

## Coprophilous Fungus Succession on Camel Dung

H.A. Bokhary

Botany Department, College of Science, King Saud University,  
Riyadh, Saudi Arabia

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ABSTRACT. Succession of coprophilous fungi has been studied on camel dung (*Camelus dromedarius* L.). Faecal pellets, which were incubated moist initially for a period of 75 days, were then dried at room temperature for 225 days and thereafter reincubated in moist chambers for 30 days. Twenty eight species belonging to twenty genera of coprophilous fungi were observed. Among the fungi examined, seven species showed profuse sporulation both in the pre- and postdrying period, whereas three species were recorded only during the post-drying period. *Mucor circinelloides* appeared during both the pre- and post-drying period.

Succession patterns of fungal fruiting bodies on the dung of herbivores have been well-investigated (Harper and Webster 1964, Webster 1970, Angel and Wicklow 1974, 1975). Coprophilous fungi exhibit the ability to grow and fructify in the dung and to subsequently decompose the latter. The growth and sporulation of these fungi is dependent upon the type of dung (Richardson 1972), temperature (Wicklow and Moore 1974), interspecific antagonism (Harper and Webster 1964, Ikediugwu and Webster 1970), moisture (Mitchell 1970), and degree of tolerance to bacteria (Carter 1958). The microbial decomposition of dung is chiefly carried out by the flora present initially in the faecal matter itself. The decomposition of lignin and cellulose by coprophilous fungi has been recently investigated (Wicklow *et al.* 1980).

The coprophilous fungi comprise an ecologically important group of fungal community and their succession on dung. Herbivores other than camel have been studied for succession of coprophilous fungi on their dung in the Northern part of the globe (Harper and Webster 1964, Wicklow and Moore 1974) and in the Southern part (Harrower and Nagy 1979). A deep scrutiny of the literature shows that

no work has been done on coprophilous fungus succession on camel dung in and around Saudi Arabia although camel has importance in many aspects (Kwasthi and Omar 1979a, b) for arid regions of the world.

Therefore, the present study aims first to provide information on the coprophilous fungus succession on camel dung, since there is no information on succession of the fungi on camel dung in the world; secondly, to determine the effect of subsequent drying on the capability of such fungi to sporulate.

### Material and Methods

Camels were selected randomly for the collection of dung during February-March 1982 in the desert area about 30 km from the city of Riyadh. Care was taken to collect the samples of fresh dung immediately after egestion from camel grazing on natural vegetation. Pellets were irregular obovate in shape and about 7.5-9.5 cm in circumference.

One pellet per sterile petridish (20 × 5 cm) 10 petridishes in total was incubated on moist filter paper for a period of 75 days. Twelve hours light and dark period was maintained (light intensity 2000-2500 lux, temperature  $25 \pm 1^\circ\text{C}$ ) in a Conviron controlled environment incubator (Germany). Following the completion of the incubation period, the dung pellets were left to dry for a prolonged period of 225 days at room temperature (20-25°C). Fresh sterile petridishes were used for re-incubation of the pellets on moist filter papers as before at room temperature for 30 days. The filter paper were kept moist throughout the experimental period by pouring sterile water at appropriate intervals but never allowed to be flooded or dried. Sporulation was regularly observed under a sterio-microscope from 3-20 days and thereafter at weekly intervals. The isolation of coprophilous fungi were carried out by using hyphal tip or single spore technique (Hildebrand 1938) on Potato Dextrose Agar, Malt Extract Agar, Czapekdox agar and Cornmeal agar medium (all were supplied by Oxoid Ltd., London) but later on cultures were maintained on Potato Dextrose agar. Fungi were isolated where possible and all the isolated specimens were deposited in the herbarium of Botany Department, King Saud University.

The identification of coprophilous fungi were carried out by using taxonomic keys of Mitchel (1979) for Myxomycetes species; Gilman (1971) for Hyphomycetes, Phycomycetes and *Perisporium funiculatum*; Richardson (1972), Mirza and Cain (1969), Walkey and Harvey (1965 a & b) for Ascomycetes and Phillips (1981) for *Coprinus* spp.

Confirmation of the identification of other coprophilous fungi were carried out by Commonwealth Mycological Institute and their herbarium number is given along with them in the text.

### Results and Discussion

Twenty-eight species belonging to 20 genera were isolated. Out of these, seven were recorded growing in both pre- and post-drying periods and three species, one of *Alternaria* and two of *Coprinus*, were found only in the post-drying incubation period. The coprophilous succession in the pre-drying period (Fig. 1A, B) was found to resemble those described for other faecal substrates; for example, rabbit pellets (Harper and Webster 1964), rabbit and kangaroo pellets (Nagy and Harrower 1979), and cattle dung (Dickinson and Underhay 1977). Species of *Mucor* and *Rhizopus* fruited abundantly on camel pellets as well as on the moist filter paper until the end of the pre-drying experimental period of 75 days, but were totally absent in the post-drying incubation period. The exception was *Mucor circinelloides* which appeared later (not shown in Fig. 1 & 2) in the post-drying incubation after 20 days on two, out of the total of 10 pellets.

Myxomycetes appeared first in the succession. *Arcyria* sp. and *Didymium* sp. appearing after two days, while *Physarum* sp. appeared after 10 days. *Rhizopus oryzae*, *Mucor circinelloides* (IMI 268921) and *M. hiemalis* (IMI 268925) fructified after 3 days, while Fungi Imperfecti and Ascomycetes produced fruit bodies between 7-15 days. *Rhizopus oryzae* (IMI 268920), *M. circinelloides*, *M. hiemalis*, *Kernia nitida*, *Perisporium funiculatum*, *Orbicula parietina* (IMI 268927) and

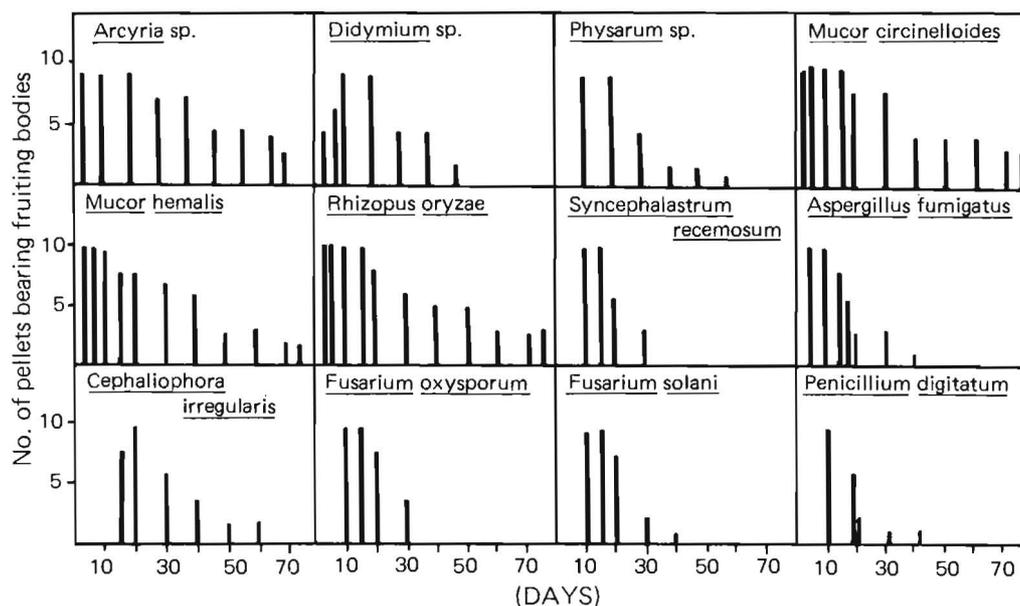
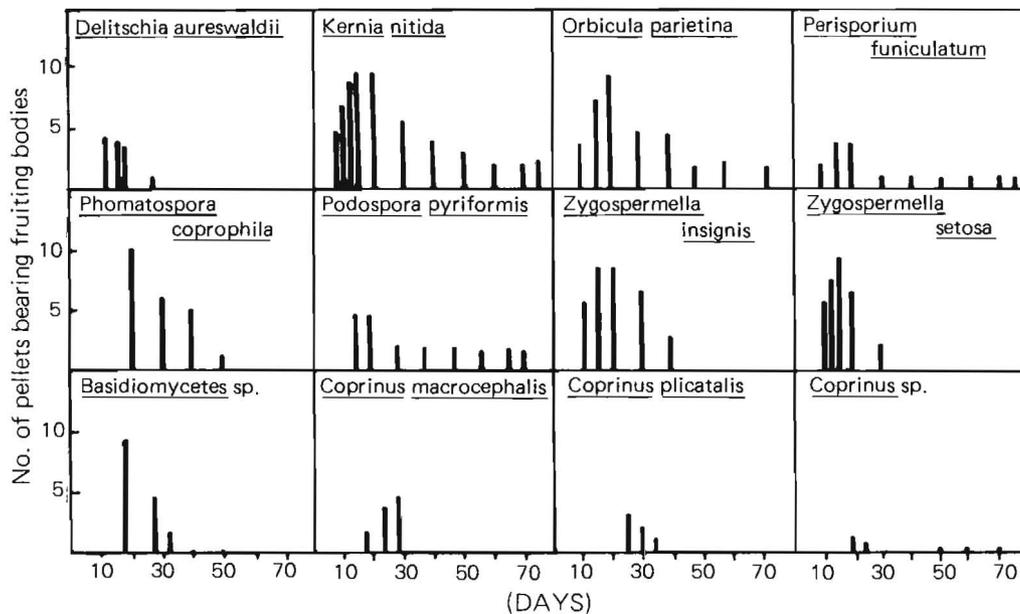
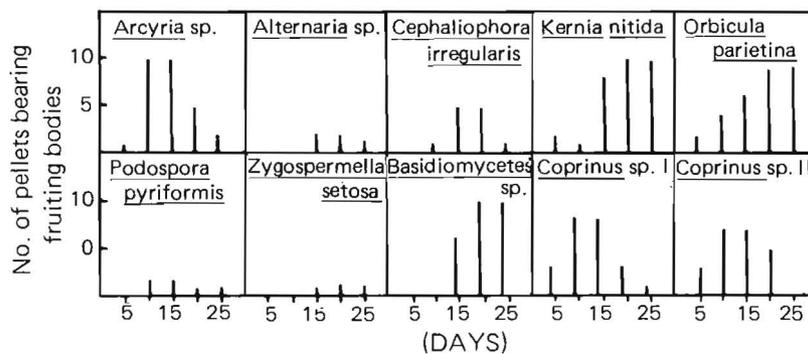


Fig. 1A. Succession of fruiting Myxomycetes, Phycomycetes and Hyphomycetes on samples of ten camel pellets at  $25 \pm 1^\circ\text{C}$  and light intensity of 2000-2500 lux in a moist chamber.



**Fig. 1B.** Succession of fruiting Ascomycetes and Basidiomycetes on samples of ten camel pellets at  $25 \pm 1^\circ\text{C}$  and light intensity of 2000-2500 lux in a moist chamber.



**Fig. 2.** Succession of fruiting coprophilous fungi on samples of ten camel pellets (room temperature dried for a period of 225 days) when re-incubated in moist chambers at 20-25°C.

*Podospora pyriformis* persisted till the end of the first phase of the experiment. Basidiomycetes, as *Coprinus* sp., appeared after 20 days of incubation. The fungi which showed growth both on camel dung pellets and moist filter paper are listed in the Table 1.

*Iodophanus carneus* (Pers) Korf, *Podospora anserina* (Rattan and El-Buni 1979) and *Cunninghamella elegans* (Mubashir and El-Dohleb 1972) have also been reported from camel dung but were not encountered in this study.

In the post-drying period, the fungi which were able to regrow on camel dung are shown in Fig. 2. *O. parietina*, *K. nitida*, *P. pyriformis* and *C. irregularis* (IMI 268934) took fewer days when compared to that in the pre-drying period, while *Zygospermella setosa* fruited within 15 days as compared to 10 days in the pre-drying period. *M. circinelloides* took 20 days to sporulate in the post-drying period, while it sporulated within three days in the pre-drying period. *Coprinus* spp., appeared within five days as compared to 20 days in the pre-drying period.

The growth of fungi after a dry period of 225 days showed that the pellet still remained a rich medium for the growth of fungi, even after one coprophilous fungus succession. The appearance of *Alternaria* sp. and two *Coprinus* spp. after the drying period may be attributed to a lesser competition among fungi, or a prolonged dormant period of the spores of these fungi or a change in the experimental conditions.

The growth of *M. circinelloides* after 20 days in the post-drying period shows that the coprophilous fungus succession on camel pellets is not due to sequential

**Table 1.** Fungal species which showed growth both on camel pellets and moist filter paper are listed according to their generic classification.

Class	Fungus
Myxomycetes	<i>Arcyria</i> sp.
Hyphomycetes	<i>Cephalophora irregularis</i>
Phycomycetes	<i>Mucor circinelloides</i>
	<i>Mucor hiemalis</i>
	<i>Rhizopus oryzae</i>
Ascomycetes	<i>Delitschia aureswaldii</i>
	<i>Phomatospora coprophila</i>
	<i>Zygospermella insignis</i>
	<i>Zygospermella setosa</i>
Basidiomycetes	<i>Coprinus macrocephalis</i>

changes in the carbon nutrition of pellets. There is no correlation between the taxonomic group of a coprophilous fungus and its nutrition (Harper and Webster 1964, Harrower and Nagy 1979). The fruiting bodies of *Z. setosa*, *K. nitida*, and *P. pyriformis* were already present sparsely on camel pellets before, but showed profuse growth when reincubated for 30 days post-drying period.

Those fungi which are listed in Table 1 cannot be true coprophilous fungi (Webster 1970) because these grew well on moist filter paper also besides camel dung.

Dried faeces naturally or in the lab yield fungi when rewetted (Faurel & Schrotter 1964) and this shows that coprophilous fungal flora have the ability to remain dormant for a long period until a degree of rainfall occurs which permits further growth. It is, however, surprising that these fungi are found in severe conditions of Saudi Arabia where many ecological factors like, high temperature, low rainfall and sparse vegetation militate against their survival, and this survival is possibly due to the long dormant period of these fungi.

The survival of these fungi at high temperature and their presence in such a number on camel dung is an indication of potential health risk (Ainsworth and Austwick 1973) to camel itself.

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## تعاقب فطريات الروث على بعر الجمل

حسن عبد الحكيم بخارى

قسم النبات - كلية العلوم - جامعة الملك سعود - الرياض - المملكة  
العربية السعودية

درس تعاقب فطريات الروث على بعر الجمل كاميلس دروميدياريس ؛ اختبر روث (بعرات) الجمل الذي سبق أن حضن لفترة ٧٥ يوما وترك ليحجف في درجة حرارة الغرفة العادية (٢٠-٢٥م) لمدة ٢٢٥ يوما وأعيد تحضينه في أطباق مبللة لمدة ثلاثين يوما.

لوحظ ظهور ٢٨ نوعا من فطريات البعر تتبع عشرين جنسا على البعر الذى عومل بهذه الطريقة. وتبين من هذه الفطريات التى فحصت أن سبعة أنواع منها، أظهرت تجرثما كثيرا فى الفترتين قبل وبعد التجفيف، فى حين أن ثلاثة أنواع من بينها نوعان من جنس كوبراينس ونوع واحد من جنس ألترناريا لم يحدث فيها التجرثم إلا فى فترة ما بعد التجفيف وإعادة التحضين، كما أن الفطرة ميوكر سيركينلويدس ظهرت قبل وبعد التجفيف.