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SUPPLEMENTARY ONLINE MATERIAL FOR

Preservation of armoured scale insects on angiosperm leaves from the Eocene of Germany

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Table SOM 1. Available material from the Eocene of Germany.

ACCESSION NUMBER	HOST	SIZE [in mm]	SPECIES number	HABITUS
NHMM PB 2005/140, LS	Dicotyledone	1.53 diameter	1	circular
FIS SM.B.Me 20426	Dicotyledone	1.53 - 2.57 diameter	1	circular
FIS SM.B.Me 19309	Dicotyledone	2.09 – 2.74 diameter	1	circular
NHMM PB 2005/411, LS	Dicotyledone	1.01 – 1.-41 diameter	1	circular
FIS SM.B.Me 3958	Dicotyledone	1.61-2.31 diameter	1	circular
FIS SM.B.Me 19250	Dicotyledone	2.66 - 3.13 diameter	1	circular
NHMM PB 1995/448, LS	Arecaceae	Female - about 1 diameter	2	circular
NHMM PB 1995/448, LS	Arecaceae	Nymph - 0.2-0.3 diameter	2	circular
NHMM PB 2005/62, LS	Arecaceae	0.69 – 0.98 diameter	2	circular
NHMM PB 2005/375, LS	Arecaceae	2.07 diameter	2	circular
NHMM PB 2005/456, LS	Arecaceae	0.643 – 0.887 diameter	2	circular
FIS SM.B.Me 3468	Arecaceae – *Phoenicites* sp.	0.32 – 0.44 diameter	3	circular
NHMM PB 2005/140, LS	Dicotyledone	1.77 - 2.3 wide, 3.1-3.2. long	4	elongate

Appendix SOM 1. Collection data of fossil Diaspididae material from Grube Messel and Eckfeld maar, Germany.

Aspidiotinae gen. et sp. indet. 1

Material.— NHMN PB 2005/140; LS; Figs. S1A$_{1-3}$.

Description.—Incomplete preserved dicotyledonous leaf found in Eckfeld maar near Manderscheid, Eifel Mountains, Germany, middle Eocene (middle Lutetian, ELMA Geiseltalian, MP13, 44.3 ± 0.4 Myr. We observed on leaf surface about 5 circular scale covers (diameter about 1.53 mm), of adult females.

Material.— FIS SM.B.Me 20426; Figs. S1B$_{1-2}$.

Description.—Complete preserved leaf of undetermined dicotyledon (microphyll), 60 mm long, with about 70 scale covers on upper surface of leaf. The scale covers are of adult females, circular, diameter 1.53 – 2.57 mm. Found in Messel pit near Darmstadt, Hesse, Germany, grid square E8/9. Messel Formation, lower Middle Eocene (lowermost Lutetian, MP11), from +350 to +250 cm above local marker horizon alpha.

Material.— FIS SM.B.Me 19309; Fig. S1C.

Description.—Incomplete dicotyledonous leaf found in Messel pit near Darmstadt, Hesse, Germany, grid square E8/9. Messel Formation, lower Middle Eocene (lowermost Lutetian, MP11), from +450 to +350 cm above local marker horizon alpha. On upper surface of leaf were observed about 25 circular, scale covers of adult females; diameter 2.09 – 2.74 mm.

Material.— NHMN PB 2005/411; LS; Figs. S1D$_{1-2}$.

Description.—Undetermined dicotyledonous leaf in Eckfeld maar near Manderscheid, Eifel Mountains, Germany, middle Eocene (middle Lutetian, ELMA Geiseltalian, MP13, 44.3 ± 0.4 Myr). On the leaf we observed 10 circular scale covers (diameter 1.01 – 1.41 mm), slightly convex, which are of adult females.

Material.— FIS SM.B.Me 3958; Fig. S1E.

Description.—Almost complete preserved dicotyledonous leaf (microphyll), about 5 cm long, found in Messel pit near Darmstadt, Hesse, Germany. Messel Formation, lower Middle Eocene (lowermost Lutetian, MP11). We observed on the leaf surface 4 scale covers, circular, diameter 1.61-2.31 mm that we interpret to be of the adult female.

Material.— FIS SM.B.Me 19250; Figs. S1F$_{1-2}$.

Description.—Incomplete dicotyledonous leaf found in Messel pit near Darmstadt, Hesse, Germany, grid square E8/9. Messel Formation, lower Middle Eocene (lowermost Lutetian, MP11), from +450 to +350 cm above local marker horizon alpha. On the leaf were observed 21 circular scale covers, diameter 2.66 – 3.13 mm. We interpret these covers to be of the adult female.

Aspidiotinae gen. et sp. indet. 2

Material.— NHMN PB 1995/448, LS; Figs. S2A$_{1-2}$.

Description.—Incomplete preserved pinnately ('fan-leaved') leaf (Arecaceae sp. indet.), found in Eckfeld maar near Manderscheid, Eifel Mountains, Germany, middle Eocene (middle Lutetian, ELMA Geiseltalian, MP13, 44.3 ± 0.4 Myr). We observed on lower surface of this leaf about 10 circular scale covers, slightly convex, diameter 0.749 -1.132 mm.. There are also smaller scales, diameter 0.312-0.362 mm, that we assume are scale covers of immature stages.

Material.— NHMN PB 2005/62; LS; Figs. S2B$_{1-2}$.

Description.—Incomplete preserved palmately ('fan-leaved') leaf (Arecaceae sp. indet.), found in Eckfeld maar near Manderscheid, Eifel Mountains, Germany, middle Eocene (middle Lutetian, ELMA Geiseltalian, MP13, 44.3 ± 0.4 Myr). We observed on lower surface of leaf 4 circular scale covers, slightly convex, diameter 0.693- 0.980 mm. In some specimens the ‘white-cap’ secretion of the first instar is quite distinct.

Material.— NHMM PB 2005/375; LS; Fig. S2C.

Description.—An incomplete preserved pinnate leaf ('feather-leaved') of Arecaceae sp., found at Eckfeld maar near Manderscheid, Eifel Mountains, Germany, middle Eocene (middle Lutetian, ELMA Geiseltalian, MP13, 44.3 ± 0.4 Myr). We observed on the adaxial surface 5 circular scale cover, presumably of adult female, slightly convex, average diameter

2.07 mm. Next to the female scale covers, we observed one small scale, diameter 0.686 mm, which is regarded as scale cover of an immature stage.

Material.— NHMM PB 2005/456; LS; Figs. S2D$_{1-3}$.

Description.—An incomplete preserved pinnate leaf ('feather-leaved') of Arecaceae sp., found at Eckfeld maar near Manderscheid, Eifel Mountains, Germany, middle Eocene (middle Lutetian, ELMA Geiseltalian, MP13, 44.3 ± 0.4 Myr). We observed on lower surface of leaf about 12 circular scale covers (diameter 0.643 – 0.887 mm), slightly convex, which we regard to be of adult females. In some specimens the ‘white-cap’ secretion of the first instar is quite distinct. Next to the female scale covers were found about 5 small scales, average diameter 0.218 mm (range 0.202 – 0.298 mm), which we regard as covers of immature stages.

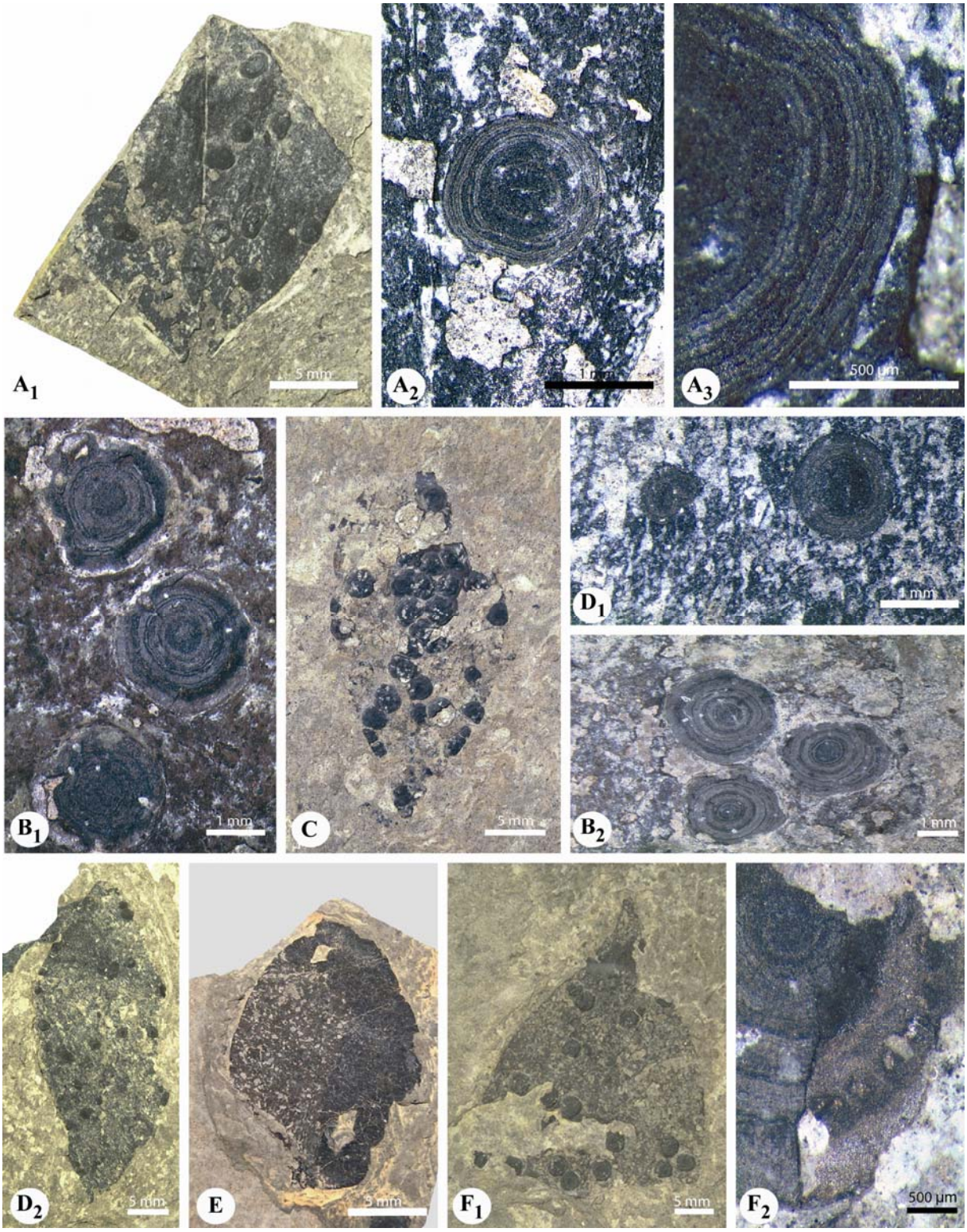

Figure S1. Armoured scale insects on dicotyledonous leaves from the mid-Eocene (47-44 Myr) Messel and Eckfeld maar fossil sites. **A_1**, Nearly complete preserved leaf with five circular and 3 elongated scale covers, NHMM PB 2005-140, LS; **A_2**, Female scale cover with distinctive concentric rings, representing the first and second nymph instars; **A_3,** Enlargement of concentric rings. **B_1, B_2,** Concentric scale covers representing females with first and second nymph instars, FIS SM.B.Me 20426. **C**. Incomplete dicotyledonous leaf with 25 scale covers of adult females, FIS SM.B.Me 19309. **D_1,** Undetermined dicotyledonous representing adult female and nymphal stages, NHMM PB 2005-411, LS. **D_2,** Undetermined dicotyledonous leaf with 10 circular scale covers. **E**. Almost complete preserved dicotyledonous leaf (microphyll) with circular scale covers, FIS SM.B.Me 3958. **F_1,** Leaf fragment with several female scale covers, FIS SM.B.Me 19250; **F_2**, Enlargement of fragmentary preserved cover, revealing leaf surface structure beneath the cover.

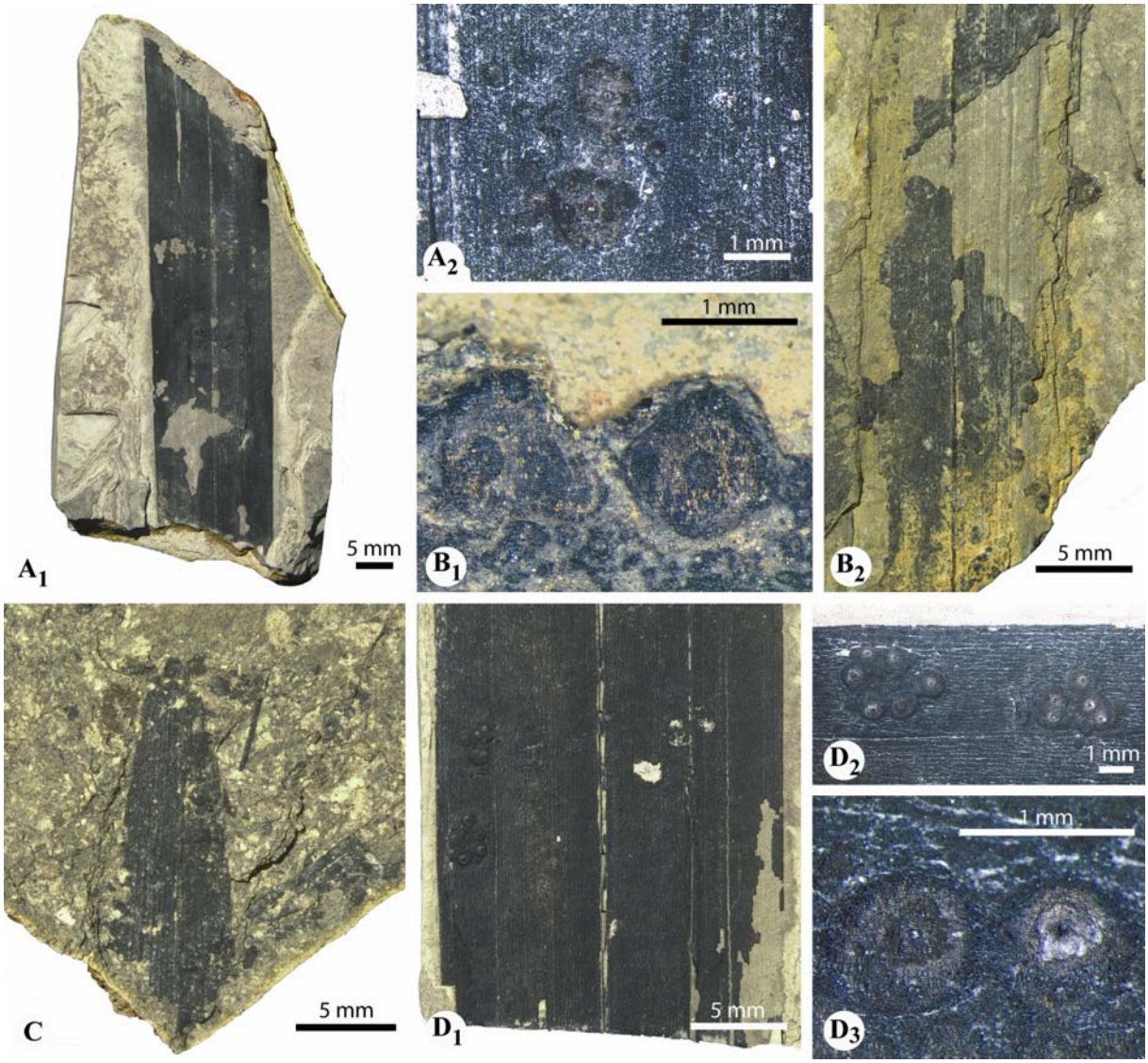

Figure S2. Armoured scale insects on palm leaves from the mid-Eocene (44 Myr) Eckfeld maar fossil site. **A_1**, Incomplete preserved pinnately ('fan-leaved') leaf with 10 slightly convex scale covers, NHMM PB 1995-448, LS; **A_2**, Adult female scale cover with putative immature stages; **B_1**, 'white-cap' secretion of the first instar; **B2**, Incomplete preserved palmately ('fan-leaved') leaf with 10 slightly convex scale covers, NHMM PB 2005-62, LS. **C**. Incomplete preserved pinnate leaf ('feather-leaved') of Arecaceae sp. with presumably adult females on the adaxial surface, NHMM PB 2005-375, LS. **D_1**, Incomplete preserved pinnate leaf ('feather-leaved') of Arecaceae sp., NHMM PB 2005-456, LS; **D_2, D_3,** Adult female scale covers with distinct 'white-cap' secretion of the first instar.