On the Relationship between *Melampsora* on *Salix Pierotii* MIQ. and *Caeoma* on *Chelidonium majus* L. and *Corydalis incissa* PERS.

By

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In the writer's second article of the study on the heteroecious rust *Melampsora*, it was suggested that the aecidial stage on *Chelidonium majus* L. in Sapporo might require *Salix babylonica* L. for complete development of its entire life cycle, since successful results were secured on *Chelidonium majus* L. by sowing the teleutosporic material obtained from *Salix babylonica* L. Nevertheless, as shown in the same article, the subject was not yet completely established, since no return infection to *Salix babylonica* was made. Since then the study had to be suspended for a couple of years owing to his stay abroad, but after his return to Japan in 1921, and settled in Morioka, northern part of Japan main island, the study was again taken up and continued. In this time, however, unfortunately negative results were always obtained as to any relationship between caeoma on *Chelidonium majus* and *Melampsora* on *Salix babylonica*. On the other hand, in May, 1924, the writer noticed some caeomata on the leaves of *Chelidonium majus* in the vicinity of the college campus, where there was growing a big willow tree, *Salix Pierotii* Miq. These indications induced him to assume that there might exist a certain genetic connection between these two materials, and immediately to perform a new series of experiments by inoculating the young leaves of *Salix Pierotii* with the caemasporae from *Chelidonium majus* L. Exactly as expected, positive results were readily secured on the willow leaves, but owing to a lack of return

infection, the subject was still not yet thoroughly established. In 1925, a large number of extensive culture experiments was conducted for the purpose of verifying the result secured in the previous year. Some of the culture experiments will be tabulated as follows :

TABLE I.

Showing the result of inoculations with *Chelidonium-caeoma* and *Salix-Melampsora*.

Inoculation material	Species inoculated	Date of inoculation	Result	Date of first sori developed
Caeomasporos from				
<i>Chelidonium majus</i>	<i>Salix Pierotii</i>	May 7	+	May 19
<i>Chelidonium majus</i>	<i>Salix babylonica</i>	May 7	—	
<i>Chelidonium majus</i>	<i>Salix Pierotii</i>	May 12	+	May 25
<i>Chelidonium majus</i>	<i>Salix Pierotii</i>	May 18	+	June 2
<i>Chelidonium majus</i>	<i>Salix babylonica</i>	May 18	—	
<i>Chelidonium majus</i>	<i>Salix Pierotii</i>	May 21	+	June 2
Teleutospores from				
<i>Salix Pierotii</i>	<i>Chelidonium majus</i>	May 14	+	May 25
<i>Salix Pierotii</i>	<i>Larix leptolepis</i>	May 14	—	
<i>Salix Pierotii</i>	<i>Chelidonium majus</i>	May 18	+	June 4
<i>Salix Pierotii</i>	<i>Larix leptolepis</i>	May 18	—	
<i>Salix Pierotii</i>	<i>Chelidonium majus</i>	May 28	+	June 10
Caeomasporos from				
<i>Chelidonium majus</i> (inoculated with the teleutospores on May 14)	<i>Salix Pierotii</i>	May 27	+	June 12

From the experiments it is evidently confirmed that the caeoma on *Chelidonium majus* requires *Salix Pierotii* for complete development of its entire life cycle, and, so far as the present experiment is concerned, the species under consideration may not be identical with *Melampsora* on *Salix babylonica*.

At about the same time, while the writer was studying with the *Chelidonium-caeoma*, he found some caeomata on the leaves of

Corydalis incissa Pers. in the vicinity where the *Chelidonium-caeomata* were noticed. By careful microscopical investigations as well as culture experiments it was evidently established that the species was identical with the *Chelidonium-caeoma*. The result of the culture experiments will be tabulated as follows :

TABLE II.

Showing the results of inoculations with *Corydalis-Caeoma*
and *Salix-Melampsora*.

Inoculation material	Species inoculated	Date of inoculation	Result	Date of first sori developed
Caeomasporos from <i>Corydalis incissa</i>	<i>Salix Pierotii</i>	May 20	+	June 1
Teleutospores from <i>Salix Pierotii</i>	<i>Corydalis incissa</i>	May 28	+	June 10

The aecidial stage of the present species is very closely related to the corresponding stage of *Melampsora Magnusiana* Wagner, as shown by the morphological characteristics, and by having its caeomata on the same kind of hosts. On the other hand, however, there are characteristic differences, as follows : (1) In the writer's case the uredo- and teleutospores are on *Salix Pierotii*, in the other on *Populus* sps. ; (2) Uredo-sori of *Melampsora Magnusiana* are hypophyllous, while in the present species amphigenous, although mostly hypophyllous ; (3) Teleutosori of *Melampsora Magnusiana* are hypophyllous and covered by epidermis, while the other amphigenous, rather abundant on the upper surface, and lying between cuticle and epidermis ; (4) There are also some differences in measurement. Besides the species mentioned above, there is another closely related species, better known as *Melampsora Klebahnii* Bubák, which has caeomata on *Corydalis cava* Schw. and *solida* Sm., but which, according to Klebahn, is identical with *Melampsora Magnusiana*. Therefore the present species can not be identified with either of them. In consideration of the evidence given above as well as that follows, the

writer considers this a new species, and the accompanying diagnosis and notes are offered.

Melampsora Chelidonii-Pierotii sp. n.

Spermogones. Epiphyllous, in round cluster, honey-colored.

Acidiospores. Caeomata hypophyllous, occasionally caulicolous, single or in groups with yellow spots on the upper surface, where the spermogones seated, roundish or oblong, 1–2 m.m. wide, often confluent in patches, 5 m.m. up, orange-red, pulverus, spores roundish or oval, occasionally roundish polygonal, finely and densely echinulate, $13-19 \times 12-15 \mu$, episore 1μ thick.

Uredospores. Sori amphigenous, mostly hypophyllous, scattered over the whole surface, orange-yellow, pulverous; spores oval or elongated, $16-23 \times 13-16 \mu$, episore hyaline, $2-3 \mu$, covered with stout rather distant spines; paraphyses capitate, $18-22 \times 20-25 \mu$, thickened above (up to 12μ), with a slender pedicel, $30-65 \mu$.

Teleutospores. Sori amphigenous, rather abundant on the upper surface, reddish brown, scattered over the whole surface, $96-480 \mu$ in diameter, lying between the cuticle and the epidermis; spores cylindrical or somewhat wedgeshaped, $20-64 \times 6-8 \mu$, episore uniformly thin, without an evident germ-pore.

Caeomata on *Chelidonium majus* L. and *Cory-*

Fig. 1.

Fig. 1. *Melampsora Chelidonii-Pierotii*. A. Caeomasporangia on *Chelidonium majus* L. B. Caeomasporangia on *Corydalis incisa* PERS. C. Uredospores and paraphyses on *Salix Pierotii* MIQ. Camera lucida drawing $\times 300$.

Fig. 2.

Fig. 2. *Melampsora Chelidonii-Pierotii*. Teleutospore on *Salix Pierotii*. Camera lucida drawing $\times 300$.

dalis incissa Pers.; uredo- and teleutospores on *Salix Pierotii* Miq. Morioka, Japan.

Finally a question must arise at this point as to the relationship between the two *Chelidonium*-caeomata, the one in Sapporo and the other in Morioka. At the present time unfortunately no satisfactory conclusion can be drawn, since no direct comparative studies can be made. But it seems probable that there might be two biologic forms of *Melampsora* on *Salix babylonica*, each having different complementary hosts, such as already noticed in *Melampsora* on *Populus tremula*, etc. Concerning the subject the further discussion will be left for the future investigation.

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BIBLIOGRAPHY.

BUBÁK, FR. *Caeoma Fumariae* Link im genetischen Zusammenhange mit einer *Melampsora* auf *Populus tremula*. Zeitschr. Pflanzenkr. 9:26-29. 1899.

KLEBAHN, H. Kulturversuche mit heteröcischen Rostpilzen, Ibid. 7:341-342. 1897.

———. *Melampsoren* auf *Populus tremula*. Ibid. 9:144-146. 1899.

———. Die wirtwechselnden Rostpilze. p. 408-410. 1904.

MATSUMOTO, T. Impfversuche mit *Melampsora* auf japanischen Weiden. Trans. Sapporo Nat. Hist. Soc. 6:22-35. 1915.

———. Some experiments with *Melampsora* in Japan. Ann. Mo. Bot. Gard. St. Louis, U. S. A. 6:309-316. 1919.

SYDOW, P. Erwiderung. Ber. Deutsch. Bot. Gesellsch. 11:234. 1893. (Cited by H. Klebahn).

WAGNER G. Zum Generationswechsel von *Melampsora tremulae* Tul. Österr. Bot. Zeitschr. 56:273. 1895. (Ibid).