Powdery Mildews in the Libyan Jamahiriya. II. Identity of Certain Powdery Mildew Fungi

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ABSTRACT

Some powdery mildew species new to Libyan Jamahiriya are reported. This paper, sequel to the first in the series based on studies made to enlist and identify powdery mildew species infecting cultivated and wild plants in Jamahiriya, includes: *Erysiphe urticae*; *Erysiphe communis*; *Sphaerotheca euphorbiae*; *Erysiphe pisi*; *Erysiphe trifolii*; *Erysiphe graminis*; and *Erysiphe convolvuli*. Some of these have been observed in perithecial stage also. *E. urticae*; *E. communis*; *S. euphorbiae*; *E. convolvuli*; and *E. trifolii* are new to the powdery mildew flora of Jamahiriya. The records of *E. urticae* on *Urticia urens*; *E. communis* on *Sisymbrium irio*; *S. euphorbiae* on *Euphorbia terracina*; *E. graminis* on *Phalaris minor*; *E. pisi* on *Vicia monantha* and *Lens esculentus*; *E. cichoracearum* on *Hedypnois cretica*, *Conyza bonariensis* and *Sonchus oleraceous*; *E. trifolii* on *Melilotus indicus* and *Trigonella foenicum-graecum*; and *E. convolvuli* on *Convolvulus arvensis*, are new to Libyan Jamahiriya. *E. pisi* on *Vicia monantha*, and *E. cichoracearum* on *Conyza bonariensis* are also new world recordings.

The causal organism of powdery mildew of Papilionaceous plants known as *Erysiphe polygoni* in Jamahiriya is suggested to be recognised as *E. pisi* or *E. trifolii*, as the case may be, in accordance with the current taxonomic status.

INTRODUCTION

Earlier records of powdery mildew fungi in Libyan Jamahiriya include only a few species infecting certain plants (1,9,11,12,13). The identity of different powdery mildew fungi from various plants appears to be not well established. The list of species infecting different plants in the country also appears to be incomplete. Recently, in an attempt to identify and enlist powdery mildew fungi existing in Jamahiriya, Khan and Mussa (8) established the identity of four species viz. *Erysiphe heraclei* on *Torilis nodosa*; *E. cichoracearns* on *Amberboa lippii*; *E. granimis* on *Bromus diandrus* and *Hordeum vulgare*; and *E. sordida* on *Plantago lagopus*. The present paper is second in the series which includes some species new to Libyan Jamahiriya. Also, some species already known to exist in the country are reported on certain new hosts. The identity of the species on their respective hosts are established and are enlisted to the powdery mildew flora of Jamahiriya.

MATERIALS AND METHODS

Wild and cultivated plants were observed for powdery mildew infections at different localities in Tripoli region. Infected plant parts were collected and brought to the

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laboratory for studies. Herbaria were prepared and some were also preserved for detailed study. The severity of the infection was observed on a mild-to-severe through moderate scale. Infected plant parts were thoroughly examined for the presence or absence of perithecia. The morphological characteristics were microscopically studied. Dimensions of structures present were measured. In certain cases, conidia were subjected to germination tests and tests for the presence or absence of fibrosin bodies (4) to ensure their identity.

The characters of conidial and perithecial stages were used as criteria for identification. In absence of perithecia, conidial characteristics, and records on the hosts based on perithecial and/or conidial stage from other parts of the world, were used for identification. The host index provided by Blumer (3) was used as check-list.

RESULTS AND DISCUSSION

Some powdery mildew species new to Libyan Jamahiriya are enumerated below. Some species already known to exist in Jamahiriya have been recorded on some new hosts for the first time in this country. A few are world records. Severity of the disease and its recurrence are mentioned. Their importance as parasites of plants of economic importance, wherever considered necessary, is discussed.

1. *Erysiphe urticae* (Wallroth.) Blumer

On living leaves and stems of *Urticia urens* L. (Urticaceae) collected from near the football pavilion, Al-Fateh University Campus, Tripoli, 26th March, 1978 and 15th February, 1979; and from the Agricultural Farm Gardens, Faculty of Agriculture, Al-Fateh University, Tripoli, 20th March, 1979.

Severe infection on leaves; mycelium well-developed; amphiphyllous, also on stems, mostly covering the entire leaf blades. Conidia scattered; generally not in chain, ellipsoidal, 30–40 × 18–22 μ. Perithecia absent.

The infection appeared initially in the form of rounded or flattened white colonies on the upper surface, which gradually spread over lower surface of leaves and stem. Leaves eventually drooped and fell leaving bare stumps which gradually dried up. This species on this hosts appears regularly in Libyan Jamahiriya and seems to be widespread in occurrence.

E. urticae is recorded on *Urticia dioica* and *U. membranacea*. It is also reported on *U. urens* but from Italy only (3). So far, there have been no records of *E. urticae* from Libya on any host. This report forms the first record on *U. urens* in Jamahiriya, and *E. urticae* is an additional species to the powdery mildew flora of Libyan Jamahiriya.

2. *Erysiphe communis* (Wallroth.) Link.

On living plants of *Sisymbrium irio* L. (Cruciferae) collected from the Agricultural Farm Gardens, Al-Fateh University, Tripoli, 23rd April, 1978 and 16th March, 1979.

Mild to severe infection on leaves; mycelium mostly well developed. Conidia held separately, seldom in short chain; ellipsoidal, 30–48 × 16–22 μ. Mostly greater in length than in breadth. Perithecia few; gregarious on lower surface of the leaves. Morphological characters of perithecia resembled those described for the species (3).

Infection appeared on seedlings and young plants on lower surface of the leaves. Severely infected plants exhibited infection on leaves, stems and even on fruits. Plants showed signs of deterioration and eventual death. Perithecia did not develop regularly.

The diseases seems to recur every year on this host.

E. communis infects many cruciferous hosts, including plants of economic importance. It is known to infect six species of *Sisymbrium* including *S. irio*. This fungus had been once identified earlier on sugarbeet in Jamahiriya (1). This record, however, does not appear to be well established. The powdery mildew of sugar-beet is recognised as *Erysiphe betae* (3). This record of *E. communis* should be considered new to Jamahiriya.

3. *Sphaerotheca euphorbiae* (Castag.) Salmon

On the living plants of *Euphorbia terracina* L. (Euphorbiaceae) collected from Al-Fateh University Campus, Tripoli, 4th April, 1978; Gharabuli, 8th April, 1979.

Primary mycelium well developed; amphiphyllous, abundant on lower surface. Conidia in chain, ellipsoidal to cylindrical 28–32 × 13–16 μ with fibrosin bodies. Secondary mycelium, in the late stage of infection, prominently developed. Secondary hyphae brown, sparsely branched; perithecia absent.

Moderate infection regularly appeared on plants in advanced stage of growth. Infection remained confined to the leaves. Infected plants exhibited poor growth and retardation but usually not killed.

The species is reported to infect different species of *Euphorbia*; on some of which it produces perithecial stage. The host index of Blumer (3) lists 20 species of *Euphorbia* including *E. terracina*.

The apparent record of the species of *Sphaerotheca* in Libyan Jamahiriya is those of *Sphaerotheca pannosa* on roses and *S. pannosa* var. *persicae* on almond, peach and plum. *S. euphorbiae* is thus a new species to the powdery mildew flora of Jamahiriya. This species, however, is not considered an important plant parasite like *S. fuliginea*, *S. pannosa* and *S. mors-uvae*.

4. *Erysiphe pisi* DC.

On the living plants of *Pisum sativum* L. (Papilionaceae) collected from the Agricultural Farm, Al-Fateh University, Tripoli, 20th February, 1978, Gharabuli, 2nd January, 1979 and 20th March, 1979.

Mild to severe infection; mycelium very variable, persistent, thin, effused, rarely dense. Conidia formed singly, rarely in short chains, ellipsoid, 31–38 × 17–21 μ. Perithecia absent.

The disease appears regularly and is widespread in Jamahiriya, assuming severity under favourable environmental conditions. Leaves, stems, tendrils, as well as pods are infected, causing reduction in the quality and quantity of the produce. It is world-wide in occurrence and one of the major diseases of the pea. The loss in yield in a severely infected crop has been estimated from 26–47% by pod weight (5).

On the living plants of *Lens esculentus* L. (Papilionaceae) collected from Experimental plots, Agricultural Farm, Al-Fateh University, Tripoli, 20th February, 1978.

Conidial stage of *E. pisi* was observed on both surfaces of leaves. Perithecia were absent. Plants showed moderate to severe infection. Infected plants exhibited poor growth, early defoliation, small and less podding.

On leaving plants of *Vicia monantha* Retz. (Papilionaceae) collected from Agricultural Farm, Al-Fateh University, Tripoli, 26th April, 1978 and Tajora, 20th March, 1979.

Severe infection of *E. pisi* was observed at both locations. Perithecial stage was absent. Conidial characters resembled those described for *E. pisi* (5). Blumer's host list for *E. pisi* does not include *Vicia monantha*. This is new to the host index of the species.

E. pisi infects Papilionaceous plants including some cultivated ones. Besides it, *E. trifolii* also causes powdery mildew on a number of leguminous plants (6). The

powdery mildew species on legumes, earlier recognised as *Erysiphe polygoni*, is now designated as *E. pisi* or *E. trifolii* (3,5,6). *E. polygoni* is now considered parasitic chiefly on the members of Polygonaceae.

E. polygoni was recorded in Libya on pea, eggplant, cabbage and carrot (1,10). Pucci (13) doubtfully assigned an *Oidium* stage from *Phaseolus vulgaris* to *E. polygoni*. The powdery mildew of pea and lentil should be recognised in Jamahiriya also as *E. pisi* in accordance with the current taxonomic status.

Powdery mildew of pea has been recorded in Jamahiriya earlier and appears regularly but records on lentil and *Vicia monantha* are new for Jamahiriya. Occurrence of *E. pisi* on 18 species of *Vicia* are on world record but *V. monantha* does not figure in this list. This apparently is a first world record and an addition to the host index of *E. pisi*.

5. *Erysiphe cichoracearum* DC.

On the living plants of *Hedypnois cretica* L. (Compositae) collected from Gharabuli, 8th April, 1979.

Severe infection on stem, leaves and inflorescence stalk. Conidial stage amphiphyllous, perithecia hypophyllous, mostly scattered, sometimes gregarious. Morphological characters of conidial and perithecial stages resembled those of *E. cichoracearum*.

On the living plants of *Conyza bonariensis* (L.) Cornq. (Compositae) collected from Gharabuli, 8th April, 1979.

Mild to severe infection was observed on stem and leaves. Conidial stage showed typical characters of *E. cichoracearum*. Perithecia absent.

On the living plants of *Zinnia elegans* L. (Compositae) collected from the Faculty of Pharmacy, and Old Agriculture Faculty Gardens, Al-Fateh University Campus, Tripoli, 12th June, 1978.

Mild to severe infection on leaves. Conidia amphiphyllous, more on the upper than the lower. Leaves gradually became chlorotic and dried. Morphological features of conidia were identical to those of *E. cichoracearum*.

On the living plants of *Sonchus oleraceous* L. (Compositae) collected from Tajora, 20th March, 1979.

Mild infection on leaves. *E. cichoracearum* in conidial stage was identified as causal organism.

E. cichoracearum is world-wide in distribution with a very wide host range. It is known to exist on many plants in Libya. Pucci (12) listed it as causal organism of powdery mildew of cabbage, watermelon and tomato in Libya. He further assigned, though doubtfully, *Oidium* stage from cucurbits, *Cynara scolymus*, *Lactuca sativa*, *Cychorium intybus*, *Nicotiana tabacum*, *Chrysanthemum cinerariaefolium* and *Zinnia sp.* to *E. cichoracearum* (13). Some of these, however, need reconfirmation. *E. cichoracearum* is listed to infect radish in Jamahiriya (1). Kranz (9) remarked that powdery mildew of melons, watermelon and pumpkin is probably caused by *E. cichoracearum* in Cyrenaica region. But, the identity of the powdery mildew cucurbits in Libyan Jamahiriya, in view of several reports that *Sphaerotheca fuliginea* is prevalent on many curcubits in most parts of the world (2,7) needs re-ascertation and establishment.

Khan and Mussa (8) identified *E. cichoracearum* in perithecial stage on *Amberboa lippii*. It appears to be prevalent species in Jamahiriya. It is reported to infect two species of *Hedypnois* viz. *H. cretica* and *H. polymorpha*. However, it is the first record on *H. cretica* in Jamahiriya. On *S. oleraceous* also, it is recorded for the first time in this country. *E. cichoracearum* is not reported on *Conyza bonariensis* and thus its occurrence on this host in Jamahiriya became a first world record.

6. *Erysiphe trifolii* Grev.

On the living plants of *Melilotus indicus* (L.) Alld. (Papilionaceae), collected from Tajora, 14th April, 1979, and Ainzara, 28th April, 1979.

Severe infection on plants; mycelium well developed, amphiphyllous. Conidia born singly, ellipsoidal, 28–40 × 16–22 μ. Perithecia absent.

Severely infected particularly younger plants; died eventually.

On the living plants of *Trigonella foenicum-graecum* L. (Papilionaceae) collected from Agricultural Farm, Al-Fateh University, Tripoli, 23rd April, 1978.

Severe infection on leaves and stems. Conidial stage present; perithecia absent. Plants showed chlorosis and poor growth.

Pucci (13) recorded powdery mildew on *Trigonella* identifying as *Oidium* sp. in Libya. *Erysiphe martii*, regarded earlier as causal organism of powdery mildew of *Melilotus* and *Trigonella*, is now designated as *E. trifolii* under current taxonomic status (6). It infects numerous Leguminosae. It is an additional species to the powdery mildew flora of Jamahiriya.

E. trifolii (=*E. martii*) is reported to infect 8 species including *M. indicus* in other parts of the world. Its record on *M. indicus* is, however, new for Jamahiriya. The powdery mildew on *T. foenicum-graecum* should now be recognised as *E. trifolii*.

7. *E. convolvuli* DC.

On the living plants on *Convolvulus arvensis* L. (Convolvulaceae) collected from Al-Fateh University Campus, Tripoli, 30th October, 1978, Al-Hamidiya and Swani, 12th May, 1979.

Severe infection on the leaves, epiphyllous; mycelium well developed. Conidia in chain, ellipsoidal to cylindrical 40–50 × 16–20 μ.

E. convolvuli and *Leveillula* sp. are reported to infect a number of species of *Convolvulus*. Their conidial stages remarkably differ in morphology. However, on *C. arvensis* *E. convolvuli* only is reported (3). In Jamahiriya, an *Oidium* stage was enlisted on *Convolvulus* (1). *E. convolvuli* thus forms an additional species to the powdery mildew flora of Libya.

8. *Erysiphe graminis* DC.

On the living plants of *Phalaris minor* Retz. (Graminae), collected from Al-Hamidiya, 14th April, 1979.

Mild-to-moderate infection on leaves. Both conidial and perithecial stages present. Perithecia gregarious to sparse. Morphological characters similar to those of *E. graminis*. Ascospores absent.

On the living plants of *Triticum aestivum* L. (Graminae) collected from Agriculture Farm, Al-Fateh University, Tripoli, 26th April, 1978.

Mild-to-severe infection on plants. Conidial as well as perithecial stages present. Perithecia mostly hypophyllous; sparsely produced. Morphologically similar to *E. graminis*; ascospores absent.

E. graminis, powdery mildew of cereals and grasses, has wide host range. It is reported to infect 3 species of *Phalaris* viz. *P. arundinacea*, *P. canariensis* and *P. minor*. However, there is no record of *E. graminis* on *Phalaris minor* in Jamahiriya.

E. graminis is known to infect cereals in Libya besides certain wild grasses. Pucci (13) recorded its occurrence on wheat, barley and oats. Mohamed (10) reported its widespread occurrence in Libya. Khan and Mussa (8) recorded its existence in perithecial stage in Libya on *Bromus diandrus*, a wild grass, and also on barley.

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البيـــاض الدقيقـــــى
فى الجماهيرية العربية الليبيـــــــة
الشعبيـــــة الاشـــــــتراكيـــة

د. محمـد واجد خـان

مســـتخلـص

فطريـات البيـاض الدقيقى بـالجماهيرية العربية الليبية الشعبيـــــــة الاشتراكية كانت مسجلة بأربعة مسببات وهى Erysiphe urticae, E. communis, E. convolvuli, Sphaerotheca euphorbiae

ولقد ذكرت فى البحث الأول من هذه السلسلة الخاصة بالبياض الدقيقى بالجماهيرية ولقد تم معرفة أنواع أخرى من هذه الفطريات على عوامـــل أخرى مثـل

Erysiphe pisi على Vicia monantha, E. cichoracearum على Conyza, bonariensis

كما وأنه عرف بأن E. trifolii, Erysiphe pisi هما المسببان للبياض الدقيقى على Papilionaceae على حسب التقسيم المعمول به حاليـا .