$2k+1$, but in no case is a finite expression by means of elementary functions obtainable.

The function $\varphi(x, m)$ as well as $f(x, m)$ satisfies the relation

$$D^h_{\alpha=1}\left\{\alpha^{-m+\frac{1}{2}}\varphi(x\sqrt{\alpha}, m)\right\} = \frac{(-1)^h\,\Gamma(m+h)}{\Gamma(m)}\,\varphi(x, m+h),$$

and by means of this rule expansions for $\varphi(x,k)$ and $\varphi\left(x, k+\frac{1}{2}\right)$ may be deduced from the equations

$$\varphi(x,1)=\int_0^\infty \frac{\sin xt}{1+t^2}\,dt = \sum_{h=0}^{h=\infty}\frac{x^{2h+1}}{(2h+1)!}\left(\frac{1}{1}+\frac{1}{2}+\frac{1}{3}+\cdots\frac{1}{2h+1}-C-\log x\right)=$$

$$=\frac{1}{2}\left\{e^{-x}\,Li\,(e^{+x}) - e^{+x}\,Li\,(e^{-x})\right\},$$

and

$$\varphi\left(x, \frac{1}{2}\right)=\int_0^\infty \frac{\sin xt}{\sqrt{1+t^2}}\,dt = \frac{\pi}{2}\sum_{h=0}^{h=\infty}\frac{\left(-\frac{x}{2}\right)^h}{\Gamma\left(\frac{h}{2}+1\right)^2}.$$

Botany. — On "Leptostroma austriacum OUD., *a hitherto unknown Leptostromacea living on the needles of Pinus austriaca; and on* Hymenopsis Typhae (Fuck.) SACC., *a hitherto insufficiently described Tuberculariacea, occurring on the withered leafsheaths of Typha latifolia.*" By Prof. C. A. J. A. OUDEMANS.

1. LEPTOSTROMA AUSTRIACUM OUD.

(Plate I.)

On the 13th of June 1904 I received from Dr. J. RITZEMA BOS, Professor at Amsterdam, a number of specimens of transplanted seedlings of *Pinus austriaca*, originating from Schoorl, all dead and of which the accompanying letter informed me that the roots showed here and there cushionlike prominences, the surface of which was covered with shuttle-shaped conidia, divided into cells, and the microscopic properties of which resembled most those of conidia of the genus *Fusarium*.

Besides I found, without my attention having been directed to it, that most needles of the dead plantlets were spotted on both sides with small black specks and streaks, the external appearance of which showed most resemblance with the perithecia peculiar to *Leptostroma* or *Leptothyrium*.

The plants sent to me, provided with a here and there ramified tap-root of about 1 decimetre length and 1—3 millimetres thickness, proved on closer inspection to have much suffered, since in various places the bark was loose from the wooden kernel, if it was not entirely lacking. These circumstances justified the supposition that the young pine-trees had succumbed under the attack of the *Fusarium*-plantlets and that the *Leptostroma*- or *Leptothyrium*-individuals had chosen the sickly, lingering or dying needles as the seat of their fatal activity.

The *Fusarium*-cushions that had remained were little numerous, 1—3 mm. in diameter and had a light rosy tint. Lacking suitable objects for investigation, I had to restrict my answer to the communication that here very likely *Fusarium roseum* had been active, and I left the further elucidation of the devastation caused by that fungus to the care of Prof. RITZEMA BOS.

A closer examination of the very numerous specks and streaks found on the needles of *Pinus austriaca*, induced me, on account of their generally elongated, sometimes more, sometimes less hysterium-like shape, their little tendency to loosen at the circumference and to fall off, the fact that nowhere a parenchymatic structure of the perithecium-wall could be distinguished and that the basidia had not developed, to think rather of the genus *Leptostroma* than of *Leptothyrium*, and besides to mark the fungus as non-described and to give the name *Leptostroma austriacum* to it in order to distinguish it from other fungi.

One of the characteristics of *Leptostroma austriacum* is that the perithecia are never united to continuous series, but rather form greater or smaller groups of streaks or small shields, which differ greatly among each other in size, and are rather dull than glossy. Their length varies from $^1/_6$ to 1 mm. and their breadth from $^1/_8$ to $^1/_5$ mm. Their perithecium-wall is "halved", as the term is, does not reach further than the epidermis of the leaf, and consequently has the shape of a cupola. This wall has no foundation or basis. Moreover it is black, carbonaceous and structureless, so that there can be no doubt that we have here a cuticle (Fig. 2 and 3), from which follows that the space, occupied by spores, rests on the epidermis, as is clearly shown by Figs. 2 and 3. By reasoning more even than by observation, one is lead to the conclusion that the spores are produced by a very thin layer of threads extending over the epidermis.

Above this layer the spores form two layers or storeys. A third layer does not exist, as the space, required for it, is occupied by the spores which have loosened themselves and have become entangled.

The spores have an elongated (cylindrical?) shape and are colourless and undivided. Their foot is rounded and encloses (Fig. 4 and 5) a circular or oval, glossy vacuole; their top is more pointed and empty. They measure 7—8 μ in length and $1^1/_2$ μ in breadth.

The difference between *Leptostroma austriacum* and other Leptostromata, peculiar to pine-needles, like *L. Pinorum, L. Pinastri* and others, is: that in the latter the perithecia form mostly narrow parallel series; that the spores are not broader than 0.5 μ, and finally, that no vacuoles are found.

The Latin diagnosis of the new species is as follows:

"Peritheciis cuticulam inter et epidermidem occultatis, amphigenis, irregulariter distributis, majoribus et minoribus, item longioribus et brevioribus intermixtis, dimidiatis, nigris, opacis, diu clausis, tandem irregulariter ruptis, persistentibus neque decedentibus nec circumcirca a substrato solutis. Sporulis sessilibus, cylindraceis, hyalinis, continuis, vulgo 7.5×1 μ, basi rotundatis guttulaque sphaerica vel ovali, micante, praeditis, apice acutiusculis, vacuis."

EXPLANATION OF THE FIGURES OF PLATE I.

Fig 1. A piece of a needle of *Pinus austriaca* with small heaps of perithecia (*p.*) on them. ($^5/_1$).

„ 2. Vertical section of a not yet fully mature perithecium.
- *a.* Cuticle.
- *b.* Epidermis.
- *c.* The two layers of rod-shaped colourless spores. ($^{500}/_1$).

„ 3. Vertical section of a ripe perithecium which has burst open.
- *a.* Cuticle.
- *b* Epidermis.
- *c.* Spores, partly undamaged, partly in a displaced position. ($^{500}/_1$).

„ 4. Spores, with a rounded foot and a sharper top. At the foot a vacuole. ($^{1000}/_1$).

„ 5. The same ($^{2000}/_1$).

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2. HYMENOPSIS TYPHAE (Fuck.) Sacc. (Plate II).

This fungus, found for the first time at Nunspeet in July 1904 on the withered leaves of *Typha latifolia*, was sent to me among many others by Mr. C. A. G. Beins.

Unlike the *Sphaerellae* and *Leptothyria* it has not the appearance of small specks but of raised black spots (Figs. 1, 2 and 3) which are spread in the grooves between the nerves and have a length of 1—4 and a breadth of $^1/_2$ mm.

FUCKEL described the fungus first under the name of *Myrothecium Typhae* (Symb. 364), in the following words: "Peridiis hemisphaericis, oblongis, $^1/_2$ lineam longis, aterrimis; conidiis oblongo-ovatis, utrimque obtusis, simplicibus, biguttulatis, $18 \times 6\ \mu$, pallide fuscis," and gave a not quite satisfactory picture of a conidium in Fig. 21 of Plate 1.

He was succeeded by SACCARDO (Syllabus IV, 745), who agreed with his predecessor that the fungus belongs to the Tuberculariaceae, but nevertheless removed it to the genus *Hymenopsis*, on account of the spore-bed (sporodochium) of *Myrothecium* being surrounded by a circle of fringes, which is not the case with *Hymenopsis*.

In a very successful drawing by Mr. C. J. KONING of a vertical section of *Hymenopsis Typhae*, (Plate 2), the structure of the fungus is excellently seen, much better than in other pictures, also of other species of the same genus.

Where the black disks or specks rise above the surface of the leaf-sheaths (Figs. 1, 2 and 3), one does not find, as FUCKEL writes, a "perithecium" (i.e. a more or less completely occluded fruit-body), but a globular assemblage of reproductive cells or conidia (Fig. 4 *s.s.*), covered by the cuticle and produced by a layer of peculiarly shaped sporophores (Fig. 4 *x.*), collectively called stroma or fruit-bed. Under this stroma the epidermis is found (Fig. 4 *o.*): a layer easily recognisable by the width of its cells. It deserves to be mentioned that the black colour of the prominent little disks (Figs. 1, 2 and 3) must not be ascribed to the colourless cuticle (*c*), nor to the colourless epidermis (*o*), but only to the conidia (Fig. 5 *y*) which have been left uncoloured, however, in Fig. 5, in order not to make the picture too full.

One of the most important Figures of Plate 2 is Fig. 5. At *x* it shows the favoured club-shaped threads or basidia, whose task is the production of the conidia; these latter, let free by their bearers, being seen in their neighbourhood in a free condition (*y*). The conidia have an elongated, cylindrical shape, are more or less asymmetrical or curved, rounded at both ends, somewhat more transparent at the base and of the grey colour of mice. (Sacc. Chromotaxia, pl. I, Fig. 3). They contain 2—4 consecutive vacuoles each and have a length of about 10 and a breadth of about 4 μ.

Comparing the Figures of Plates I and II, one might get the impression that in the Figures 2 and 3 of Plate I a perithecium is lacking as well as in those of Plate II, although this term is usual in descriptions of the Leptostromaceae. Therefore we remark that this latter family of the Sphaeropsideae forms a transition between the perithecium-bearing and the peritheciumless forms and that in judging these two cases weight has been attached to the black colour of the upper half of the shields, which sometimes consists of the cuticle only, sometimes of a combination of the cuticle with the epidermis.

In addition to this the Leptostromaceae do not produce well-developed basidia and have remarkably small spores.

The Latin diagnosis of *Hymenopsis Typhae* is as follows:

"Sporodochiis amphigenis, hemisphaericis, inaequaliter in vaginarum sulcis distributis, majoribus et minoribus, item longioribus et orbicularibus intermixtis, primo cuticulam inter et epidermidem caelatis, 1—18 μ in diam., aterrimis; denique expositis, calvis, thalamo basidiophoro basilari praeditis; basidiis dense fasciculatis, elongato-clavatis, hyalinis, continuis; conidiis oblongis, rectis vel paullo curvatis et utplurimum inaequilateralibus, utrimque obtusis, basi vulgo clarioribus, $10 \times 4\,\mu$, murinis (Sacc. Chromotaxia Tab. I, f. 3), 2—4-guttulatis, guttulis hyalinis, nunc binis sibi oppositis, tunc iterum ternis (aut quaternis) in seriem dispositis."

EXPLANATION OF THE FIGURES OF PLATE II.

Fig. 1. Piece of a leafsheath of *Typha latifolia*, studded in the grooves between the nerves with sporodochia (spora = spore; docheion = receptacle), (natural size); *p.p.* perithecia.

„ 2. Piece of a leafsheath with two sporodochia, of which one is opened, the other closed ($^{40}/_{1}$).

„ 3. Piece of a leafsheath with two sporodochia, of which one has a groove on the dorsal side ($^{40}/_{1}$).

„ 4. Vertical section of a ripe sporodochium. — *c.c.* cuticle; *o.o.* epidermis; *s.s.* conidia; *vb. vb.* vascular bundles; *x.* club-shaped basidia.

„ 5. A bundle of club-shaped basidia (*x. x.*) with some conidia (*y. y.*), in which two or three vacuoles. The end of the conidia resting on the basidia or turned towards them is always somewhat more transparent than the other.

Fig. 1.

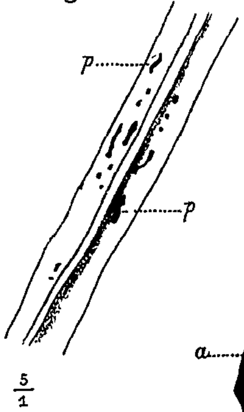

Fig. 2

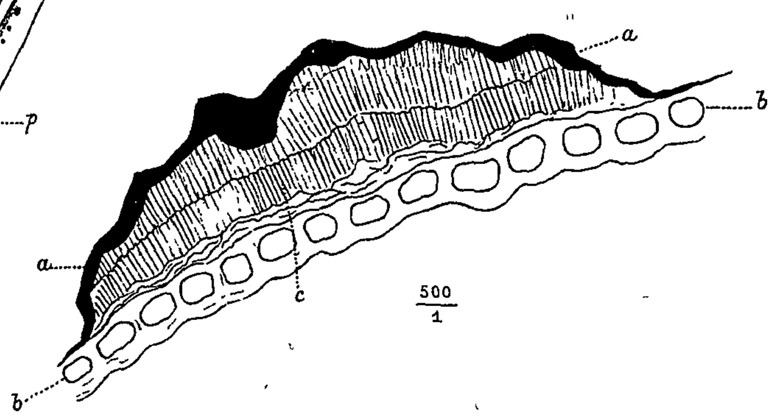

Fig. 3.

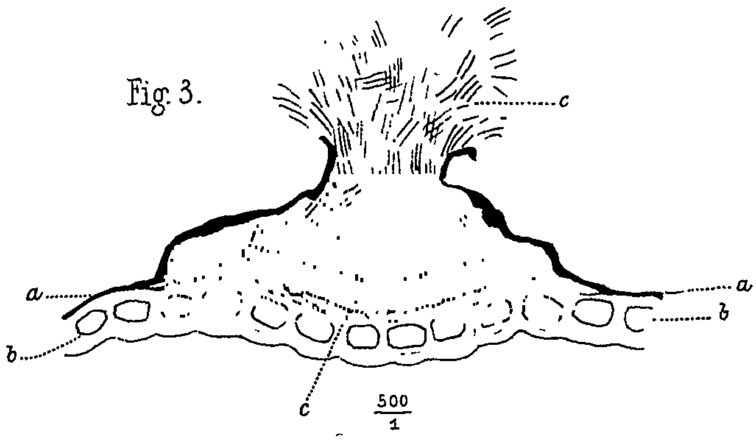

Fig. 4.

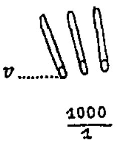

Fig. 5.

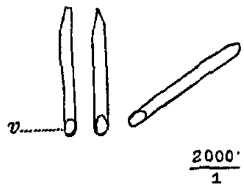

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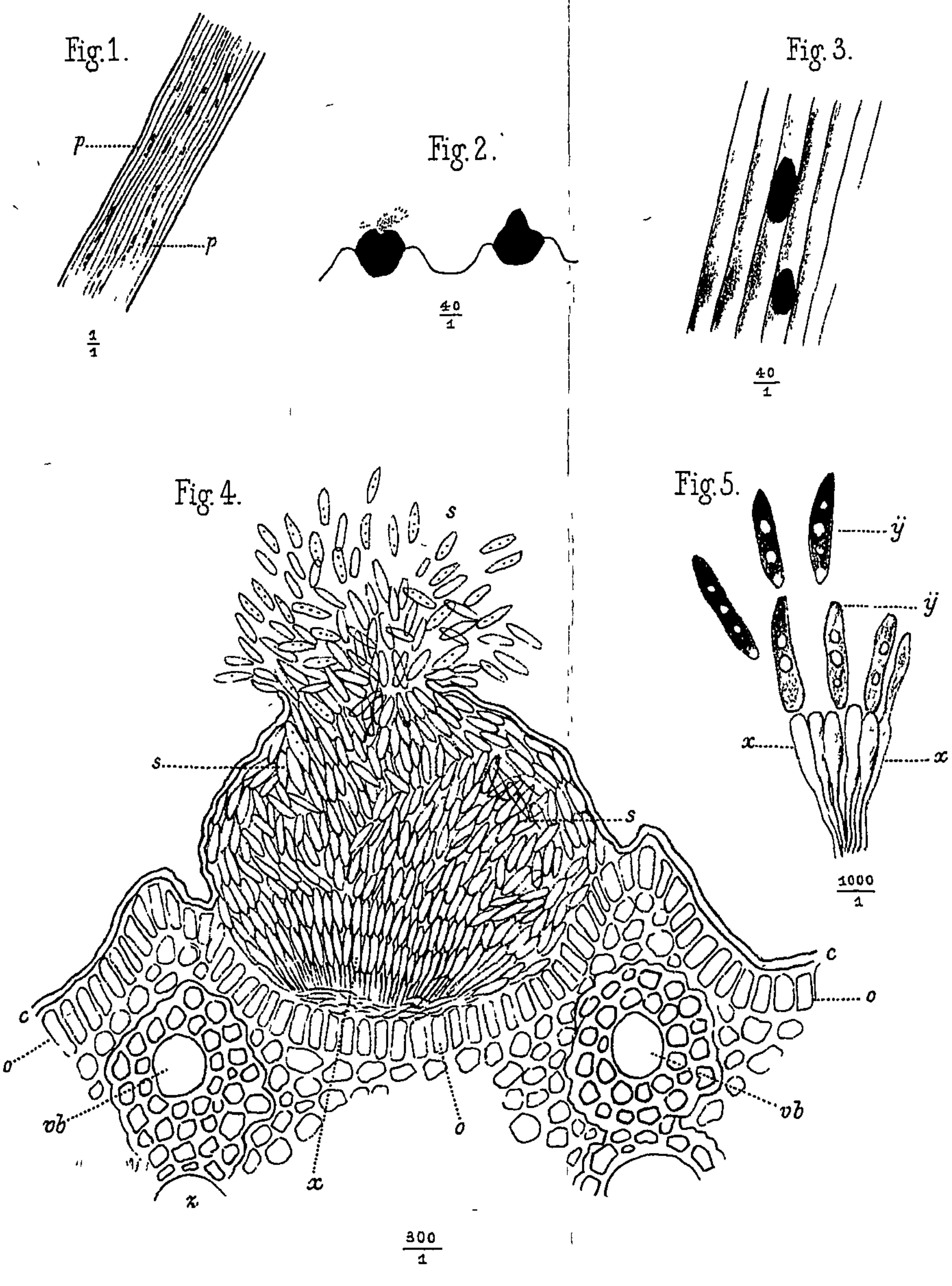
Plate II.



C. J. Koning, del.

J. BIJTEL Lith., P. J. MULDER Impr. Leiden.