions.

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A PHYSICAL CONSIDERATION OF THE MECHANISM OF THE CRACKING OF SWEET CHERRIES

BY

EIKICHI SAWADA

(澤　田　英　吉)

(With 5 text-figures)

Introduction

It has long been known that cherries are liable to crack when it is rainy during their harvest time. It is not of rare occurrence that they are injured so severely and extensively that they are abandoned to remain on the tree without being harvested, since their disagreeable appearance, poor taste and increased susceptibility to fungus infection render them almost worthless for sale. Such being the case, it is most natural that some American and Japanese horticulturists [1.2.3.4.] have attempted to determine the conditions which induce the cracking.

The writer has engaged in the study of the present problem since 1928, attacking it from the following points of view.

1. Cause of the cracking of cherries after rainfall.
2. Physical mechanism of the cracking.
3. Susceptibility and resistance of cherry varieties to cracking.

With regard to the first problem the writer has already reported in 1931 [5], that the absorption of water through the stomata of the skin results in increased turgidity of the fruit cells and eventually in the cracking of the fruit.

The next year he published a paper entitled "Butsurigakuteki ni kansatsu shita Mizakura-miware no Kiko" (On the mechanism of the cracking of cherries studied from physical points of view.) and discussed mainly on the second problem.

In the present paper the writer intends to give the outlines of the latter report.

The writer wishes to express his sincere thanks to Prof. Y. Hoshino, under whose direction this investigation was carried out, and Prof. S. Ito, for his valuable critisism and encouragement given during the progress of this study.

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

He wishes also to acknowledge his indebtedness to Prof. U. NAKAYA, who gave helpful guidance concerning the physical problems.

Observation on the Cracking

Before a description of the types of cracking, it seems desirable to describe the morphological aspects of cherry fruit and the terms used in this paper. The cherry fruit can be divided into the following three parts: cavity, body and apex. It has three different sides, namely, ventral, lateral and dorsal. On the ventral side runs a distinct longitudinal line, called the ventral suture. In the middle part of the dorsal side, there is also a longitudinal line called the dorsal suture. Although no more lines can actually be seen the writer assumes, for the convenience of explanation, three other longitudinal lines named as follows: the first line is supposed to pass through the middle part of the lateral side and is called the lateral line, the second on the middle line between the ventral suture and the lateral line and called the V-L line, and the third likewise between the dorsal suture and the lateral line and called the D-L line (Fig. 1).

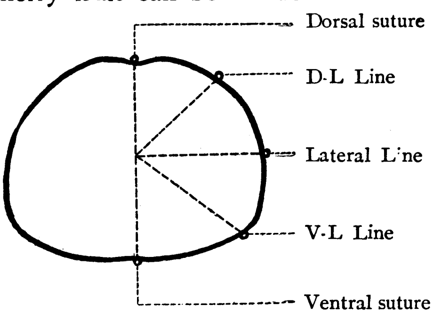

Fig. 1. Cross section of cherry fruit indicating diagrammatically the position of the longitudinal lines including ventral and dorsal suture.

On July 28, 1931, the day after a rainfall, all fruits, without regard to their maturity, were gathered from certain branches of Black Tartarian, Elton and Hokko cherry trees, and classified according to their maturity and types of cracking. The results are summarized in Table 1.

Table 1. The classification of the splits of affected fruits according to the part of fruit.

Variety	Number of fruits Observed	Maturity		Number of affected Fruits	Percentage of affected Fruits	Number of Splits in the 3 parts of fruit							
						Cavity			Body				Apex
						V-L	Lateral	D-L.	Ventral suture	V-L	Lateral	D-L	
Black Tartarian	1255	Unripe	808	65	8	0	43	10	1	38	13	11	0
		Ripe	447	210	47	18	177	82	1	164	43	34	21
Elton	495	Unripe	223	2	1	0	2	0	0	2	0	0	0
		Ripe	272	13	5	0	9	0	0	7	0	1	1
Hokko *	1173	Unripe	542	38	7	0	30	10	3	18	3	4	0
		Ripe	631	146	23	1	133	53	12	90	8	27	1

* This seems to be a variety appeared in Hokkaido as a chance seedling of Elton.

From the data shown in Table 1, it appears that the severity of the injury depends much on the maturity of fruits. However that point will not be discussed here, because it is not significant for the present study. Of the three parts of the fruit, the body as well as the cavity is most generally and severely affected, while the apex is injured only rarely and slightly except in some special varieties. The type of crack occurring in each part of the fruit having characteristic features and moreover having an important connection with the later discussion, it seems desirable to describe the cracks in detail. When the cavity is injured it is usual that a semicircular split occurs, tracing the shoulder part of fruit as shown in Fig. 2. (A). When the split occurs on the body, it is usually parallel to the fruit axis, extending longitudinally through the body

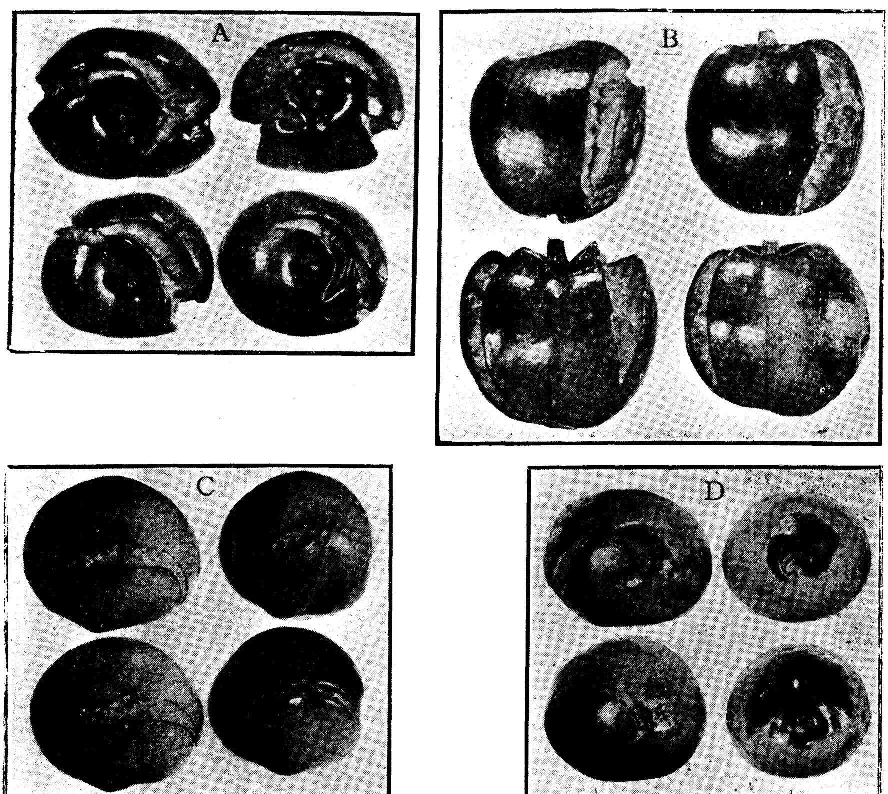

Fig. 2. The most usual type of cracking
(A) in the cavity.
(B) in the body.
(C) and (D) in the apex.

as shown in Fig. 2. (B). In the above two parts, the portion, where a split occurs most frequently, it is almost always confined to a definite side of the fruit. Fore instance, it is the lateral side on the cavity and the V-L line region on the body, as is shown in Table 1. On the other hand, the type of crack on the apex, being variable according to the individual variation of fruit shape as well as to the varietal differences, does not seem to have such a definite tendency as in the above two parts. It appears that there exist at least two types of injury. The first type, which occurs mostly in fruits having a depressed stylar scar, is characterized by a circular or a semicircular split surrounding the scar, as indicated in Fig. 2. (D). In this case, the split occurs with almost equal frequency on all sides of the apex except the ventral. In the second type, the scar is divided into halves by a linear split as shown in Fig. 2. (C). It is very common that this sort of split connects with that of the body. As the split of the body takes place mostly along the V-L line, the split of the apex is also apt to occur on the same side of the apex. However the cracking is not confined to that side only, splits in other directions occuring rather frequently. Thus, in the apex, the crack type is less distinct as compared with that of the body and the cavity.

When the type of crack in each part is examined, taking the curvature of the fruit shape into consideration, splitting occurs, in each part, along the most acute-angled part of fruit. For instance, in the body, as shown in the cross section of the fruit, (Fig. 1.) the peripheral line curves at the V-L line part most acutely, and it is the part where the cracking appears most frequently. This is the reason why the present investigation was undertaken.

Material and Method

Two healthy cherry trees of the variety Bigarreau Jabouley, grown in the Orchard of the Hokkaido Imperial University at Sapporo, were chosen for the study. Fully ripened fruits were gathered from these trees separately and brought into the laboratory. Fruits of uniform size and maturity, were selected and divided into three groups each of twenty fruits. The first and second groups designated as A and B in Table 2, consist of the fruits collected from one of the two trees and third group, C. from the other. Experiments were conducted in parallel with these groups. The weight and dimensions of the materials are presented in Table 2.

Table 2. Weight and dimensions of the materials (var. Bigarreau Jabouley) used for the determination of the curvature.

Group	Average weight of fruit in Gm.	Dimensions of fruits		
		Longitudinal diameter	Suture diameter	Lateral diameter
		mm	mm	mm
A	4.905 ± 0.068	20.1 ± 0.095	17.7 ± 0.072	21.6 ± 0.133
B	4.430 ± 0.039	19.6 ± 0.080	17.1 ± 0.127	21.0 ± 0.121
C	5.905 ± 0.065	21.1 ± 0.134	18.8 ± 0.136	22.4 ± 0.118
Mean	5.080 ± 0.064	20.3 ± 0.076	17.8 ± 0.088	21.7 ± 0.084

The investigation mainly consisted in the determination of the curvature of the fruit. The spherometer was not used in order to avoid the experimental error due to the smallness and softness of the material, which might be great when this apparatus was employed. The determination of the curvature by means of cutting also seemed almost impossible, because both a longisection and a transection from one fruit could not be made owing to the hard stone.

So the writer devised another method. Namely, the vertical view* (Fig. 3) of fruit was used as a substitute for its transection for the reason that the outline of the vertical view is nearly the same as the transection through the largest transverse diameter of the fruit. Actual sectioning was done only in getting longisections. In order to obtain longisections, the fruit was cut first longitudinally along the V-L line and the ventral suture with a Valet-razor blade, and a small spherical wedge was cut out; then the newly cut surface was photographed in such a manner as to show the V-L line as in Fig. 4. (A). Next, the same fruit was cut along the lateral line, then along the D-L line, and finally through the dorsal and ventral suture, and each newly cut surface was photographed successively as shown in Fig. 4. (B, C, D). In photographing, 4 fruits were treated simultaneously in each case, and much care was taken to keep them in their respective position within the square rim.

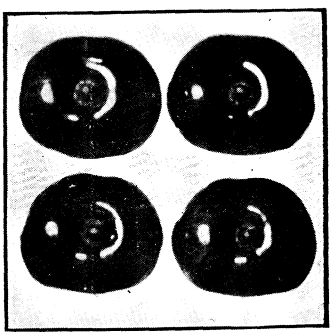

Fig. 3. Vertical view of fruits, which was used as a substitute of the transection of the fruit.

*) The visual angle of the camera to the square rim, in which the fruits were arranged, was adjusted as small as 7°8′. So it may be said that the images are vertical.

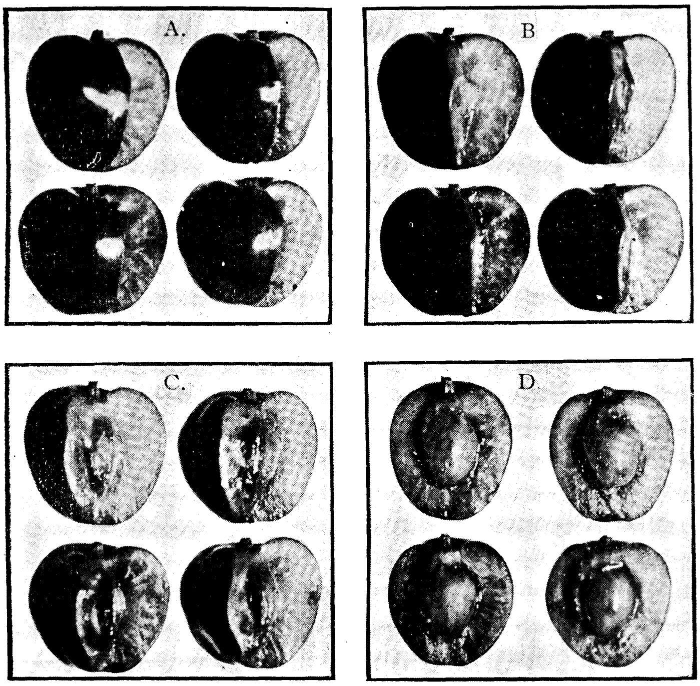

Fig. 4. Longitudinal sections of fruit showing
(A) the V-L line.
(B) the lateral line.
(C) the D-L line.
(D) the ventral and dorsal suture.

After the above photographs were taken, the curvature was determined at five peripheral points by combining the photographs of longi-section with that of the vertical view.

Hereafter, the vertical view of fruits will be referred to as 'transection' for convenience of contrasting with longi-sections.

In order to measure the radius of curvature, the photographs were enlarged 3.85 times (in length) to the natrual size of the fruit. The instruments used were rulers, compasses, needles and a Zeiss magnifying glass with micrometer. Needles were used for drawing lines and points. A micrometer was used for measuring the height of arc and length of the chord.

Let h = height of arc cut as short and equidistantly as possible from the point where the radius of curvature is to be measured.

l = half length of the chord connecting both feet of the arc.

Then the radius of curvature r will be

$$r = \frac{h}{2} + \frac{l^2}{2h}$$

Presentation and Discussion of Results

The measurement of the radius of curvature are presented in Table 3.

Table 3. Length of the radius of curvature of the transverse line and five longitudinal lines measured at their intersecting points. The curvature of those points is shown in the last column by the ratio of the radii in both directions.

Side of Fruit	Group	Radius of Curvature of		Ratio
		Longitudinal Line	Transverse Line	
		mm	mm	
Ventral Suture	A	9.69±0.208	8.75±0.784	1.107
	B	9.82±0.226	8.50±0916	1.155
	C	10 92±0.248	10.39±0.298	1.c51
	Mean	10.14±0.142	9.21±0.468	1.104
V-L Line	A	9.96±0.273	6.54±0.119	1.523
	B	9.12±0.176	6.25±0.107	1.459
	C	10.38±0.239	6.72±0.132	1.545
	Mean	9.82±0.140	6.50±0.070	1 509
Lateral Line	A	10.63±0.277	9.08±0.241	1.171
	B	10.90±0.316	9.07±0.252	1.202
	C	11.29±0.258	9.85±0 300	1.143
	Mean	10.94±0.162	9.33±0.165	1.173
D-L Line	A	10.29±0.275	9.00±0.277	1.143
	B	9.81±0.252	7.99±0.167	1.228
	C	10.83±0 252	9.55±0.271	1.134
	Mean	10.31±0.152	8.85±0.151	1.168
Dorsal Suture	A	10.85±0.284	-21.86±2 316	-0.496
	B	11.34±0.322	-20.39±2.202	-0.556
	C	11.61±0.478	-13.64±1.676	-0.851
	Mean	11.27±0.215	-18.63±1.210	-0.634

In the above table it will be noted that the results are quite in agreement in each group, considering the larger size of the materials of group C. It is also obvious that the radius of curvature of longisections is almost equal in length at five peripheral points, while in the 'transection' it differs according to the point. Moreover, when both radii of curvature of the longisection and of the transection, which mutually bisect each other, are compared, it will be found that the former surpasses the latter in length in each point except the dorsal part. Hence it follows that the curvature, expressed by their ratio, exceeds 1. This means that the body of the cherry is composed of ellipsoidal surfaces whose axes of rotation are directed all alike in the longitudinal direction of the fruit. Another outstanding characteristic of the transection is the negative sign of the radius of curvature at the dorsal part. This is because of the concave surface at that part. But in this investigation this part of fruit was treated as an exception, because there are some evidences to indicate that the cracking would not occur at that part as shown by its anatomical features.

The next problem to be studied, is the relation between curvature and the mechanism of the cracking of the fruit. As the surfaces of the fruit are of ellipsoidal nature, this problem will become more simple, if an ellipsoid, instead of the fruit, is studied in such a relation, assuming the inner pressure of the fruit to be hydrostatic in its nature. However, as far as an ellipsoid in general is concerned, there is no formula which show the relation between the hydrostatic pressure and the tension caused by it. So an attempt was made to apply the solutions in the case of a sphere and a cylinder for ellipsoid, because either a sphere or a cylinder is considered as a special case of ellipsoid, a sphere being formed when the axis of rotation and the transverse axis of an ellipsoid become equal in length, whereas a cylinder is likewise produced when the axis of rotation of an ellipsoid is prolonged infinitely.

Let P_o = Strength of the inner hydrostatic pressure
b = length of the internal radius
d = thickness of the wall

then in the case of a sphere, the tension $\theta\theta$, caused by the inner overpressure, is expressed theoretically by the following formula:

$$\theta\theta = \frac{1}{2} P_o \frac{b}{d}$$

In a sphere, all of its nature being independent of the directions, the strength of the tension remains always constant in all directions. But in the case of a cylinder the relation becomes more complex than in a sphere. The strength of the tension varies according to the directions. From theoretical calculation the maximum strength acts in the direction at right angle to the altitude and its strength ($\theta\theta$) is expressed by the following formula:

$$\theta\,\theta = P_o \frac{b}{d}$$

In this formula the terms other than $\theta\,\theta$ are the same as mentioned before. The tension decreases gradually as the angle between the altitude and the direction of the tension decreases until at last it diminishes to zero when the direction of the tension coincides with that of the altitude. When the above two formulae are compared with each other, it will be soon understood that the transverse tension of the cylinder is stronger than that of the sphere just as much as the cylinder is surpassed by the latter in the tension of longitudinal direction. So, in both sphere and cylinder, the sum of the tensions in both directions is the same. Considering the above relation, it is very likely that in an ellipsoid, which is intermediate between a sphere and a cylinder in its nature, the tension is stronger in the transverse direction than in the longitudinal. Moreover as the shape of an ellipsoid becomes longer, or in other words, as the curvature at a certain point increases, the tension seems to increase in the transverse direction whereas the tension in the longitudinal direction decreases gradually.

As already stated the body of cherry fruit is composed of ellipsoidal surfaces lying longitudinally, and, besides, its curvature is the highest at the V-L line region. Hence the cherry fruit, for the reason described above, should crack longitudinally and especially at the V-L line region. This is actually the case of the cracking of cherries. This seems to indicate that the types of cracking are mainly determined by the curvature of the surface of the fruit. If it is true, it must be applied to the strength of the tension too. When a cherry fruit is cut, while it is fresh, at any part and in any direction with a cutting tool such as a razor, a split wider than the thickness of the blade is formed. This is presumably due to the contraction of the skin. Moreover, the width of the split varies not only according to the part of fruit but also to the direction of the cut even at the same point. So the width of the split was considered reliable as an index of the strength of tension at different parts of fruit, provided that uniformity in the length and depth of the split is secured. The data presented in Table 4 show the distribution of the tension upon the fruit, as measured by the width of split. In obtaining data only one cut was made on each fruit, because the contraction of the whole skin may be affected by cutting at one part, and each figure in the table represents average of twenty-five measurements. The width of each split was measured twice under a low power microscope, immediately after the cutting and fifteen minutes later, since the split is apt to become wider as time elapses. The mean of these two measurements is given to represent the width of each split.

Table 4. The tension of the skin as measured by the width of split artificially made at various parts of the cherry fruit (var Napolon Bigarreau.)

Part of Fruit	Side of Fruit / Width of Split	Ventral Suture	V-L Line	Lateral Line	D-L Line	Dorsal Suture
		μ	μ	μ	μ	μ
Cavity	Longitudinal	70.37±0.29	....	480.74±0.90	....	204.44±0.61
	Transversal	350.37±1.27	....	665.92±1.55	....	378.51±0.98
	Ratio	0.210	....	0.722	....	0.540
Body	Longitudinal	264.07±0.97	740.00±1.82	678.52±1.89	540.74±0.91	291.85±0.89
	Transversal	274.07±0.59	526.67±1.28	568.15±1.09	451.85±0.79	177.78±0.67
	Ratio	0.964	1.405	1.194	1.197	1.642
Apex	Longitudinal	357.78±0.53	....	382.96±0.62	....	395.56±0.64
	Transversal	365 93±0.49	....	414.07±0.54	....	361.48±1.30
	Ratio	0.687	....	0.925	....	1.c94

Now, let us discuss whether the above measured tensions agree with the theoretical induction based on the curvature of the fruit surface. In this connection, the body only will be dealt with, since the curvature was measured only in the body. In the first place, the longitudinal split is witer than the transverse in each point except the ventral part. This may be attributed to the fact that the tension is larger in the transverse direction than in the longitudinal. This is quite in accod with the theoretical expectation and gives a sufficient basis to explain why the body of a cherry fruit cracks longitudinally but not transversely. It is evident from Fig. 5, a graphical presentation of the data in Table 4, that the longitudinal split is the widest at the place of the V-L line. This also offers adequate evidence for the theoretical expectation, and the reason why cherries usually crack at that part is easily understood. Finally, if the strength of the tension on the surface of the fruit is determined primarily by the curvature of the surface, there should exist complete harmony between the curvature and the ratio of longitudinal and transverse tension In reality, there can be found an almost exact ageement between them, when the data given in Tables 3 and 4 are compared with each other, in spite of the varietal difference of the materials. Accordingly it seems that the strength of the tension does correspond decidedly to the curvature of the surface of the fruit.

The mechanism of the cracking of both cavity and apex appears to be identical in principle with that of the body. Since the ratio of width of splits in both directions is less than 1 as shown in Table 4, the cavity seems to be composed of ellipsoidal surfaces lying in the transverse direction. The apex, judging from the fact that its ratio is nearly 1, seems to be nearly like a sphere in its nature. The reason why the cracking in the cavity tends to occur transversely and why the apex fails to show so distinct a tendency in cracking direction, may be explained by these specialities of the curvature of those parts. Another type of cracking in the apex, namely the semicircular splitting, may be accounted for by the same reason as in the case of the cracking of the cavity.

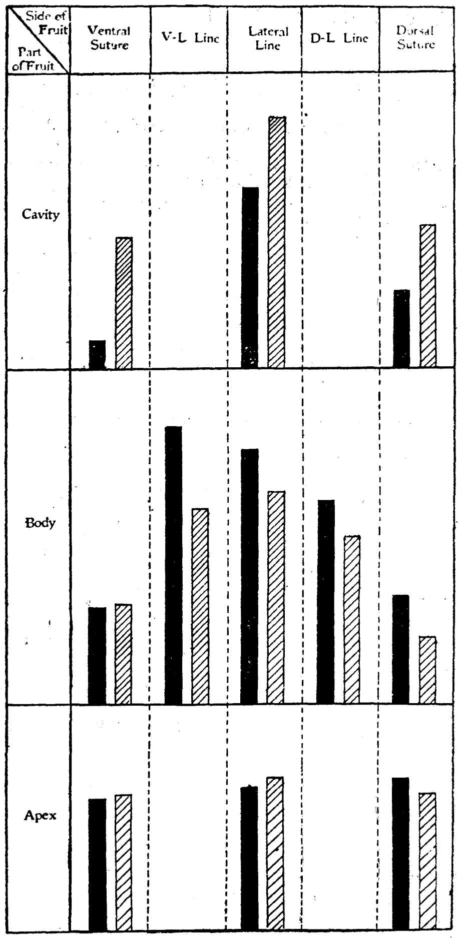

Fig. 5. Diagramatical presentation of the results shown in Table 4.
...... denotes the width of the transversely cut split.
...... denotes the width of the longitudinally cut split.

Though the discussion in this paper was confined to the cracking of cherries, it should not be taken to mean that this sort of injury is restricted to cherries only. There are some other fruits and vegetables that are affected by cracking. Grapes and plums, especially those varieties which produce large fruits, are sometimes injured seriously by cracking. In tomatoes the cracking is of rather usual occurrence in the field, though it does not necessarily injure their quality. On the other hand, cracking is a fatal defect in muskmelons, as they are rendered almost worthless for sale. Cracking can be seen also in root crops such as radishes and carrots. It is also a well known fact that vegetable growers suffer from the bursting of cabbages after rainfall. This can be regarded as one sort of cracking. When the types of cracking of those fruits and crops are observed carefully, it is found that the cracking occurs mostly at the part of high curvature and in the longitudinal direction as in the cracking of cherries. For instance tomatoes crack longitudinelly or transversally, even in the same variety, according to the individual shape of the fruit, and radishes and carrots always crack longitudinally. From these facts, it is evident that the curvature is an important factor in those crops in determination of the types of cracking.

Summary

After a heavy rainfall cherries are affected, sometimes seriously, by cracking. The cracking occurs usually at a difinite part of the fruit and in a definite direction. This investigation was undertaken for the purpose of examining the relation between the curvature of the fruit and the types of cracking. As a result of the measurement of the curvature of the body of the fruit, it was found that the body is composed of ellipsoidal surfaces lying all alike in the longitudinal direction of the fruit. Hence the relation of the curvature to the tension in an ellipsoid under hydrostatic pressure was studied and some deductions were made in regard to the strength and direction of the tension. The theoretical deductions are quite in agreement with the actual nature of the cracking. Moreover, the comparison of the curvature and the strength of the tension within the fruit, as measured by the width of artificial cuts, offered sufficient evidence to indicate that the types of cracking are determined primarily by the curvrture of the fruit surface.

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注　意

本會に對する總ての書信は北海道帝國大學農學部內札幌博物學會に宛て發送せらるべし。

札幌博物學會報原稿募集

下記事項御含みの上御寄稿願上候

1. 第十三卷第四號原稿
2. 昭和九年十月末日〆切
3. 昭和九年十二月發行の豫定
4. 原稿は尨大ならざるもの
5. 歐文は「タイプライテング」のこと
6. 論文には歐文及び和文の題目を記せられ度し
7. 著者の姓名は歐文、和文共に全体を記入せられ度し
8. 歐文には和文、和文には歐文の摘要を附すること
9. 圖版代は著者支辨のこと
10. 編輯の都合により掲載不能のことあるべし
11. 別刷參拾部を會より寄贈す
12. 原稿には左記の記號によりて活字型を定められ度し

キャップ	(CAP)	
スモールキャップ	(SMALL CAP)	
イタリック	(*Italic*)	
ヘビータイプ	(**Heavy type**)	
ヘビーイタリック	(***Heavy Italic***)	
ゲスペルト	(G e s p e r r t)	

人名はスモールキャップ。學名はイタリック。

昭和九年六月十五日印刷
昭和九年六月二十日發行

札幌市北五條西十五丁目三番地
編輯兼發行者　犬　飼　哲　夫

札幌市北一條西七丁目二番地
印刷者　小　原　久　平

札幌市北一條西七丁目二番地
印刷所　小原歐文印刷所

札幌市北海道帝國大學農學部內
發行所　札　幌　博　物　學　會