A NEW ERGOT FROM QUEENSLAND

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(*Received 27th June*, 1949 ; *read before the Royal Society of Queensland*, 31*st October*, 1949 ; *issued separately* ———).

In 1941 an ergot or *Hyparrhenia filipendula* (Hochst.) Stapf was found a few miles north of Ipswich, Queensland, but attempts to determine the species of *Claviceps* responsible were not successful (Langdon 1942A). In May, 1948, sclerotia were collected from this host at Conandale, South Queensland. Subsequent germination showed that the ergot was a species previously unknown. It was first brought to notice by the development of the saprophyte *Cerebella* on infected spikelets. The amount of honey-dew produced is limited, and after mid-morning it usually dries up, at least on the exterior of infected spikelets, leaving a white encrustation about the margins of the glumes. The sclerotia remain hidden within the glumes and can be detected only by the darker and plumper condition of the spikelets. The name of this new species of *Claviceps* is derived from the unobtrusive symptom-picture shown by infected plants.

Claviceps inconspicua Langdon ; species nova, affinis *C. annulatae* Langdon, sed stromatis colore et indumento differt.

Sclerotia fuliginea, subcylindrica vel fusoidea, in spiculis inclusa, 2-5 mm. longa. Stromata in quoque sclerotio 1 vel plures. Stipites 1.5-9 mm. longi, colore Anthracene Purple (Ridgway) vocato. Capitula globosa, papillosa, in superficie hyphis raris brevibus, in basi annulo hypharum brevissimarum albarum praedita, colore Raisin Black (Ridgway) vocato, 0.3-0.6 mm. diam. Perithecia 155-180 × 105-125 μ. subglobosa. Asci cylindrici, 140-175 × 4 μ. Ascospori lineares, hyalini, Conidia hyalina, guttulata vel granulosa, lateribus recta vel leniter curva, finibus ambobus rotundata, 15-20 × 5-10 μ.

In ovariis *Hyparrheniae filipendulae* (Hochst.) Stapf, Queensland. Prope Conandale, 30th May, 1948, Langdon (425 TYPE) ; prope Ipswich, 28th May, 1941, Langdon (163) ; Grovely, Brisbane, 12th April, 1949 (426).

The sclerotia were kept dry during the winter and subjected to cold treatment (2-4° C. for 28 days). In September they were placed on moist sand in petri dishes. Development of the ascal stage began in mid-November. Germination of the sclerotium begins with the protrusion of a small white papilla which quickly grows out into a globose tuft of white hyphae. The developing stroma is veiled with white hyphae as it pushes up, and at maturity loose hyphal elements persist on the surface of the capitulum. A ring of very short white hyphae is present at the base of the capitulum where it joins the stipe. The tuft of hyphae at the base of the stipe is persistent.

OTHER RECORDS OF ERGOT ON *HYPARRHENIA*.

Goncalves (1937) reported the occurrence of ergot on *Hyparrhenia rufa* in Brazil, and noted an association of *Cerebella* with the sphacelial stage of the disease. There are records of *Cerebella* and *Fusarium* as saprophytes in the honey-dew of ergot of *Hyparrhenia ruprechtii* in Southern Rhodesia (Hopkins, 1947). McDonald (1927) reported the

occurrence of *Cerebella* on *Hyparrhenia collina* in Kenya. In Sierra Leone, Deighton (1947) has found *Cerebella* on *Hyparrhenia gracilescens*, *H. rufa* and *H. subplumosa*, but he stated that he did not find it associated with ergot honey-dew. From the work of Langdon (1942B) there seems little doubt that a record of *Cerebella* on a grass is a safe indication of a prior infection of the host with ergot.

DISCUSSION.

In Queensland a number of native grasses are hosts for indigenous species of *Claviceps* (Langdon 1942A). A wide search in south-eastern Queensland since 1946 has revealed only two new hosts for ergot, and both of these were infected by *Claviceps pusilla*. *Hyparrhenia filipendula* is the only host known for *Claviceps inconspicua*. There are at present no other suspected hosts of this ergot, *i.e.*, plants which have been found infected with ergot, the perfect stage of which has not been observed. A consideration of the origin of *Claviceps inconspicua*, whether the fungus is indigenous to Australia or has been introduced, must take into account the origin of its host. *Hyparrhenia filipendula* is a plant about which there has been some doubt as to its natural distribution. Stapf (1934) for the genus *Hyparrhenia* writes : " Species over 60, almost confined to tropical Africa (including the islands) and subtropical South Africa, three of them extending to tropical America, one to Asia and Australia, one to Mediterranean countries and temperate Africa." For *Hyparrhenia filipendula*, Stapf gives the general extra-African distribution as Ceylon, the Philippines, and Australia, but adds that " *Hyparrhenia filipendula* is often found on abandoned plantations, and its occurrence in India, Malaya and Australia may possibly be due to casual introduction."

In Australia, *Hyparrhenia filipendula* is found as a constituent of the herbage in open forest areas, and it occurs also in induced grassland communities following changes effected by man in the natural plant cover. Blake (1942) found *Hyparrhenia filipendula* associated with a number of native grasses in an Open Eucalyptus Forest community at Running Creek in south-eastern Queensland. The herbaceous cover was dominated by kangaroo grass, *Themeda australis*, a species which is amongst the earliest to disappear under grazing conditions. This occurrence of *Hyparrhenia filipendula* in a mixture of native grasses in what must be regarded as an area carrying almost unaltered natural vegetation is worthy of note. That *Hyparrhenia filipendula* occurs in induced grassland communities is not evidence that it is an introduced grass as might be inferred from Stapf's remarks on the occurrence of the species in abandoned plantations. Native grasses frequently are dominant in disturbed ground, for example, *Capillipedium spicigerum* and *Bothriochloa decipiens*. *Imperata cylindrica* var. *major*, a species indigenous to Australia and south-east Asia, often occupies cultivated land which has been abandoned.

Through the courtesy of Mr. S. T. Blake of the Queensland Herbarium, records of the locality and date of collection of specimens of *Hyparrhenia filipendula* in various Australian herbaria have been obtained. The earliest collection was by Leichhardt in 1843, the locality being given as " Eastern Australia." Other early collections are from the islands of Moreton Bay by Mueller in 1855, from the country west of Rockhampton by Bowman in 1867, from the Clarence River (N.S.W.) by Beckler between 1870 and 1880, and from the Apsley River in the

Kimberley district of Western Australia by Crawford in 1887. The distribution of *Hyparrhenia filipendula* in Australia, as indicated by specimens in various herbaria, is from the Clarence River in northern New South Wales to North Queensland, and in the north of Western Australia. Mount Fraser, near Mossman, is the northernmost area from which the species has been collected in Queensland, and the grass has been recorded from a number of coastal and sub-coastal areas at various places between its known southern and northern limits. Crawford's collection from the Apsley River is the only record of the grass in Western Australia. The comparatively late collection of *Hyparrhenia filipendula* in Australia might suggest that the grass has been introduced after colonization of Australia by white men, though its occurrence in places remote from centres of early settlement controverts this idea. If introduced from Africa early in the nineteenth century, the grass might be expected to occur in the south-west of the continent or near Sydney, but it does not. That the climatic conditions in the latitude of Sydney are such that *Hyparrhenia* cannot develop to maturity there is not a tenable hypothesis. There is in the Queensland Herbarium a fertile specimen of *Hyparrhenia* (? *rufa*), grown in the Sydney Botanic Gardens from seed imported from Nairobi. Although a species other than *H. filipendula* is concerned here, the range of the latter in Africa does cover the territory from which the Sydney grass was obtained. *Hyparrhenia filipendula*, if it had been introduced in the Sydney or Perth areas, might have established itself there in waste areas where it would be free from competition from native plants. A final point against the possibility of introduction of the grass from Africa is that *Hyparrhenia filipendula* does not occur south of latitude 30° S., and so is not likely to have been brought over by travellers who visited the Cape of Good Hope area on their way to Australia in the late eighteenth or early nineteenth centuries. Since *Hyparrhenia filipendula* was not found in the areas serving as bases for those who originally explored or settled in other parts of the continent, it is very likely that the record of the grass by Leichhardt in " Eastern Australia " represents the collection of a naturally occurring species. The possibility of the introduction of *Hyparrhenia filipendula* from south-east Asia direct to the settlement around Moreton Bay prior to 1843 is remote.

In south-eastern Queensland, a smut, *Ustilago hyparrheniae* Hopkins is common on *Hyparrhenia filipendula*. This smut was described from the same host from Southern Rhodesia, and a Queensland specimen sent to Southern Rhodesia was reported as being identical with the type collection (Bates 1948). If seed of this grass had been accidentally introduced to this country from Africa in the past, one might reasonably suppose that the smut had come with it.

The occurrence of ergot on *Hyparrhenia* in Africa has been noted above, but the species of *Claviceps* affecting the genus there has not yet been determined. Nor is the species of *Claviceps* affecting *Hyparrhenia* in South America known. While these ergots are undetermined, one cannot say whether all the ergot diseases of *Hyparrhenia* are the same. But to assume that the Australian ergot has been brought here with an accidental introduction of seed would suppose a rather unlikely series of events, the carriage of sclerotia, with their subsequent development and release of ascospores at a time when the introduced host was flowering. This view is put forward despite the presence in Australia of *Claviceps purpurea* and *Claviceps paspali*, neither of which is indigenous

to this country. The former was introduced in the nineteenth century, probably with cereal grain or with seed of pasture grasses (possibly in both ways). In any case, an abundance of hosts of more than one species would be available to any germinating sclerotia, for native grasses as well as introduced plants are recorded as hosts of this ergot in southern Australia. *Claviceps paspali* appears to have been introduced much later. It has been widespread and very common on several species of *Paspalum* in eastern Australia since the summer of 1935-36, when it was observed for the first time. The quick development of epiphytotics of ergot in *Paspalum* every year now in coastal Queensland indicates how well local conditions suit this ergot. The first sclerotia to germinate after their introduction (probably in 1935) had available an abundance of *Paspalum dilatatum* which flowers profusely, and the initial infections should not have been difficult to accomplish. Plants of *Hyparrhenia filipendula*, unlike *Paspalum dilatatum* the chief host of *Claviceps paspali*, are not massed in pure stands over large areas, and are not common as weeds of waste places. Nor is any alternative host of *Claviceps inconspicua* known. The possibility of infection of *Hyparrhenia* by ascospores from sclerotia introduced by chance at any time is very much less than for the hosts of *Claviceps purpurea* and *Claviceps paspali*. Furthermore, all observed occurrences of *Claviceps inconspicua* on *Hyparrhenia* have been light infections, indicating that environmental conditions do not usually favour epiphytotics of this ergot, and that infection under prevailing circumstances is relatively difficult. The enphytotic state of this ergot disease may perhaps be regarded as the result of a long-standing association of host and parasite in this country.

The mycological evidence bearing on the question of whether *Hyparrhenia filipendula* is a native or an introduced species in Australia is divided. The introduction of a smut with the seed is feasible, but the probability of the introduction of an ergot specific to this host is not easy to accept. One might postulate development of an ergot species, specific to *Hyparrhenia filipendula*, from some indigenous Australian ergot. *Claviceps inconspicua*, morphologically, has much in common with *Claviceps pusilla*, an ergot which infects a wide range of genera in the sub-tribe Andropogoninae, and with *Claviceps annulata*, an ergot infecting *Eulalia* of the sub-tribe Saccharinae. Possibly *Claviceps inconspicua* and *Claviceps annulata* are Australian variants of the more widely distributed *Claviceps pusilla*. If one rejects the hypothesis that *Claviceps inconspicua* is an evolutionary product of the past century, specific to *Hyparrhenia filipendula* and developed since the time of that grass's introduction to Australia, the above proposition may still be valid. The host *Hyparrhenia filipendula* is known from the Philippines (Merrill 1925) and from Ceylon, India and Malaya (Stapf 1934). Possibly it is a species of wide natural distribution, extending from Africa, through Asia, to Australia. If it is a grass of long-standing occurrence in Australia, an explanation of the presence here of its ergot, having affinities with other indigenous ergots, can be found.

The ecological, phytogeographical and mycological evidence presented here supports the theory that *Hyparrhenia filipendula* is a species native to Australia. If one accepts the indigenous nature of the host, then *Claviceps inconspicua* can be regarded as an ergot indigenous to Australia.

ACKNOWLEDGMENTS.

I wish to thank Mr. S. T. Blake for his assistance in the preparation of this paper by discussion with me of the plant distribution problem involved and by making available various records of the occurrence of *Hyparrhenia filipendula* in Australia ; and Professor D. A. Herbert whose constructive criticism of the theories put forward has been most helpful. Financial assistance for this work was granted by the University of Queensland Commonwealth Research Projects Committee, to whom the author is grateful.

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